Department of Energy

Washington, DC 20585

March 4, 1999

Dear Interested Party:

The Final *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) (DOE/EIS-0288) has now been completed and a copy is enclosed.

The CLWR EIS evaluates the environmental impacts associated with producing tritium at one or more of the following five CLWRs operated by the Tennessee Valley Authority (TVA): (1) Watts Bar Nuclear Plant Unit 1 (Spring City, Tennessee); (2) Sequoyah Nuclear Plant Unit 1 (Soddy Daisy, Tennessee); (3) Sequoyah Nuclear Plant Unit 2 (Soddy Daisy, Tennessee); (4) Bellefonte Nuclear Plant Unit 1 (Hollywood, Alabama); and (5) Bellefonte Nuclear Plant Unit 2 (Hollywood, Alabama). Specifically, this EIS analyzes the potential environmental impacts associated with fabricating tritium-producing burnable absorber rods (TPBARs); transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; irradiating TPBARs in the reactors; and transporting irradiated TPBARs from the reactors to the proposed tritium extraction facility at the Savannah River Site (SRS) in South Carolina.

The CLWR EIS follows the December 1995 Record of Decision (60 Federal Register [FR] 63878) for the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (DOE/EIS-0161). In a December 1995 Record of Decision (ROD), DOE decided to pursue a dual-track approach on the two most promising tritium-supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator system for tritium production (SRS was selected as the location for an accelerator, should one be built). Under the dual-track approach described in the ROD, the Department would, within 3 years, select one of these two technologies as the primary source of tritium. The other technology, if feasible, would serve as a backup. The Department also stated in the ROD that a tritium extraction facility was to be constructed at SRS.

As a result of the PEIS and the ROD, DOE made a determination to prepare three site-specific EISs: the *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) (DOE/EIS-0288), the *Environmental Impact Statement: Accelerator Production of Tritium at the Savannah River Site* (APT EIS) (DOE/EIS-0270), and the *Environmental Impact Statement: Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (TEF EIS) (DOE/EIS-0271). If you are interested in receiving a copy of the TEF and/or APT EISs, please contact Andrew R. Grainger, NEPA Compliance Officer, Savannah River Operations Office, by calling 1-800-881-7292. Additional copies of the CLWR EIS are also available by contacting Stephen M. Sohinki, Director, Commercial Light Water Reactor Project Office, by calling 1-800-332-0801. The EISs will also be available on the internet at: http://tis.eh.doe.gov/nepa/docs/docs.htm.

Last December 22, U.S. Department of Energy Secretary Bill Richardson announced that commercial light water reactors will be the primary tritium supply technology and that APT will be the "backup" technology. Secretary Richardson designated TVA's Watts Bar and Sequoyah reactors as the preferred facilities for tritium production and this preferred alternative is reflected in the final CLWR EIS. DOE will continue with developmental activities and preliminary design, but will not construct the accelerator.

A consolidated Record of Decision to formalize the December programmatic announcement and complete project-specific decisions for the three final EISs will follow no sooner than 30 days after publication of the Environmental Protection Agency's Notice of Availability in the *Federal Register*. These decisions will include the selection of specific CLWRs to be used for tritium supply, the location of a new tritium extraction capability at SRS, and limited technical and siting decisions consistent with the backup role of the APT.

Thank you for your interest in the Department's Tritium Supply Program.

Sincerely,

Stephen M. Sohinki, Director
Office of Commercial Light Water
Reactor Production

Enclosure:
As stated

COVER SHEET

Responsible Agency: United States Department of Energy

Cooperating Agency: Tennessee Valley Authority

Title: Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor

Contact: For additional information on this Final Environmental Impact Statement, write or call:

Jay Rose
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1000 Independence Avenue, SW
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Attention: CLWR EIS
Telephone: (202) 586-5484

For copies of the CLWR Final EIS call: 1-800-332-0801

For general information on the DOE National Environmental Policy Act (NEPA) process, write or call:

Carol M. Borgstrom, Director
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Abstract: The U.S. Department of Energy (DOE) is responsible for providing the nation with nuclear weapons and ensuring that these weapons remain safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other materials utilized in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically. Currently the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to continue supporting the nation's stockpile. The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS), DOE/EIS-0161, issued in October 1995, evaluated the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at five DOE sites for four different production technologies. This Programmatic EIS also evaluated the impacts of using a commercial light water reactor (CLWR) without specifying a reactor location. In the Record of Decision for the Final Programmatic EIS (60 FR 63878), issued December 12, 1995, DOE decided to pursue a dual-track approach on the two most promising tritium supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or reactor irradiation services; and (2) to design, build, and test critical components of an accelerator system for tritium production. At that time, DOE announced that the final decision would be made by the Secretary of Energy at the end of 1998.

On December 22, 1998, Secretary of Energy Bill Richardson announced that the CLWR would be DOE's primary option for tritium production, and the proposed linear accelerator at the Savannah River Site would be the back-up option. The Secretary designated the Tennessee Valley Authority's (TVA) Watts Bar and Sequoyah Nuclear Plants as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

This *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) evaluates the environmental impacts associated with producing tritium at one or more of the following five CLWRs: (1) Watts Bar Nuclear Plant Unit 1 (Spring City, Tennessee); (2) Sequoyah Nuclear Plant Unit 1 (Soddy Daisy, Tennessee); (3) Sequoyah Nuclear Plant Unit 2 (Soddy Daisy, Tennessee); (4) Bellefonte Nuclear Plant Unit 1 (Hollywood, Alabama); and (5) Bellefonte Nuclear Plant Unit 2 (Hollywood, Alabama). Specifically, this EIS analyzes the potential environmental impacts associated with fabricating tritium-producing burnable absorber rods (TPBARs); transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; irradiating TPBARs in the reactors; and transporting irradiated TPBARs from the reactors to the proposed tritium extraction facility at the Savannah River Site in South Carolina.

The public comment period on the CLWR Draft EIS extended from August 28 to October 27, 1998. During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. An additional public meeting was held in Evensville, Tennessee, on December 14, 1998. The CLWR Draft EIS was made available through mailings and requests to DOE's CLWR Office and at DOE's Public Reading Rooms. In preparing the CLWR Final EIS, DOE considered comments received via mail, fax, submission at public hearings, recorded telephone messages, and the Internet. In addition, comments and concerns identified during discussions at the public hearings were recorded by a court reporter and were transcribed for consideration by DOE.

The CLWR Final EIS contains revisions and new information in response to the comments on the CLWR Draft EIS and technical details disclosed since the Draft EIS was issued. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger changes. Volume 2 (Comment Response Document) of the CLWR Final EIS contains the comments received during the public review of the CLWR Draft EIS and DOE's responses to these comments.

No sooner than 30 days after the notice of filing this EIS with the U.S. Environmental Protection Agency, DOE expects to issue a Record of Decision.

PREFACE

The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS) (DOE/EIS-0161), which was completed in October 1995, assessed the potential environmental impacts of technology and siting alternatives for the production of tritium for national security purposes. On December 5, 1995, DOE issued a Record of Decision for the Final Programmatic EIS that selected the two most promising alternative technologies for tritium production and established a dual-track strategy that would, within 3 years, select one of those technologies to become the primary tritium supply technology. The other technology, if feasible, would be developed as a backup tritium source. Under the dual-track strategy, DOE would: (1) initiate the purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) design, build, and test critical components of an accelerator system for tritium production. Under the Final Programmatic EIS Record of Decision, any new facilities that might be required, i.e., an accelerator and/or a tritium extraction facility to support the commercial reactor alternative, would be constructed at DOE's Savannah River Site in South Carolina.

The Final Programmatic EIS described a two-phase strategy for compliance with the National Environmental Policy Act (NEPA). The first phase included completion of the Final Programmatic EIS and subsequent Record of Decision. The second phase included the preparation of site-specific NEPA documents tiered from the Final Programmatic EIS. These EISs address the environmental impacts of specific project proposals. As a result of the Final Programmatic EIS and the Record of Decision, DOE determined to prepare three site-specific EISs: the *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT) (DOE/EIS-0270), the *Environmental Impact Statement for the Production of Tritium in a Comercial Light Water Reactor* (CLWR) (DOE/EIS-0288), and the *Environment Impact Statement, Construction and Operation of a Tritium Extraction Facility at Savannah River Site* (TEF) (DOE/EIS-0271). Each of these EISs presents an analysis of alternatives which do not affect the alternatives in the other EISs, with one exception. This exception is one alternative in the TEF EIS which would require the use of space in the APT. For this alternative to be viable, the APT would have to be selected as the primary source of tritium.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and the Sequoyah Units 1 and 2 reactors near Soddy-Daisy, Tennessee, as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the "backup" technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. Finally, selection of the CLWR reaffirms the December 1995 Final Programmatic EIS Record of Decision to construct and operate a new tritium extraction capability at the Savannah River Site.

DOE has completed the final EISs for the APT, CLWR, and TEF. No sooner than 30 days after publication in the *Federal Register* of the Environmental Protection Agency's Notice of Availability of the final EISs for APT, CLWR, and TEF, DOE intends to issue a consolidated Record of Decision to: (1) formalize the programmatic announcement made on December 22, 1998; and (2) announce project-specific decisions for the three EISs. These decisions will include, for the selected CLWR technology, the selection of specific CLWRs to be used for tritium supply and the location of a new tritium extraction capability at the Savannah River Site. For the backup APT technology, technical and siting decisions consistent with its backup role will be made.

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ACRONYMS AND ABBREVIATIONS

APT	Accelerator Production of Tritium
BEIR	Biological Effects of Ionizing Radiation
Bellefonte 1	Bellefonte Nuclear Plant Unit 1
Bellefonte 2	Bellefonte Nuclear Plant Unit 2
CFR	Code of Federal Regulations
CLWR	Commercial light water reactor
DOE	U.S. Department of Energy
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HEPA	High-efficiency particulate air
IAEA	International Atomic Energy Agency
ISFSI	Independent spent fuel storage installation
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
Sequoyah 1	Sequoyah Nuclear Plant Unit 1
Sequoyah 2	Sequoyah Nuclear Plant Unit 2
START	Strategic Arms Reduction Treaty
TPBAR	Tritium-producing burnable absorber rod
TVA	Tennessee Valley Authority
U.S.C.	United States Code
Watts Bar 1	Watts Bar Nuclear Plant Unit 1
Watts Bar 2	Watts Bar Nuclear Plant Unit 2

SUMMARY

S.1 INTRODUCTION AND BACKGROUND

S.1.1 General

> **What is Tritium?**
>
> *Tritium is a radioactive isotope of hydrogen that occurs naturally in the environment in small quantities. However, it must be manufactured to obtain useful quantities. Tritium is not a fissile material and cannot be used by itself to construct a nuclear weapon. It is, however, an essential component of every warhead in the current and projected nuclear weapons stockpile. These warheads depend on tritium to perform as designed. Tritium decays at about 5.5 percent per year; therefore, it requires periodic replacement.*

The U.S. Department of Energy (DOE) is responsible for providing the nation with nuclear weapons and ensuring those weapons remain safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other nuclear materials used in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically.

At present, the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to support the nation's current and future stockpile. Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq*.) and the DOE regulations implementing NEPA (10 CFR 1021), this *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) analyzes the potential consequences to the environment associated with the production of tritium using one or more Commercial Light Water Reactors (CLWRs).

Concurrent with the preparation of this EIS, DOE evaluated the feasibility of various CLWR alternatives through its standard procurement process (see Section S.1.4). This EIS evaluates the environmental impacts associated with tritium production for all Tennessee Valley Authority (TVA) reactor plants that were offered by TVA during the procurement process. DOE is considering only the purchase of irradiation services, not the purchase of a reactor. Purchase of a reactor is no longer considered because, based on the proposals offered during the procurement process, no reactors were offered for sale.

S.1.2 Proposed Action and Scope

DOE proposes to use one or more CLWRs to provide tritium in sufficient quantities to support the nation's nuclear weapons stockpile requirements for at least the next 40 years. The proposed action includes: the manufacture of tritium-producing burnable absorber rods (TPBARs) at a commercial facility; irradiation of the TPBARs at one or more of five operating or partially constructed TVA nuclear reactors; the possible completion of TVA's nuclear reactors; transportation of nonirradiated and irradiated materials; and the management of spent nuclear fuel and low-level radioactive waste.

As depicted in **Figure S–1**, this EIS analyzes the potential environmental impacts associated with: (1) fabricating TPBARs; (2) transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; (3) irradiating TPBARs in the reactors; and, (4) transporting irradiated TPBARs from the reactors to the proposed Tritium Extraction Facility at the Savannah River Site in South Carolina. This EIS further analyzes

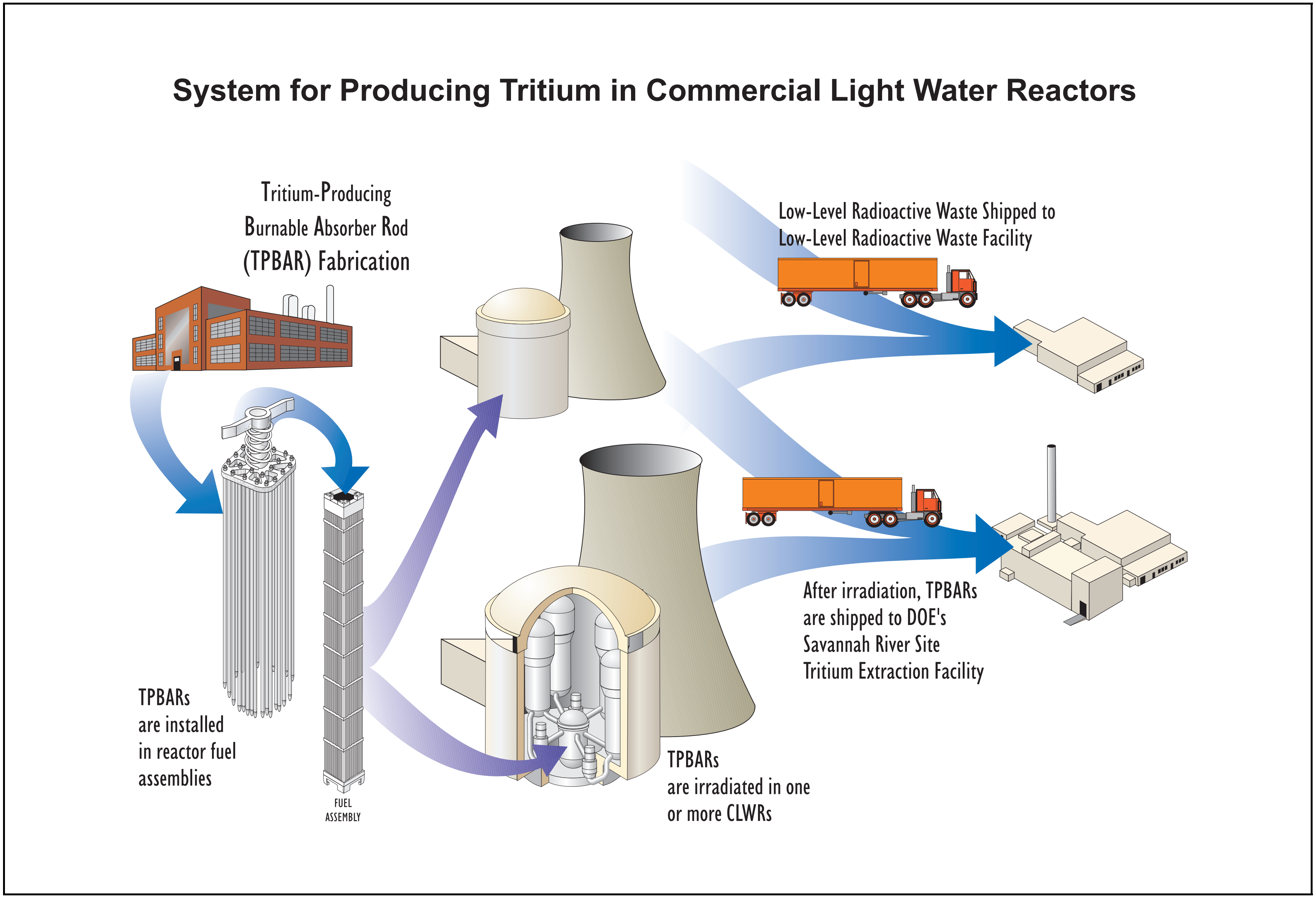


Figure S–1 Schematic of Process for Producing Tritium in CLWRs

the potential environmental impacts associated with both the management of spent nuclear fuel and the transportation and management of low-level radioactive waste generated from CLWR tritium production.

In addition, this EIS evaluates the environmental impacts of the No Action Alternative. Under the No Action Alternative, the stockpile requirements for tritium would have to be met by the construction and operation of an accelerator at DOE's Savannah River Site in South Carolina (see Section S.1.6.2.1). For the purpose of this EIS a No Action Alternative (i.e., no tritium production at that CLWR) has been evaluated for each candidate reactor facility.

S.1.3 Development of the CLWR EIS

> ***What is a CLWR?***
>
> *A CLWR is a nuclear reactor designed and constructed to produce electric power for commercial use. Tritium can be produced during normal operation of a CLWR. The process uses TPBARs which, like the burnable absorber rods that they replace, absorb excess neutrons and help control the power in a reactor. Pressurized water reactors are well suited for the production of tritium because the TPBARs can be inserted into the nonfuel positions of the fuel assemblies. Tritium is generated within the TPBARs as they are irradiated during normal reactor operation.*

The CLWR EIS is a tiered document that follows the December 1995 Record of Decision (60 Federal Register 63878) for the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS). In that Programmatic EIS, DOE considered a range of reasonable alternatives for obtaining the required quantities of tritium. In the December 1995 Record of Decision, DOE decided to pursue a dual-track approach on the two most promising tritium-supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator system for tritium production (the Savannah River Site was selected as the location for an accelerator, should one be built).

DOE committed to selection of one of these approaches by the end of 1998 to serve as the primary source of tritium. The other alternative, if feasible, would continue to be developed as a backup tritium source. Production of tritium in an accelerator is analyzed in the *Draft Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT Draft EIS), DOE/EIS-0270 (see Section S.1.6.2.1).

On December 22, 1998, U.S. Department of Energy Secretary Bill Richardson announced that tritium production in one or more CLWRs would be the primary tritium supply technology and that the accelerator would be developed, but not constructed, as a backup to CLWR tritium production. Secretary Richardson further stated that the Watts Bar and Sequoyah reactors have been designated as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

S.1.4 The CLWR Procurement Process

The production of tritium in a CLWR would require a contract/interagency agreement between DOE and the owner/operator of the CLWR. Accordingly, on June 3, 1997, DOE issued in final form a Request for Proposals from owners/operators for irradiation services or sale of a CLWR. In September 1997, DOE received proposals for producing tritium using operating or partially completed reactors. The proposals for the Watts Bar and Bellefonte Nuclear Plants received from TVA were the only proposals determined to be responsive to the requirements of the procurement request. Under Federal Procurement Law, a proposal is "responsive" if it meets the criteria set forth in the agency's Request for Proposals. In addition to the responsive bids discussed in this EIS, DOE received one nonresponsive bid. That bid did not offer to produce tritium. TVA initially offered Watts Bar Nuclear Plant Unit 1 (Watts Bar 1) and Bellefonte Nuclear Plant Unit 1 (Bellefonte 1). Since Bellefonte 1 was a partially completed unit, in the event that it could not be completed and licensed in time to support DOE's requirements for tritium production, TVA, through the procurement process, offered to make Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2) available to meet the need for tritium. In addition, Bellefonte Nuclear Plant Unit 2 (Bellefonte 2) was considered a reasonable alternative. These reactors, the location of which are shown in **Figure S–2**, are owned by the U.S. Government and operated by TVA. They are as follows:

- Watts Bar Nuclear Plant Unit 1 (Watts Bar 1), Spring City, Tennessee (operating)
- Sequoyah Nuclear Plant Unit 1 (Sequoyah 1), Soddy-Daisy, Tennessee (operating)
- Sequoyah Nuclear Plant Unit 2 (Sequoyah 2), Soddy-Daisy, Tennessee (operating)
- Bellefonte Nuclear Plant Unit 1 (Bellefonte 1), Hollywood, Alabama (partially complete)
- Bellefonte Nuclear Plant Unit 2 (Bellefonte 2), Hollywood, Alabama (partially complete)

Because both TVA and DOE are Federal agencies, an interagency agreement between them could be reached via the Economy Act (31 U.S.C. 1535). The Economy Act is a Federal law that allows two government agencies to enter into an interagency agreement similar to the contractual agreement that a Federal agency would enter with a nonfederal party through the competitive procurement process. The Federal procurement process for the CLWR program explicitly allows for an interagency agreement via the Economy Act.

Subsequent to the initial TVA proposals, in May 1998 TVA allowed its initial procurement proposal for selling irradiation services at the Sequoyah and Watts Bar reactors to expire. However, because the TVA proposals are also subject to the Economy Act, this action did not affect the TVA reactor alternatives. Thus, the CLWR Draft EIS assessed all five of the TVA reactors as reasonable alternatives for tritium production. In November 1998, Energy Secretary Richardson asked TVA to submit a revised proposal for irradiation services at the Watts Bar and Sequoyah reactors, as well as final proposals for completion of Bellefonte, so that he would have a comprehensive set of options on which to base the technology decision. In December 1998, TVA submitted revised proposals for both the Watts Bar and Sequoyah reactors, as well as Bellefonte. Consequently, all of the alternatives that were evaluated in the CLWR Draft EIS remain as reasonable alternatives in the CLWR Final EIS.

DOE may enter into an interagency agreement with TVA, contingent on completion of the NEPA process, for production of tritium required to support the nuclear weapons stockpile. Only those actions that are determined not to have an adverse effect and not to limit the choice of reasonable alternatives would be permitted prior to the completion of the NEPA process. However, before completion of the CLWR EIS and its associated Record of Decision, DOE and TVA will have taken and will continue to take appropriate actions (e.g., studies, analyses) related to the potential submission of licensing documents to the U.S. Nuclear Regulatory Commission (NRC). The NRC must approve the use of TPBARs in licensed reactors.

S.1.5 Background

S.1.5.1 Defense Programs Mission

Since the inception of the nuclear weapons program in the 1940s, DOE and its predecessor agencies have been responsible for designing, manufacturing, maintaining, and retiring the nuclear weapons in the nation's stockpile. In response to the end of the Cold War and changes in the world political regime, the emphasis of the United States' nuclear weapons program has shifted dramatically over the past few years from producing weapons to dismantling weapons. Accordingly, the nuclear weapons stockpile is being greatly reduced; the United States is no longer producing new-design nuclear weapons; and DOE has closed or consolidated many former weapons production facilities.

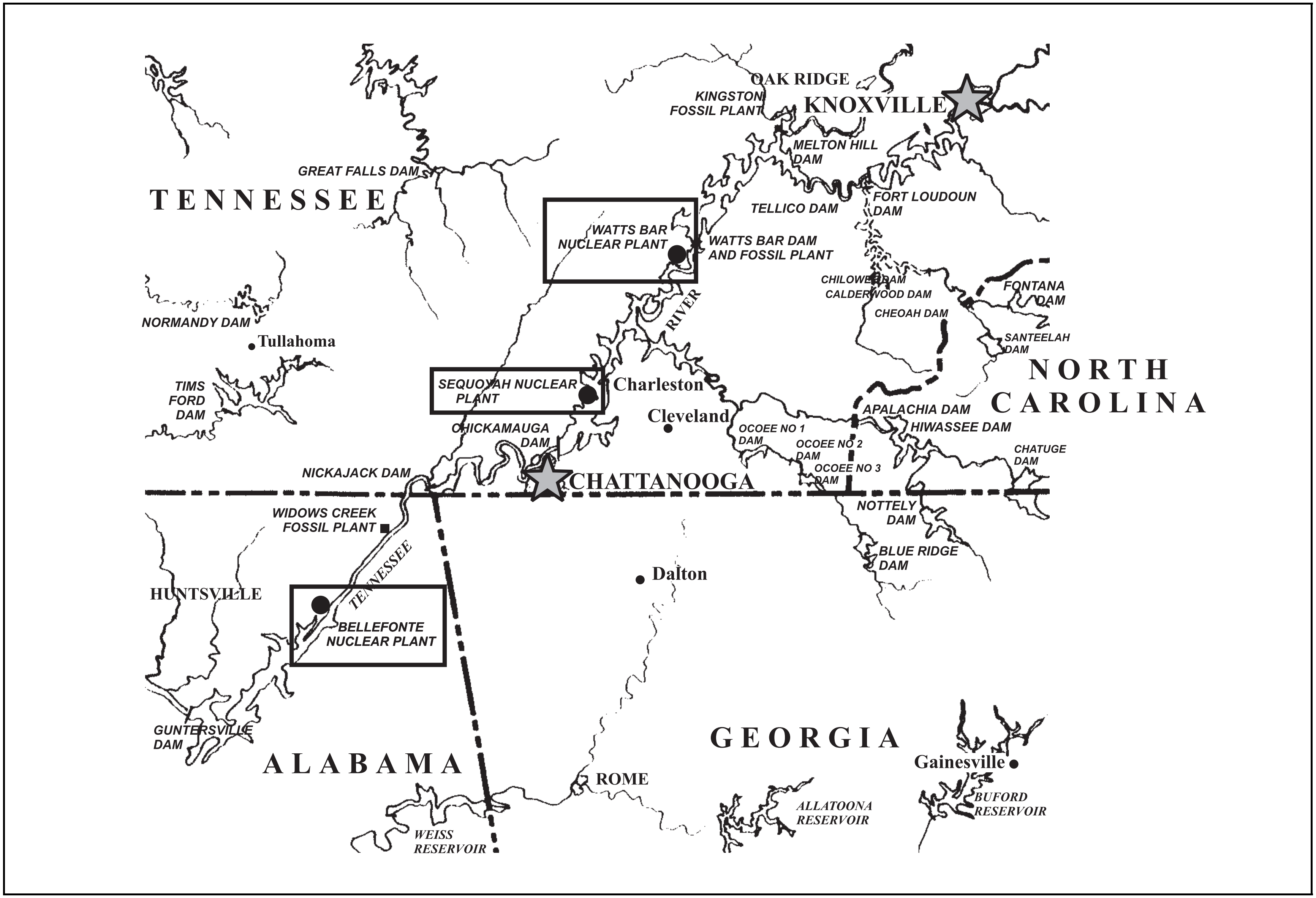


Figure S–2 Locations of Candidate CLWRs for Tritium Production

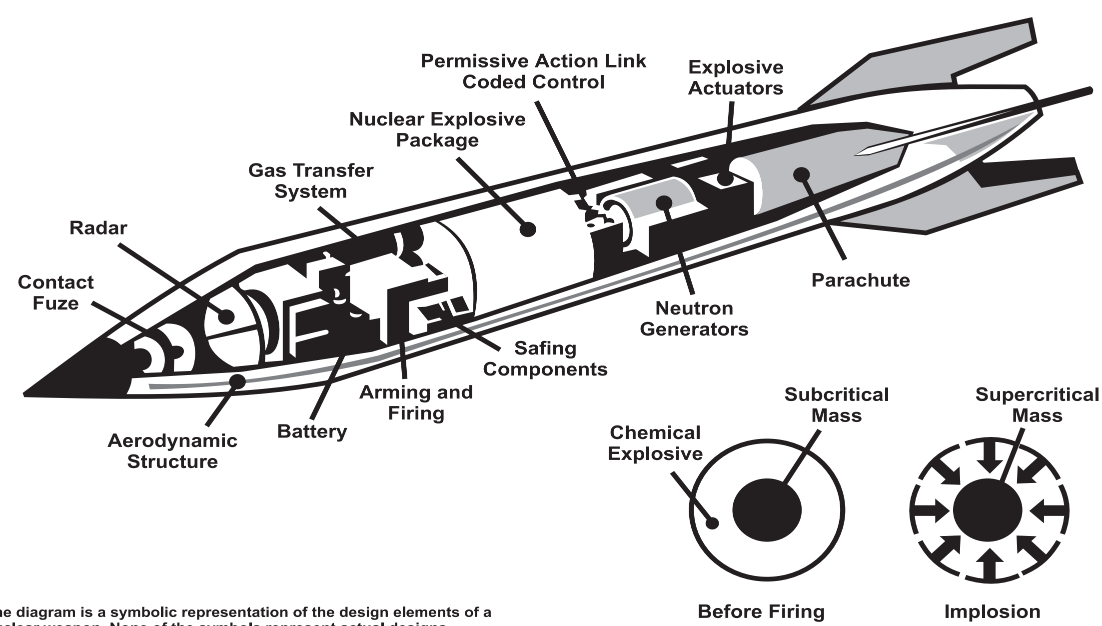
Tritium Use in a Nuclear Weapon

The figure below presents a simplified diagram of a modern nuclear weapon. An actual U.S. nuclear weapon is much more complicated, consisting of many thousands of parts.

The nuclear weapon primary is composed of a central core called a pit, which is usually made of plutonium-239 and/or highly enriched uranium. This is surrounded by a layer of high explosive, which, when detonated, compresses the pit initiating a nuclear reaction. This reaction is generally thought of as the nuclear fission "trigger" which activates the secondary assembly component to produce a thermonuclear hydrogen fusion reaction. The remaining nonnuclear components consist of everything from arming and firing systems, to batteries and parachutes. The assembly of these components into a weapon or the dismantlement of an existing weapon are done at the weapons assembly/disassembly facility.

Tritium is not a fissile material and cannot be used by itself to construct a nuclear weapon. However, tritium is a key component of all nuclear weapons presently in the nation's nuclear weapons arsenal. Tritium enables weapons to produce a larger yield while reducing the overall size and weight of the warhead. This process is called "boosting." Boosting is accomplished by injecting a mixture of tritium gas and deuterium gas, a naturally occurring, nonradioactive hydrogen isotope, into the pit. The deuterium and tritium are stored in reservoirs (which is depicted as the "gas transfer system" in the figure) until the gas transfer system is initiated. The implosion of the pit along with the onset of the fissioning process heats the deuterium-tritium mixture to the point that the atoms undergo fusion. The fusion reaction releases large quantities of very high energy neutrons which flow through the compressed pit material and produce additional fission reactions. Such boosting has allowed for the development of today's sophisticated delivery systems. The key function of tritium is to enhance the fission yield of a nuclear weapon.

Diagram of a Modern Nuclear Weapon



The diagram is a symbolic representation of the design elements of a nuclear weapon. None of the symbols represent actual designs.

Additionally, in 1991 President Bush declared a moratorium on underground nuclear testing, and in 1995 President Clinton decided to pursue a zero-yield Comprehensive Test Ban Treaty. Despite these significant changes, DOE's responsibilities for the nuclear weapons stockpile continue, and the President and Congress have directed DOE to continue to maintain the safety and reliability of the nuclear weapons stockpile and to provide the tritium necessary to satisfy national security requirements. As explained in Section S.2, the United States will need a new tritium production source by approximately 2005.

In the absence of new weapons designs and the total redesign of all warheads and delivery systems, the nation requires a reliable source of tritium to maintain a nuclear deterrent. Furthermore, total redesign of all warheads would require nuclear testing, which would be contrary to the President's pursuit of a Comprehensive Test Ban Treaty.

S.1.5.2 Brief History of the Production of Tritium

Tritium is so rare in nature that useful quantities must be manufactured. DOE has constructed and operated over a dozen nuclear reactors for the production of nuclear materials at the Savannah River Site, South Carolina, and the Hanford Site, Washington, starting with the early part of the Manhattan Project during World War II. None of these reactors is currently operational. The last one, the K-Reactor at the Savannah River Site, was shut down in 1988 for major environmental, safety, and health upgrades to comply with today's stringent standards. DOE discontinued the K-Reactor Restart Program in 1993 when smaller stockpile requirements delayed the need for tritium. As explained in the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling*, the K-Reactor is not a reasonable alternative for tritium production.

In recent years, international arms control agreements have caused the nuclear weapons stockpile to be reduced in size. Reducing the stockpile has allowed DOE to recycle the tritium removed from dismantled weapons for use in supporting the remaining stockpile. However, due to the decay of tritium, the current inventory of tritium will not meet national security requirements past approximately 2005. Therefore, the most recent Presidential direction, contained in the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive, mandates that new tritium be available by approximately 2005.

S.1.5.3 Production of Tritium in a CLWR

The production of tritium in a CLWR is technically straightforward and requires no elaborate, complex engineering development and testing program. All the nation's supply of tritium, as mentioned previously, has been produced in reactors. Most existing commercial pressurized water reactors utilize 12-foot-long rods containing an isotope of boron (boron-10) in ceramic form. These rods are sometimes called burnable absorber rods. The rods are inserted in the reactor fuel assemblies to absorb excess neutrons produced by the uranium fuel in the fission process for the purpose of controlling power in the core at the beginning of an operating cycle. DOE's tritium program has developed another type of burnable absorber rod in which neutrons are absorbed by a lithium aluminate ceramic rather than boron ceramic. These TPBARs would be placed in the same locations in the reactor core as the standard burnable absorber rods. There is no fissile material (uranium or plutonium) in the TPBARs.

While the two types of rods function in a very similar manner to absorb excess neutrons in the reactor core, there is one notable difference: when neutrons strike the lithium aluminate ceramic material in a TPBAR, tritium is produced. This tritium is captured almost instantaneously in a solid zirconium material in the rod, called a "getter." The solid material that captures the tritium as it is produced in the rod is so effective that the rod will have to be heated in a vacuum at much higher temperatures than normally occur in the operation of a light water reactor to extract the tritium for eventual use in the nuclear weapons stockpile. Depending upon tritium needs, as many as 3,400 TPBARs could be placed in a CLWR for irradiation.

S.1.5.4 Nonproliferation

Nuclear proliferation refers to the spread of nuclear weapons to nonnuclear weapons states. In an effort to limit nuclear proliferation, the United States, along with other signatories to the Nuclear Nonproliferation Treaty, has sought to preclude nonnuclear-weapons states from acquiring fissile materials (highly enriched uranium or plutonium) for weapons or explosive use. Under the terms of the Nuclear Nonproliferation Treaty, the United States is a weapons state and, as such, is allowed to conduct nuclear weapons activities. The production of tritium is one such activity. Accordingly, the use of a CLWR for the production of tritium is not inconsistent with the terms of the Nuclear Nonproliferation Treaty.

Along with other weapons-state signatories to the Nuclear Nonproliferation Treaty, the United States, under Article VI, undertakes to pursue negotiations or nuclear disarmament. Production of tritium in a CLWR in no way conflicts with these commitments. Since the end of the Cold War, the United States has significantly reduced the size of its nuclear weapons stockpile. At the present time, the United States is further downsizing the nuclear weapons stockpile consistent with the terms of the Strategic Arms Reduction Treaty (START) I Treaty. The United States has ratified the START II Treaty and is hopeful Russia also will ratify this treaty soon. Additionally, the United States has ceased production of fissile materials and the manufacture of new-design nuclear weapons and has closed several weapons production facilities.

Negotiations required for further reductions in United States nuclear weapons and, ultimately, total nuclear disarmament, will likely stretch well into the next century. United States production of tritium in a CLWR will support the U.S. nuclear weapons stockpile during this process. Such support of a decreased nuclear weapons stockpile is not inconsistent with the long-range goal of total nuclear disarmament.

The International Atomic Energy Agency (IAEA) is charged with detecting and deterring the spread of nuclear weapons. The United States has offered its commercial power plants to be inspected by the IAEA as an act of good faith and to encourage other nations to be equally open about their nuclear programs. Commercial reactor tritium production would not change this commitment. The commercial reactors would remain open for IAEA inspection whether they are producing tritium or not. Furthermore, the IAEA has indicated that CLWR production of tritium would not alter the existing IAEA Safeguards Program.

In accordance with the direction provided in the Fiscal Year 1998 National Defense Authorization Act (P.L. 105-85) conference report, DOE facilitated a high level interagency review of the policy issues associated with the use of commercial reactors to make tritium for national security purposes. Participants in the interagency review included the NRC, the U.S. Department of Defense, and the U.S. Department of State Arms Control offices. This process was completed in July 1998 and is documented in the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress*. The report concluded that the nonproliferation policy issues associated with the use of a CLWR are manageable and that DOE should continue to pursue the reactor option as a viable source for future tritium production. This conclusion was based upon a number of considerations including the following:

1. The use of CLWRs for tritium production is not prohibited by law or international treaty.

2. Historically, there have been numerous exceptions to the practice of differentiating between U.S. civil and military facilities, including the operation of the N-Reactor at Hanford, Washington, the dual use nature of the U.S. enrichment program, the use of defense program plutonium production reactors to produce radioisotopes for civilian purposes, and the sale of tritium produced in the defense reactors in the U.S. commercial market.

3. Although the CLWR alternative raised initial concerns because of its implications for the policy of maintaining separation between U.S. civil and military nuclear activities, these concerns could be adequately addressed, given the particular circumstances involved. These circumstances include the fact that the reactors would remain eligible for IAEA safeguards and the fact that, if TVA were the utility selected for the tritium mission, the reactors used for tritium production would be owned and operated by the U.S. Government, making them roughly comparable to past instances of government-owned dual-purpose nuclear facilities.

In addition to those examples referred to in the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy*, there are other instances in which military nuclear programs have been commingled with civilian programs. These instances include: (1) Atomic Energy Commission purchase of plutonium separated from commercial reactor spent fuel for unrestricted use, including defense purposes; (2) fabrication of both military and commercial reactor fuel by commercial reactor fuel fabricators; and (3) TVA generation of electricity for use in the production of fissile military materials.

S.1.5.5 Background on the Tennessee Valley Authority

TVA was established by an Act of Congress in 1933 (16 U.S.C. 831-831dd) as a Federal corporation to improve the navigability of and provide flood control for the Tennessee River; to provide reforestation and ensure the proper use of marginal lands in the Tennessee Valley; to provide agricultural and industrial development of the Tennessee Valley; to provide for the national defense; and for other purposes. Within a few years of its establishment, TVA built a series of multipurpose dams on the Tennessee River system. One of the purposes of these dams was production of abundant, inexpensive electricity. The hydroelectric power generated by these dams met most of the rapidly increasing needs of the region through the 1940s. By the early 1950s, however, the growing demand was quickly outstripping the capacity of the dams and the Watts Bar Fossil Fuel Plant, which began operation in 1942. During the next 20 years, TVA built 11 large, coal-fired, electricity-generating plants to meet the region's growing needs. Some of these plants were the largest, first-of-their-kind coal-fired units in the world. The 1960s brought even greater growth to the region. To meet the anticipated need for more power, TVA began an ambitious program of nuclear plant construction.

Today TVA is one of the largest producers of electricity in the United States, generating 4 to 5 percent of all electricity in the nation. TVA's power system serves almost 8 million people in a seven-state region encompassing some 207,200 square kilometers (80,000 square miles). TVA's electricity is distributed to homes and businesses through a network of 159 power distributors, including municipally owned utilities and electric cooperatives. TVA also sells power directly to approximately 60 large industrial customers and Federal facilities.

TVA's power system, which is self-financed, has a generating capacity of 28,000 megawatts-electric. Its generating system consists of 11 coal-fired plants (53 percent of total generating capacity), 5 nuclear generating units at three sites (20 percent), 29 hydroelectric dams (15 percent), 48 combustion turbine units at four sites (7 percent), and one pumped-storage facility (5 percent). These plants are owned and operated by the U.S.

Government. The TVA power system is linked by 25,750 kilometers (16,000 miles) of transmission lines that carry power to 750 wholesale delivery points, as well as 57 interconnections with 13 neighboring utilities.

In December 1995, with the publication of *Energy Vision 2020, Integrated Resource Plan and Environmental Impact Statement*, TVA projected demands for electricity in the TVA power service area through the year 2020 and evaluated different ways of meeting these projected increases. Since the Integrated Resource Plan was completed in 1995, TVA has continued to evaluate and select the best resource options based on the latest proposals and TVA's forecast of power needs. The total system generating capacity has been increased with the successful completion of Watts Bar 1 and the return to service of Browns Ferry Nuclear Plant Unit 3. Both units have operated above expectations and have proven to be very reliable.

Current projections show the demand for electricity (including reserves) will exceed TVA's 1998 generating capacity by about 5,200 megawatts-electric in 2005; this projection is slightly less than the 1998-2005 medium load forecast of 5,450 megawatts-electric in *Energy Vision 2020, Integrated Resource Plan and Environmental Impact Statement*. About 2,800 megawatts-electric of additional generating capacity will be needed by the year 2001. A portion of this could be met by the proposed Red Hills Power Project. The remainder will be met by option purchase agreements, forward contracts for delivery of electricity to TVA, and internal TVA projects to increase net dependable capacities for TVA's combustion turbines, fossil plants, and pumped storage units. An additional 2,400 megawatts-electric of capacity will be required between 2001 and 2005. The completion of the Bellefonte unit(s) would offset some of this planned capacity.

Producing tritium in a TVA reactor would be consistent with the Congressional purposes that established TVA—namely, to provide for the industrial development of the Tennessee Valley and for national defense. Producing tritium in a TVA reactor would also enable TVA to maximize the utilization of its resources and potentially increase its electricity generating capacity. TVA, as a Federal agency, in order to fulfill NEPA responsibilities, chose to be a cooperating agency on this EIS. A cooperating agency is defined by Council on Environmental Quality regulations as any Federal agency other than a lead agency having jurisdiction by law or special expertise with respect to any environmental issue involved in a proposal (40 CFR 1508.5).

S.1.6 NEPA Strategy

DOE's strategy for compliance with NEPA has been to make decisions on programmatic alternatives in the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* and the subsequent Record of Decision (60 FR 63878), followed by site-specific analyses to implement the programmatic decisions. The decisions made in the December 12, 1995 *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* Record of Decision have resulted in DOE preparing this EIS and the following NEPA documents:

1. *Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*

2. *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site*

3. *Environmental Assessment, Lead Test Assembly Irradiation and Analysis, Watts Bar Nuclear Plant, Tennessee and Hanford Site, Richland, Washington*

The relationship of the CLWR EIS with these, as well as other relevant NEPA documents, is explained below.

S.1.6.1 Completed NEPA Actions

S.1.6.1.1 Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling

The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling*, DOE/EIS-0161, evaluated the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at each of five DOE candidate sites (the Idaho National Engineering and Environmental Laboratory; the Nevada Test Site; the Oak Ridge Reservation, Tennessee; the Pantex Plant, Texas; and the Savannah River Site, South Carolina) for four different production technologies (heavy water reactor, modular high temperature gas-cooled reactor, advanced light water reactor, and accelerator production of tritium). This Programmatic EIS also evaluated the impacts of using a CLWR, but did not analyze specific locations or reactor sites. Issued in October 1995, the Final Programmatic EIS was followed by a Record of Decision on December 12, 1995 (60 FR 63878). In the Record of Decision, DOE decided to pursue a dual-track approach on the two most promising tritium supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or reactor irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator system for tritium production (the Savannah River Site was selected as the location for an accelerator, should one be built) (60 FR 63878). The Record of Decision also called for the construction of a proposed new Tritium Extraction Facility at the Savannah River Site. The CLWR EIS is intended to provide the NEPA analysis necessary to implement the Final Programmatic EIS Record of Decision, which will select the technology and specific site for a tritium production facility.

On December 22, 1998, Energy Secretary Richardson announced that tritium production in one or more CLWRs would be the United States' primary tritium supply technology and that the accelerator would be developed, but not constructed, as a backup to CLWR tritium production. Secretary Richardson further stated that the Watts Bar and Sequoyah reactors have been designated as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

S.1.6.1.2 Lead Test Assembly Environmental Assessment

This NEPA analysis addressed the environmental impacts associated with the fabrication of the Lead Test Assembly TPBARs at Pacific Northwest National Laboratory, Washington; the irradiation of these TPBARs in Watts Bar 1; post-irradiation examination of the TPBARs at Pacific Northwest National Laboratory and Argonne National Laboratory West, Idaho; and associated impacts of transporting TPBARs to and from the Watts Bar Nuclear Plant. The purpose of the Lead Test Assembly demonstration is to confirm and provide confidence to regulators and the public that tritium production in a CLWR is technically straightforward and safe. DOE issued a Finding of No Significant Impact in July 1997. Subsequently, the TPBARs were placed in Watts Bar 1 on September 25, 1997, and they are presently being irradiated during the normal 18-month fuel cycle. Following irradiation, the TPBARs will undergo post-irradiation examination. To meet its own NEPA requirements, TVA adopted the Lead Test Assembly Environmental Assessment and issued a Finding of No Significant Impact on August 14, 1997. Additionally, NRC prepared an independent Environmental Assessment and issued its own Finding of No Significant Impact on September 11, 1997 (62 FR 47835).

> ***Lead Test Assembly Program***
>
> *In September 1997, a confirmatory demonstration using the TPBARs began at Watts Bar 1 following approval by DOE and NRC. The purpose of the confirmatory tests is to provide confidence to the NRC, utilities, and the public that tritium production in a CLWR is both technically straightforward and safe. DOE expects TVA to remove these rods in the Spring of 1999, at which time they will be shipped to a DOE laboratory for examination.*

S.1.6.1.3 EISs for the Operation of Watts Bar 1 and Sequoyah 1 and 2 and for Construction of Bellefonte 1 and 2

EISs analyzing the environmental impacts associated with operation of the Watts Bar and Sequoyah Nuclear Plants and the construction of the Bellefonte Nuclear Plant have been completed and serve to a great extent as a baseline on which the environmental impacts associated with tritium production are assessed. For the partially completed Bellefonte 1 and 2, this CLWR EIS evaluates the environmental impacts associated with their completion and their subsequent operation for 40 years.

S.1.6.2 Ongoing NEPA Actions

S.1.6.2.1 Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site

This EIS analyzes the potential environmental impacts associated with the construction and operation of an accelerator for the production of tritium at the Savannah River Site. On a programmatic level, the accelerator for the production of tritium at the Savannah River Site represents the No Action Alternative for the CLWR EIS. A summary of the APT Draft EIS, is included in Volume 1, Section 5.2.11, of the CLWR EIS. The Draft APT EIS was issued in December 1997. The Final EIS was issued concurrently with the CLWR Final EIS. As a result of the decision by Secretary Richardson on December 22, 1998, that the accelerator would be a backup to CLWR tritium production, DOE will continue with developmental activities associated with the accelerator. However, the accelerator will not be constructed. The APT EIS is incorporated in the CLWR EIS by reference.

S.1.6.2.2 Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility

This EIS analyzes the potential environmental impacts associated with the construction and operation of a Tritium Extraction Facility at the Savannah River Site. The Draft EIS for the Tritium Extraction Facility was issued in May 1998; a Final EIS was issued concurrently with the CLWR EIS. The purpose of the Tritium Extraction Facility would be to extract the tritium from the TPBARs or from targets of similar design. TPBARs irradiated at the selected CLWRs would be sent to the Tritium Extraction Facility for extraction of the tritium-containing gases. A summary of the environmental impacts of the *Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271, is included in the CLWR EIS. The Tritium Extraction Facility EIS is incorporated in the CLWR EIS by reference.

S.1.6.2.3 Environmental Assessment for the Tritium Facility Modernization and Consolidation Project at the Savannah River Site

This environmental assessment addresses the potential impacts of consolidating the tritium activities currently performed in Building 232-H into the newer Building 234-H. Tritium extraction functions would be transferred to the Tritium Extraction Facility under the Preferred Alternative. The overall impact would be to reduce emissions by up to 50 percent. Another effect would be to reduce the amount of low-level radioactive waste generated. Effects on other resources would be negligible. Therefore, impacts from these actions were not included in the cumulative impacts of this CLWR EIS.

S.1.6.2.4 Final Environmental Impact Statement for the Bellefonte Conversion Project

This EIS, issued by TVA, addresses the environmental impacts anticipated from: (1) the conversion of the partially completed Bellefonte 1 and 2 to fossil fuel electricity generating facilities, and (2) the No Action Alternative of maintaining the facilities as partially completed nuclear facilities. The EIS was completed in October 1997. The issuance of a Record of Decision on the *Final Environmental Impact Statement for the Bellefonte Conversion Project* will not be made until it is determined whether one or both of these reactor plants will be used for tritium production.

S.1.7 Public Comment Period

In August 1998, DOE issued the CLWR Draft EIS (DOE/EIS-0288D). This document explained the need for a domestic tritium production source to maintain the U.S. nuclear deterrent and described and analyzed the environmental impacts associated with tritium production at one or more nuclear power plants operated by TVA. The 60-day public comment period on the CLWR Draft EIS began on August 28, 1998, and ended on October 27, 1998.

During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. The public was encouraged to submit comments via the U.S. mail service, e-mail to a special DOE web site on the Internet, a toll-free 800-number phone line, and a toll-free fax line.

The public hearings were conducted using a modified traditional public hearing format that allowed two-way interaction between DOE representatives and members of the public and also encouraged public comments on the document. A neutral facilitator was present at each hearing to direct and clarify discussions and comments. A court reporter was present at each hearing to record the proceedings and provide a transcript of the public comments and the dialogue between the public and the DOE and TVA representatives.

Comments from the public hearings were combined with comments received by other means (mail, e-mail, 800 number, fax, etc.) during the comment period. The written comments were date-stamped and assigned a sequential document number in the order in which they were received. Volume 2 of this CLWR EIS, the Comment Response Document, describes the public comment process in detail (Chapter 1); provides scanned images of all the comment documents received (Chapter 2); summarizes the public hearing comments (Chapter 2); and provides DOE's responses to the public comment summaries (Chapter 3).

Prior to fulfilling the requirement to reach a technology decision by the end of 1998, Energy Secretary Richardson asked TVA to submit final proposals for its Watts Bar and Sequoyah reactors, as well as for completion of its Bellefonte reactor. These proposals were provided to DOE the first week of December 1998, after the October 27, 1998, closing of the public comment period for the CLWR Draft EIS. After receiving these offers, Secretary Richardson directed that this information be presented to the public so they could review the latest TVA offers and provide their comments prior to his reaching the technology decision. To enable this, in spite of the short notice, a public meeting was scheduled and conducted on December 14, 1998. At this meeting, DOE presented information on the new proposals; answered questions; and accepted comments on the proposals, as well as on CLWR tritium production in general. The public was encouraged to comment on the new TVA proposals via U.S. mail, fax, toll-free 800-number phone line, or e-mail. Although the comments received as a result of this December 14, 1998, meeting were submitted after the public comment period, DOE responded to all of these comments as though they were received during the public comment period and they are included in Volume 2, the Comment Response Document.

During the public comment period, approximately 800 comments were received. An additional 230 comments were in conjunction with the December 14, 1998, public meeting. Most of the comments focused on a limited number of major issues. These issues and DOE's responses are summarized below.

By far, a majority of comments supported the completion and operation of the Bellefonte Nuclear Plant for tritium production because it would promote economic development in a depressed area and provide other, similar benefits. Other commentors generally opposed the completion of the Bellefonte plant as a nuclear power plant, particularly for tritium production. In response to these comments, DOE acknowledged there is both public support and opposition for the Bellefonte alternative. The CLWR EIS addresses all of the benefits cited by the commentors who favored the Bellefonte alternative, as well as the concerns expressed by opponents. DOE's response to these and other related comments may be found in Volume 2, Chapter 3 of this EIS, under Category 7: General Support/Opposition.

The cost-effectiveness of the CLWR and APT tritium production alternatives was another frequent theme among many commentors. Most asked for cost-related information and/or expressed the opinion that cost should be the major determining factor in a tritium production decision. In addition, some commentors questioned the accuracy of the cost information that DOE provided at the public hearings and the December 14, 1998, public meeting, and many believed there was little possibility that TVA could complete the Bellefonte plant for the cost estimates cited. Other commentors stated they felt the large expenditures required for CLWR tritium production would be better spent on other, more urgent social needs such as education and environmental restoration. Some commentors were concerned about possible costs to TVA ratepayers resulting from tritium production.

In response to the cost-related comments, DOE stated that the CLWR EIS was prepared in accordance with NEPA, the Council on Environmental Quality's regulations on implementing NEPA (40 CFR Parts 1500-1508), and DOE's NEPA regulations (10 CFR 1021). None of these regulations require the inclusion of a cost analysis in an EIS. As discussed in Volume 1, Chapter 3, Section 3.2.1, the basic objective of the CLWR EIS is to provide the public and DOE decisionmakers with a description of the reasonable alternatives for CLWR tritium production and information about their potential impacts on public health and safety and the environment. While costs could be an important factor in the ultimate Record of Decision, the purpose of this and other EISs is to address the environmental consequences of the proposed action. DOE distributed cost information comparing the CLWR and APT alternatives at the public hearings in October 1998, however, and this information is available upon request. In response to comments concerning the accuracy of TVA's cost estimates for completing the Bellefonte plant, DOE considers TVA's cost estimates to be both accurate and conservative, given that the plant is nearly complete and TVA's cost estimates were evaluated by an external reviewer. In response to comments that CLWR funds would be better spent on other, more urgent social needs, DOE noted that Congress determines how funds are allocated, and DOE does not determine Federal spending priorities. Furthermore, such spending priorities are beyond the scope of this EIS. In response to the concerns of TVA ratepayers about potential costs resulting from tritium production, DOE responded that no additional costs to ratepayers are expected. DOE's responses to the cost-related public comments are found in Volume 2, Chapter 3 of this EIS, under Category 23: Cost Issues.

Many commentors questioned the need for nuclear weapons and/or the present need for tritium. Other commentors expressed a belief that the amount of tritium needed to support current and future nuclear weapons stockpiles is less than the amount stated in the CLWR EIS. In response, DOE cited its responsibilities for maintaining the nation's nuclear weapons stockpile under the Atomic Energy Act of 1954 and the requirements of the 1996 Nuclear Weapons Stockpile Plan and accompanying Presidential Decision Directive, which established the size and composition of the nation's nuclear weapons stockpile and the need for a new tritium production source by approximately 2005. DOE stated that sufficient quantities of tritium no longer can be obtained from weapons being retired from the existing stockpile, as cited in the most recent Presidential

Decision Directive. DOE's responses to comments concerning the need for tritium are found in Volume 2, Chapter 3 of this EIS, under Category 2: Purpose and Need for Tritium.

Several commentors expressed concern that tritium production in a commercial reactor would violate U.S. policy regarding the separation of commercial and military uses of nuclear energy, would hinder nonproliferation efforts, and would encourage other nations to use their own commercial facilities for nuclear weapons purposes. In response to these concerns, DOE cited the conclusions of a high-level study entitled, *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress.* This interagency review concluded that any nonproliferation issues associated with the production of tritium in a CLWR were manageable and that DOE should continue to pursue the CLWR option, as stated in Volume 1, Chapter 1, Section 1.3.5, of the CLWR EIS. DOE also stated that there is no U.S. policy, law, or treaty that prohibits the production of tritium that ultimately will be used in weapons in a commercial reactor. In addition, DOE stated that the United States is a declared weapons state, and the purpose of nonproliferation efforts is to keep nonweapons states from acquiring nuclear weapons while the declared weapons states work toward total disarmament. DOE noted that other nations already operate dual-purpose reactors that serve both civilian and military needs. DOE's responses to comments on nonproliferation, the separation of civilian and military nuclear facilities, and other policy issues are found in Volume 2, Chapter 3 of this EIS, under Category 1, Policy Issues.

Many commentors were concerned with public and occupational health and safety issues. Some specifically questioned TVA's past history and practices related to plant safety. In response to these concerns, DOE stated that the environmental impacts and potential radiological doses to both workers and the public resulting from tritium production would be well below the limits considered acceptable by Federal and state regulatory authorities. Public and occupational health and safety issues are discussed in Volume 1, Chapter 5, of the CLWR EIS. DOE also stated that prior to irradiation of any TPBARs, an NRC safety evaluation would be required to amend the operating license of the reactors for tritium production. This review specifically would look at all potential health and safety issues. DOE's responses to public and occupational health and safety comments are found in Volume 2, Chapter 3 of this EIS, under Category 14: Occupational and Public Health and Safety - Normal Conditions.

Several commentors stated that DOE has a history of polluting and contaminating every site they have operated and wanted to know why the proposed action would be any different. In response, DOE acknowledged having a number of older facilities in need of environmental cleanup, and an aggressive cleanup program is underway to upgrade these facilities and ensure their continued compliance with Federal and state regulations. All of the CLWR tritium production alternatives involve the use of state-of-the-art TVA reactors. These reactors have excellent environmental compliance records and exemplary environmental, health, and safety programs to ensure their continued compliance with Federal and state regulations. In addition, DOE expressed confidence that tritium production in a CLWR would be safe and is technically straightforward. To commentors who expressed concern that CLWR tritium production expenditures would drain DOE's budget for its facility cleanup activities, DOE responded that the funding for both of these programs would come from separate Congressional appropriations. Funding for CLWR tritium production would not be obtained from funding already allocated for facility cleanup activities. DOE's responses to comments about past DOE practices and conflicts between DOE's cleanup activities and tritium production are found in Volume 2, Chapter 3 of this EIS, under Category 8: Past DOE Practices.

Some commentors suggested that the CLWR EIS was deficient and inadequate as a NEPA document. In response, DOE stated that it believes that the EIS is adequate and fully complies with NEPA. The EIS evaluates all reasonably foreseeable environmental impacts for all reasonable alternatives, in accordance with the requirements of the Council on Environmental Quality's regulations (40 CFR 1500-1508) and DOE's

NEPA regulations (10 CFR 1021) and procedures. DOE's responses to NEPA-related comments are found in Volume 2, Chapter 3 of this EIS, under Category 5: NEPA Process.

Other commentors stated that the relationship between the CLWR , APT, and Tritium Extraction Facility EISs was not clearly explained in the CLWR Draft EIS. In response, DOE added a Preface to the CLWR Final EIS to better describe the relationship between the CLWR EIS, the APT EIS, and the Tritium Extraction Facility EIS. This Preface also addresses Energy Secretary Richardson's December 22, 1998, announcement that the CLWR would be the primary tritium supply technology. DOE's response to comments concerning the relationship between the CLWR , APT, and Tritium Extraction Facility EISs is found in Volume 2, Chapter 3 of this EIS, under Category 5: NEPA Process (Comment Summary 05.01).

Several commentors were concerned about the additional spent nuclear fuel that would be generated by tritium production. DOE responded that additional spent nuclear fuel would be generated if more than 2,000 TPBARs were irradiated in a single reactor, as stated in Section 3.2.1, Volume 1, of the CLWR Final EIS. DOE also stated that the CLWR EIS evaluates the environmental impacts of additional spent fuel generation resulting from a maximum number of 3,400 TPBARs. DOE stated that it would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel. In the event a suitable repository is not available, as required by law, the additional spent nuclear fuel generated as a result of tritium production would be stored on site in a dry cask independent spent fuel storage installation. DOE's responses to spent nuclear fuel comments are found in Volume 2, Chapter 3 of this EIS, under Category 17: Spent Fuel Management.

Several commentors suggested that the production of tritium in a CLWR would make TVA reactors an attractive target for terrorists and that DOE should address the consequences of such an attack in the EIS. In response, DOE stated that, prior to loading TPBARs in TVA's Watts Bar reactor as part of the Lead Test Assembly Program, a thorough security review was conducted. This review found existing security provisions to be adequate to protect against such a threat. Prior to utilizing Watts Bar or other TVA reactors for tritium production, additional DOE and NRC reviews would be required to ensure safeguard and security provisions are adequate. DOE's responses to these and other security-related comments are found in Volume 2, Chapter 3 of this EIS, under Category 22: Safeguards and Security.

S.1.8 Changes from the Draft Environmental Impact Statement

In response to comments on the CLWR Draft EIS and as a result of information that was unavailable at the time of the issuance of the Draft, Volume 1 of the CLWR Final EIS contains revisions and new information. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger additions. Volume 2, Comment Response Document, contains the comments received during public review of the CLWR Draft EIS and DOE's responses to those comments. A brief discussion of the most important changes is provided in the following paragraphs.

TPBAR Failures

In analyzing the potential releases of tritium to the environment from the proposed action, the CLWR Draft EIS assumed that two of the TPBARs under irradiation would fail and the entire inventory of tritium would be available to be released to the environment under normal operating conditions. The same two-TPBARs failure assumption was made in the analysis of transportation accidents. The assumption was based on the failure statistics of standard burnable absorber rods, i.e., two failures out of 29,700 rods through July 1980. Since the issuance of the CLWR Draft EIS, additional information obtained from Westinghouse revealed that both failures were attributed to early manufacturing defects that have been corrected. The failures were attributed to slumping of the absorber material—a condition that cannot occur in the TPBARs. Since the two early failures, more than 500,000 Westinghouse burnable absorber rods have been used without a single observed failure. Consequently, the CLWR Final EIS still analyzes the impacts to the health and safety of the public from the potential failure of two TPBARs, but characterizes the event of such a failure as an abnormal event during an irradiation cycle, rather than a continuous, normal-operation occurrence. This change in assumptions results in changes in the potential tritium releases and estimated doses to the public under normal reactor operation and some accident conditions (i.e., the nonreactor design-basis accident) for all reactor alternatives.

The Secretary's Technology Announcement

The CLWR Draft EIS was issued in August 1998. At the time, the decision on the primary and backup technologies to be used for tritium production had not been made. On December 22, 1998, Energy Secretary Bill Richardson announced that the CLWR would be DOE's primary option for tritium production and the proposed linear accelerator at the Savannah River Site would be the backup option. In addition, the Secretary designated TVA's Watts Bar and Sequoyah Nuclear Plants as the preferred CLWR facilities. The CLWR Final EIS was revised to reflect the Secretary's announcement and include the Preferred Alternative. Changes were made primarily in the introductory sections of the CLWR Final EIS for accuracy. The evaluation of the impacts was not affected.

Clarification of TVA Proposals

In response to public comments about the status of the TVA proposals to provide irradiation services or the sale of a CLWR, Section 1.1.4 was revised. The discussion of the procurement process clarifies that DOE is considering only the purchase of irradiation services, not the purchase of a reactor. Additionally, the section clarifies that TVA submitted several proposals to DOE during the ongoing negotiations. An earlier TVA proposal for the use of Watts Bar expired. However, in December 1998, TVA submitted to DOE another offer to provide irradiation services at Watts Bar and Sequoyah, as well as additional proposals for Bellefonte. TVA's offer to provide irradiation services at one or more of the three proposed sites is still viable.

Nonproliferation Policy Issues

In response to public comments requesting DOE to provide examples of the commingling of civilian nuclear programs with military nuclear programs, Section 1.3.5 was revised. The discussion of nonproliferation now includes an explanation and some background information on the issue, as well as examples of the commingling of civilian and military uses of nuclear power.

Water Quality Analysis

In response to public comments expressing concern about impacts to public water withdrawals downstream of the Bellefonte Nuclear Plant, sections of Chapters 4 and 5 were revised. The discussion of surface water use for Bellefonte (Section 4.2.3.4) identifies nearby intakes downstream. The discussions of potential impacts to surface water near the three reactor sites (Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4) include the tritium concentration at various locations downstream. In addition, Section 5.2.3.4 was revised to include potential chemical concentrations downstream of Bellefonte.

Accident Analysis

During the preparation of the CLWR Final EIS, data related to the design and fabrication of the TPBARs indicated that the release of tritium from an accidental breach of a TPBAR more likely would be time-dependent than instantaneous and finite, as was assumed in the Draft EIS. Consequently, the analysis for the

TPBAR handling accident and the transportation cask handling accident at the reactor site (Appendix D), and the transportation cask accident en route (Appendix E), were revised to reflect the more recent data.

Environmental Justice

Figures in Appendix G were revised to improve their quality. New figures were added to show the location of minority and low-income populations within a 16.1-kilometer (10-mile) radius. In addition, a representative average individual dose at 40.2 kilometers (25 miles) to each of the 16 principal directions has been overlaid onto the 80.5-kilometer (50-mile) radius to show the potential dose to minority and low-income populations.

Tritium Requirements and Supply

In response to public comments expressing concerns about the disparity between the amount of tritium needed and the amount that could be supplied by one CLWR, Section 3.2.1 was revised. The discussion explains that the exact amount of tritium needed is classified information, however, for the purposes of analysis, it is not expected to exceed 3 kilograms per year (6.6 pounds per year). It further clarifies that one reactor with 3,400 TPBARs would be expected to satisfy a steady state tritium requirement in most years.

Comparison of the APT and CLWR Alternatives

In response to public comments requesting additional information about the No Action Alternative, Section 3.2.6 was expanded to include a table comparing the impacts of producing tritium under the accelerator and CLWR options. A document comparing the costs of the technology options is available upon request from DOE.

Source of Uranium-235 for Tritium Production

In response to public comments concerning the source of blended-down uranium-235 that could be used as nuclear fuel for tritium production, Section 5.2.7 was revised for clarification. A discussion of the environmental impacts resulting from blending-down activities of highly enriched uranium was also added.

Mitigation Measures

The CLWR Draft EIS discusses the need for mitigation measures, if such a need were warranted, right after the presentation of the impacts for each environmental resource. A new Section 5.5 was added to the CLWR Final EIS to summarize these discussions.

Sensitivity Analysis

An additional variation from the baseline analysis has been included in Section 5.2.9 of the CLWR EIS, that is, the possibility of producing tritium at some date later than 2005.

Miscellaneous Revisions and Editorial Changes

Several sections in the CLWR Final EIS were revised to reflect the availability of more recent data, or to include corrections on erroneous information, improvements in the presentation, and other editorial changes. None of these revisions affect the environmental impact assessment of the EIS.

S.2 PURPOSE AND NEED

Since nuclear weapons came into existence in 1945, a nuclear deterrent has been a cornerstone of the nation's defense policy and national security. Both President Clinton and the Congress have reiterated this principle in public statements and through legislation. The President has stated on a number of occasions his commitment to maintaining a nuclear deterrent capability. Most recently, in May 1997, the President stated in *A National Security Strategy for a New Century* that, ". . . our nuclear deterrent posture is one of the most visible and important examples of how U.S. military capabilities can be used effectively to deter aggression and coercion. Nuclear weapons serve as a hedge against an uncertain future, a guarantee of our security commitments to allies, and a disincentive to those who would contemplate developing or otherwise acquiring their own nuclear weapons."

U.S. strategic nuclear systems are based on designs that use tritium gas. Since tritium decays at a rate of about 5.5 percent per year (i.e., every 12.3 years one-half of the tritium has decayed), periodic replacement is required as long as the United States relies on a nuclear deterrent. The nation, therefore, requires a reliable source of tritium to maintain its nuclear weapons stockpile.

The size of the nation's nuclear weapons stockpile is determined by the Secretaries of Defense and Energy who, in coordination with the Nuclear Weapons Council, jointly sign and submit to the President the Nuclear Weapons Stockpile Memorandum. This Memorandum transmits the Nuclear Weapons Stockpile Plan to the President for final approval. Many factors are considered in the development of the Nuclear Weapons Stockpile Plan, including the status of the currently approved stockpile, arms control negotiations and treaties, Congressional constraints, and the status of the nuclear material production and fabrication facilities. Under this plan, DOE can determine the amount of tritium necessary to support the approved stockpile.

Over the past 40 years, DOE has built and operated over a dozen nuclear reactors (five of them at the Savannah River Site in South Carolina) to produce tritium and other nuclear materials for weapons purposes. Today, none of these reactors are operational, and DOE has not produced tritium for addition to the stockpile since 1988. According to the Atomic Energy Act of 1954, however, DOE is responsible for developing and maintaining the capability to produce the nuclear materials, such as tritium, that are necessary for the defense of the United States (40 U.S.C. 2011).

Until a new tritium supply source is operational, DOE will continue to support tritium requirements by recycling tritium from weapons retired from the nation's stockpile. However, because of the tritium decay rate, recycling can only meet the tritium demands for a limited time, even with the reduction in stockpile requirements and no identified need for new-design weapons in the foreseeable future. Current projections, derived from the most recently approved, classified projections of future stockpile scenarios, indicate that recycled tritium will support the nation's nuclear weapons stockpile adequately until approximately 2005 (see **Figure S–3**).

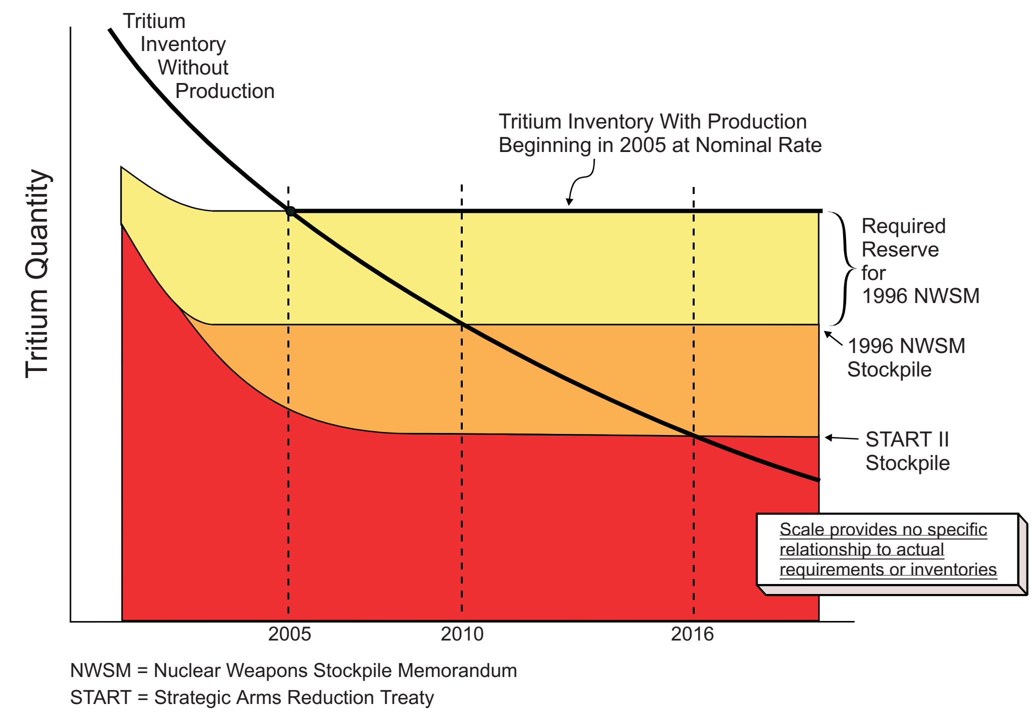


Figure S–3 Estimated Tritium Inventory and Reserve Requirements

Even with a reduced nuclear weapons stockpile and no identified requirement for new nuclear weapons production in the foreseeable future, an ensured long-term tritium supply and recycling capability will be required to maintain the weapons determined to be needed for national defense under the prevailing Nuclear Weapons Stockpile Plan. Presently, no U.S. source of new tritium is available. The effectiveness of the U.S. nuclear deterrent capability depends not only on the nation's current stockpile of nuclear weapons or the effectiveness of those it can produce, but also on its ability to reliably and safely provide the tritium needed to maintain these weapons.

To meet requirements mandated by the President and supported by the Congress, the United States will need a new source of tritium production by approximately 2005. For planning purposes, the operational life of the new production source would be about 40 years. Without a new supply source, after 2005 the United States would have to use its five-year reserve of tritium to maintain the readiness of the nuclear weapons stockpile. The five-year reserve contains a quantity of tritium maintained for emergencies and contingencies. In such a scenario, the complete depletion of the five-year tritium reserve would degrade the nuclear deterrent capability because not all weapons in the stockpile would be able to function as designed. Eventually, the United States would lose its nuclear deterrent. The purpose of DOE’s action is to produce in one or more commercial light water reactors, the tritium needed to maintain the nation’s nuclear weapons stockpile.

TVA’s purpose and need relative to this EIS is to maximize the utilization of its resources while simultaneously providing support to national defense. National defense support has been one of TVA’s historic multi-purpose missions (see Section S.1.5.5).

S.3 COMMERCIAL LIGHT WATER REACTOR PROGRAM ALTERNATIVES

S.3.1 Production of Tritium in a Commercial Light Water Reactor

To produce tritium in a CLWR, TPBARs would be inserted into the reactor core. The TPBARs are long, thin tubes that contain lithium-6, a material that produces tritium when it is exposed to neutrons in the reactor core. The exterior dimensions of the TPBARs are similar to the burnable absorber rods, so that they can be installed in fuel assemblies where burnable absorber rods are normally placed. To ease the insertion and removal from fuel assemblies, the TPBARs would be attached to a base plate. See **Figures S–4** and **S–5** for a sketch of a typical TPBAR assembly and components. In addition to producing tritium, TPBARs would fill the same role as burnable absorber rods in the operation of the reactor.

The neutron absorber material in the TPBARs would be enriched in the isotope lithium-6, instead of the boron usually used in the burnable absorber rods. When the TPBARs are inserted into the reactor core, neutrons would be absorbed by the lithium-6 isotope, thereby initiating a nuclear process that would turn it into lithium-7. The new isotope would then split to form helium 4 and tritium (see Appendix A for a more detailed discussion of this process). The tritium then would be captured in a solid metal nickel-plated zirconium material in the TPBAR called a "getter." The tritium would be chemically bound in the TPBAR "getter" until the TPBAR is removed from the reactor during refueling and transported to the proposed Tritium Extraction Facility at the U.S. Department of Energy's (DOE) Savannah River Site in South Carolina. There the tritium would be extracted by heating the TPBARs in a vacuum to temperatures in excess of 1,000 degrees Centigrade (°C) (1,800 degrees Fahrenheit [°F]). Following extraction, the tritium would be purified.

S.3.1.1 Impacts of Tritium Production on Reactor Operations

The replacement of burnable absorber rods with TPBARs should have few impacts on the normal operation of the reactor. The normal power distribution within the core and reactor coolant flow and its distribution within the core would remain within existing technical specification limits. Some tritium is expected to permeate through the TPBARs during normal operation, which would increase the quantity of tritium in the reactor's coolant water system. Since tritium is a type, or isotope, of the hydrogen atom, once the tritium is in the reactor's coolant water system, it could combine with oxygen to become part of a water molecule and could eventually be released to the environment.

The operational differences between a tritium production reactor and a nuclear power plant without tritium production were determined by evaluating each environmental resource area and identifying the operational parameters that would change in a typical CLWR as a result of operating in a tritium production mode. The summarized operational differences are:

- Accident conditions—The physical changes to the reactor core would involve replacing some burnable absorber rods with TPBARs. This change would increase the estimated quantity of radionuclides assumed to be released in the analysis.

- Personnel—Additional TPBAR handling and shipping activities would create new jobs and possibly require the hiring of extra personnel at the CLWR sites.

- Effluent—The tritium content in the liquid effluent and gaseous emissions is expected to increase as a result of the presence of TPBARs in the reactor.

- Waste—Additional activities associated with handling, processing, and shipping TPBAR assemblies are expected to increase low-level radioactive waste generation rates.

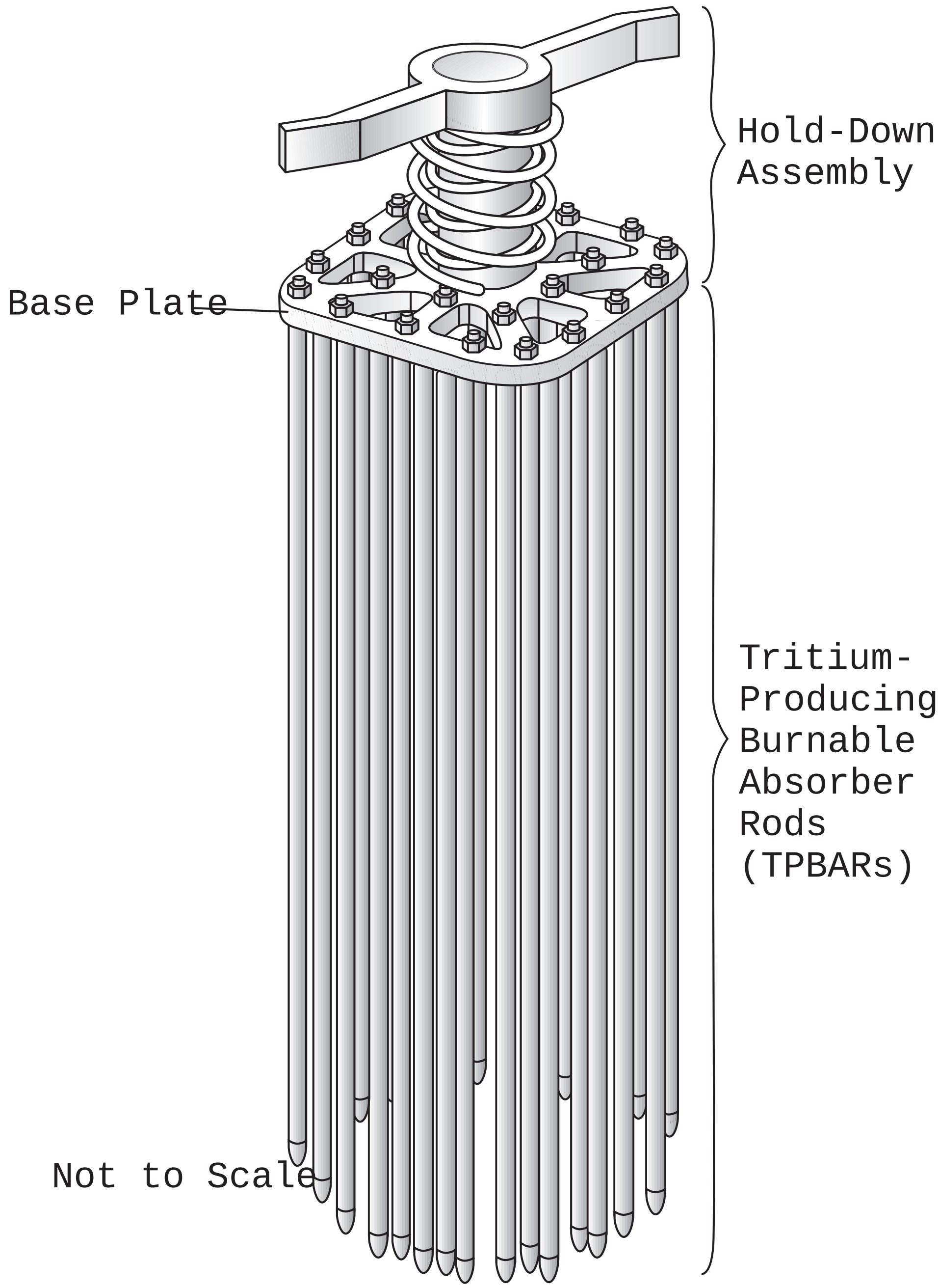


Figure S–4 Typical TPBAR Assembly

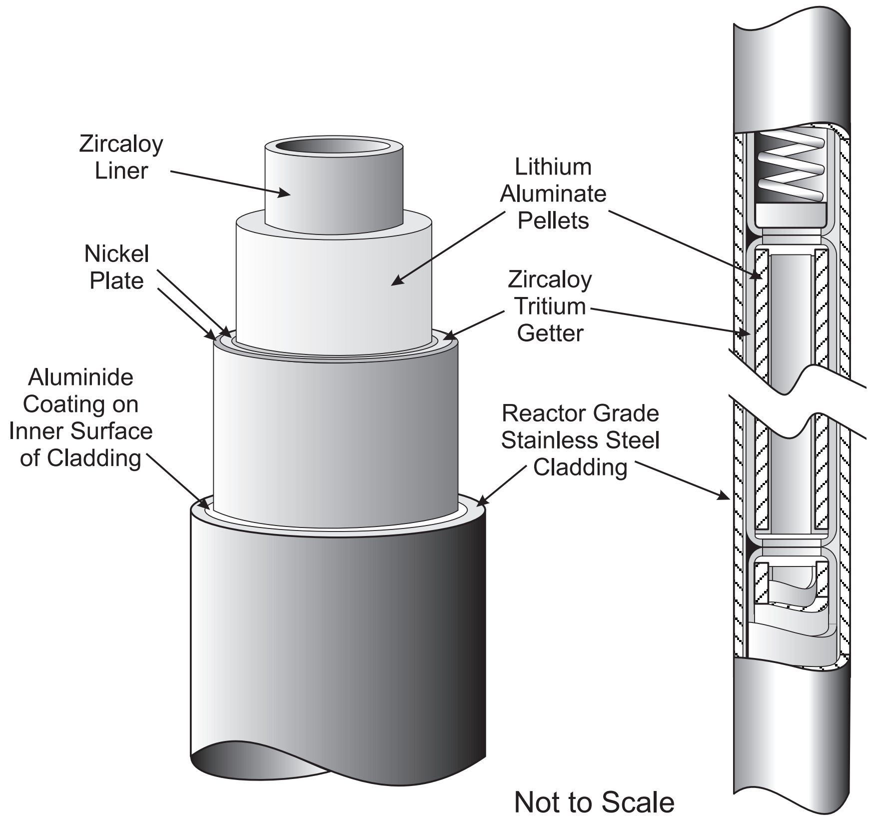


Figure S–5 Sketch of TPBAR Components

- Spent fuel—Additional spent fuel could be generated when a reactor operates in a tritium-producing mode. Depending on existing spent fuel capacity, additional storage for spent fuel could be required.

- Public and worker exposure—The increased levels of tritium in the reactor coolant and the additional activities required in the handling and processing of TPBARs would result in increased radiation exposure for the public, operations workers, and maintenance personnel.

- Transportation and handling—Irradiated TPBAR assemblies would be packaged and transported from the CLWR sites to the Savannah River Site for tritium extraction and purification. Some additional risks of an accident en route would be expected. In addition, low-level radioactive waste associated with the TPBARs would be packaged and transported for disposal at the Barnwell disposal facility or the Savannah River Site.

S.3.2 Development of Alternatives

S.3.2.1 Major Planning Assumptions and Basis for Analysis

The major planning assumptions and considerations that form the basis of the analyses and impact assessments presented in this EIS are listed below.

- The purpose of DOE's action is to produce tritium in a CLWR. Tritium is needed to maintain the nation's nuclear weapons stockpile. For the purposes of analysis in this EIS, DOE assumed that the CLWR program would be designed to produce up to 3 kilograms of tritium per year. Three kilograms of tritium represents an unclassified maximum requirement that only would be required if the tritium reserve, which is maintained for emergencies and contingencies, were ever lost or used (see Figure S–3). Considering the current design of the TPBARs and the efficiency of the tritium extraction process, this would involve the irradiation of up to 6,000 TPBARs in an 18-month refueling cycle (4,000 TPBARs per year). The maximum number of TPBARs that could be irradiated at each reactor unit without significantly disturbing the normal electricity-producing mode of reactor operation is approximately 3,400 TPBARs; the exact number depends on the specific design of the reactor. Steady-state tritium requirements, which are classified and would vary depending upon the specific requirements of the Nuclear Weapons Stockpile Plan, are less than 3 kilograms of tritium per year. This EIS evaluates the impacts at each reactor site by considering a range of 1,000 to 3,400 TPBARs. A sensitivity analysis of the irradiation of fewer than 1,000 TPBARs is included in Volume 1, Section 5.2.9 of the CLWR EIS.

  Producing 3 kilograms of tritium per year likely would be a short-term requirement to reconstitute the tritium reserve. In such a case, as explained in Appendix A of this EIS, it is technically feasible to produce larger quantities of tritium in a single reactor by changing some of the design parameters of the TPBARs and/or some technical parameters of the host reactor core, including shortening the refueling cycle. DOE does not foresee the implementation of this mode of production in any of the reactor units considered in this CLWR EIS. For the purpose of completeness, however, the sensitivity analysis in Volume 1, Section 5.2.9 of the CLWR EIS also addresses the environmental impacts of changing the existing design parameters of the TPBARs and some of the operating parameters of the host reactors to maximize tritium production.

- The EIS assesses the environmental impacts of tritium production in CLWRs for a period of 40 years, starting with the delivery of irradiated TPBARs at the Tritium Extraction Facility in approximately the year 2005. For alternatives involving the partially completed reactor(s), it is assumed that any construction activities needed for the completion of Bellefonte 1 (and any other start-up tests and activities) would take place during the time period between 1999 and 2004, at which time the completed reactor would be fully operational. In the event Bellefonte 2 was also selected for completion, Bellefonte 1 would come on line in approximately 2005, while Bellefonte 2 would begin operation in approximately 2007.

- CLWRs are licensed by NRC to operate for 40 years. Currently operating reactors are not in a position to continue operation beyond 40 years without NRC approval for "life extension." Some of the environmental impacts associated with life extension activities would be attributable to tritium production. The NRC has addressed the generic impacts of life extension in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. The life extension impacts associated with alternatives involving the currently operating units are based on this publication and are addressed generically in the EIS. Tritium production is not expected to affect relicensing. Life extension impacts for a partially completed reactor would not be an issue, since it would be expected to operate for 40 years after its completion.

- Tritium production in a currently operating reactor would not be expected to affect the radiological condition of the reactor at the end of its life. Therefore, environmental impacts associated with decommissioning and decontamination activities would be attributed to the normal operation of the reactor as an electricity-producing unit. For a partially completed reactor, the impacts from decommissioning and decontamination activities are evaluated in this EIS. Decommissioning and decontamination impacts are based on the generic EIS issued by the NRC entitled *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*.

- Fabrication of the TPBARs would take place in a commercial facility that normally fabricates and assembles the components for the fresh fuel used in the CLWRs.

- Production of tritium in a CLWR would increase the generation rate of spent fuel if more than approximately 2,000 TPBARs are irradiated in a fuel cycle. Normally (i.e., during normal operation with no tritium production), fuel assemblies are used in more than one cycle. However, in order to maximize tritium production, TPBARs would be inserted in fresh fuel assemblies. In accordance with the Nuclear Waste Policy Act of 1982, DOE is planning to manage all spent nuclear fuel at a national repository. Siting and development of a repository is ongoing, and the location and opening date for a suitable repository has not been determined. Accordingly, for the purposes of this EIS, the initial management of any additional spent nuclear fuel that may be generated as a result of tritium production is assumed to be stored on site in a generic dry cask independent spent fuel storage installation (ISFSI) pending the availability of a suitable repository. The environmental impacts from the construction and operation of an ISFSI are addressed in this EIS. However, no decision will be made to either construct or operate an ISFSI as a result of this EIS. Appropriate NEPA documentation would be prepared prior to the construction of a dry cask ISFSI.

S.3.2.2 Reasonable Alternatives

As discussed in Section S.1.4, DOE issued a Request for Proposals for the CLWR production of tritium. DOE stated in the Request for Proposals its intent to select one or both of two approaches: (1) the acquisition of CLWR irradiation services for tritium production, or (2) the purchase of an operating CLWR by DOE for production of tritium. The only qualified response to DOE's solicitation came from TVA, the operator of Watts Bar 1 and Sequoyah 1 and 2. TVA also maintains the partially completed units of Watts Bar 2 and Bellefonte 1 and 2. With the exception of Watts Bar 2, which was considered and dismissed, these units form the basis for the Reasonable Alternatives.

To supply tritium to meet national security requirements, DOE could use one or more reactors. Considering that a maximum number of 3,400 TPBARs could be irradiated in a single reactor, at least two reactors would be needed for the 6,000 TPBARs based on an 18-month refueling cycle. Considering also that additional spent nuclear fuel generation attributed to tritium production starts approximately with the irradiation of approximately 2,000 TPBARs in a single reactor, DOE could use as many as three reactors to irradiate 6,000 TPBARs without increasing the amount of spent nuclear fuel. Mathematically, DOE has the option of selecting 1 of the 18 combinations of reactor units presented in **Table S–1**. These 18 combinations form the Reasonable Alternatives of the irradiation element of the project.

S.3.2.3 No Action Alternative

On December 22, 1998, Energy Secretary Bill Richardson announced that CLWRs would be the primary tritium supply technology for tritium and that the accelerator would be developed—but not constructed as a backup to CLWR tritium production. Based on this announcement, if tritium is not produced in a CLWR, it will be produced in an accelerator. Accordingly, for purposes of analysis in this EIS, the No Action

Alternative assumes the continued operation of Watts Bar 1 and Sequoyah 1 and 2 for the generation of electricity and the deferral of construction activities necessary for completion of Bellefonte 1 and 2 as nuclear units. Consequently, this No Action alternative entails the production of tritium in an accelerator. A summary of the environmental impacts associated with the production of tritium in an accelerator is contained in Volume 1, Section 5.2.11 of the CLWR EIS. A comparison between the environmental impacts of the CLWR EIS reactor alternatives and those for accelerator production is presented in **Table S-3** at the end of this summary. Since the APT EIS was developed in parallel with the CLWR EIS, the impacts in Table S-3 represent the conclusions of the APT Draft EIS. These impacts are not expected to change in the APT Final EIS.

Table S–1 CLWR Tritium Production Program Reasonable Alternatives

Alternative	*Watts Bar 1 Operation*	*Sequoyah 1 Operation*	*Sequoyah 2 Operation*	*Bellefonte 1 Complete Construction and Operation*	*Bellefonte 2 Complete Construction and Operation*[a]
One Reactor[b]					
1	●				
2		●			
3			●		
4				●	
Two Reactor Combinations					
5	●	●			
6	●		●		
7	●			●	
8		●	●		
9		●		●	
10			●	●	
11				●	●
Three Reactor Combinations					
12	●	●	●		
13	●	●		●	
14	●		●	●	
15	●			●	●
16		●	●	●	
17		●		●	●
18			●	●	●

[a] Construction on Bellefonte 2 may be completed only if Bellefonte 1 is completed and operated.
[b] The one-reactor alternative could not produce 3 kilograms of tritium per year on an 18-month refueling cycle.

S.3.2.4 The Preferred Alternative

The Council on Environmental Quality regulations require that an agency identify its Preferred Alternative(s) in the Final EIS (40 CFR 1502.14e). The Preferred Alternative is defined as the alternative that the agency believes would fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. This EIS provides information on the environmental impacts. Cost, schedule, and technical analyses will be discussed in the Record of Decision for the EIS. DOE has identified the purchase of irradiation services from the Watts Bar and Sequoyah reactor facilities as the Preferred Alternative for the production of tritium in a CLWR. Under the Preferred Alternative, no more than 3,400 TPBARs would be irradiated in a single reactor per each refueling cycle. In implementing the Preferred Alternative, DOE and TVA would minimize, to the extent practicable, the generation of additional spent nuclear fuel.

S.3.2.5 Reactor Options

S.3.2.5.1 Watts Bar Nuclear Plant Unit 1

Watts Bar 1 is located on a 716-hectare (1,770-acre) site in Rhea County, Tennessee, on the Tennessee River at Tennessee River Mile 528, approximately 80 kilometers (50 miles) northeast of Chattanooga, Tennessee. The general arrangement of the Watts Bar Nuclear Plant is shown in **Figure S–6**.

Watts Bar 1 began commercial power operation in May 1996. The Watts Bar 1 structures include a reactor containment building, a turbine building, an auxiliary building, a service building, a water pumping station for circulating water in the condenser, a diesel generator building, a river intake pumping station, a natural-draft cooling tower, a transformer yard, a 500-kilovolt switchyard and a 161-kilovolt switchyard, a spent nuclear fuel storage facility, and sewage treatment facilities. The reactor containment building houses a pressurized water reactor designed and manufactured by the Westinghouse Electric Corporation. No modifications are expected to be necessary for Watts Bar 1 to irradiate TPBARs. Design equipment and facilities are sufficient to load and unload the TPBAR assemblies. During normal operation with tritium production, the plant could employ a few more workers (less than 10) in addition to the 809 presently employed. The spent nuclear fuel storage capacity is not sufficient for 40 years of operation with or without TPBARs.

S.3.2.5.2 Sequoyah Nuclear Plant Units 1 and 2

Sequoyah 1 and 2 are operating, pressurized CLWR nuclear power plants. The units are located on a 212-hectare (525-acre) site in Hamilton County, Tennessee, on the Tennessee River at Tennessee River Mile 484.5, approximately 12 kilometers (7.5 miles) northeast of the nearest city limit of Chattanooga, Tennessee. The general arrangement of the Sequoyah Nuclear Plant is shown in **Figure S–7**.

Sequoyah 1 began commercial operation in July 1981, and Sequoyah 2 began commercial operation in June 1982. The nuclear steam supply systems, designed and manufactured by the Westinghouse Electric Corporation, include the reactor vessel, steam generators, and associated piping and pumps. These are housed in two reactor containment buildings. The balance of the nuclear power plant includes: a turbine building, an auxiliary building, a service and office building, a control building, a condenser circulating water pumping station, a diesel generator building, a river intake pumping station, two natural draft cooling towers, a transformer yard, a 500-kilovolt switchyard and a 161-kilovolt switchyard, spent nuclear fuel storage facilities, and sewage treatment facilities. No modifications are expected to be needed for Sequoyah 1 and 2 to irradiate TPBARs. Equipment and facilities are sufficient to load and unload the TPBAR assemblies. Tritium production could require the addition of a few more employees (fewer than 10 per unit) to the 1,120 employees currently employed at the two-unit site. The spent nuclear fuel storage capacity is not sufficient for 40 years of operation with or without TPBARs.

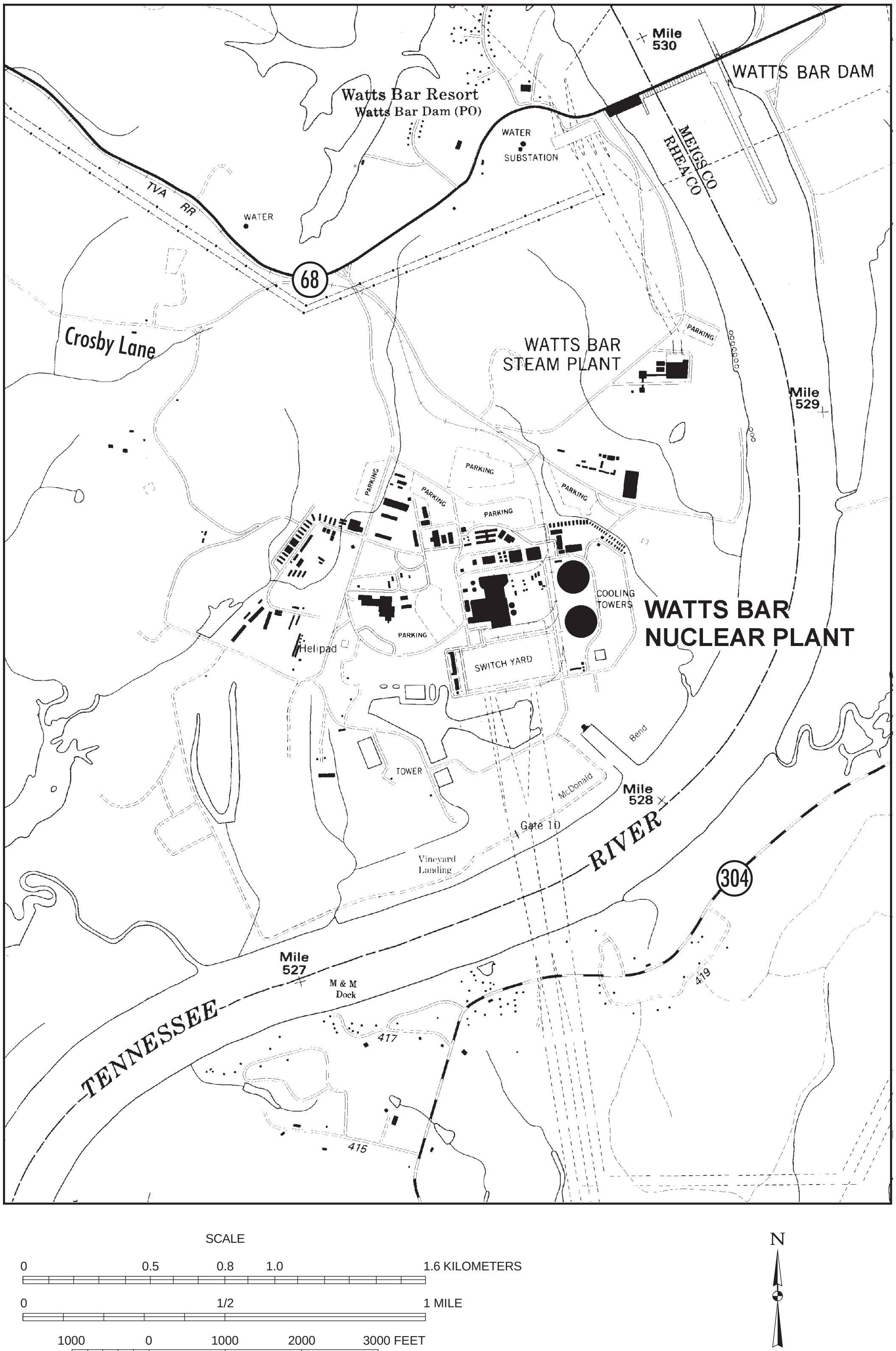


Figure S–6 Watts Bar Nuclear Plant

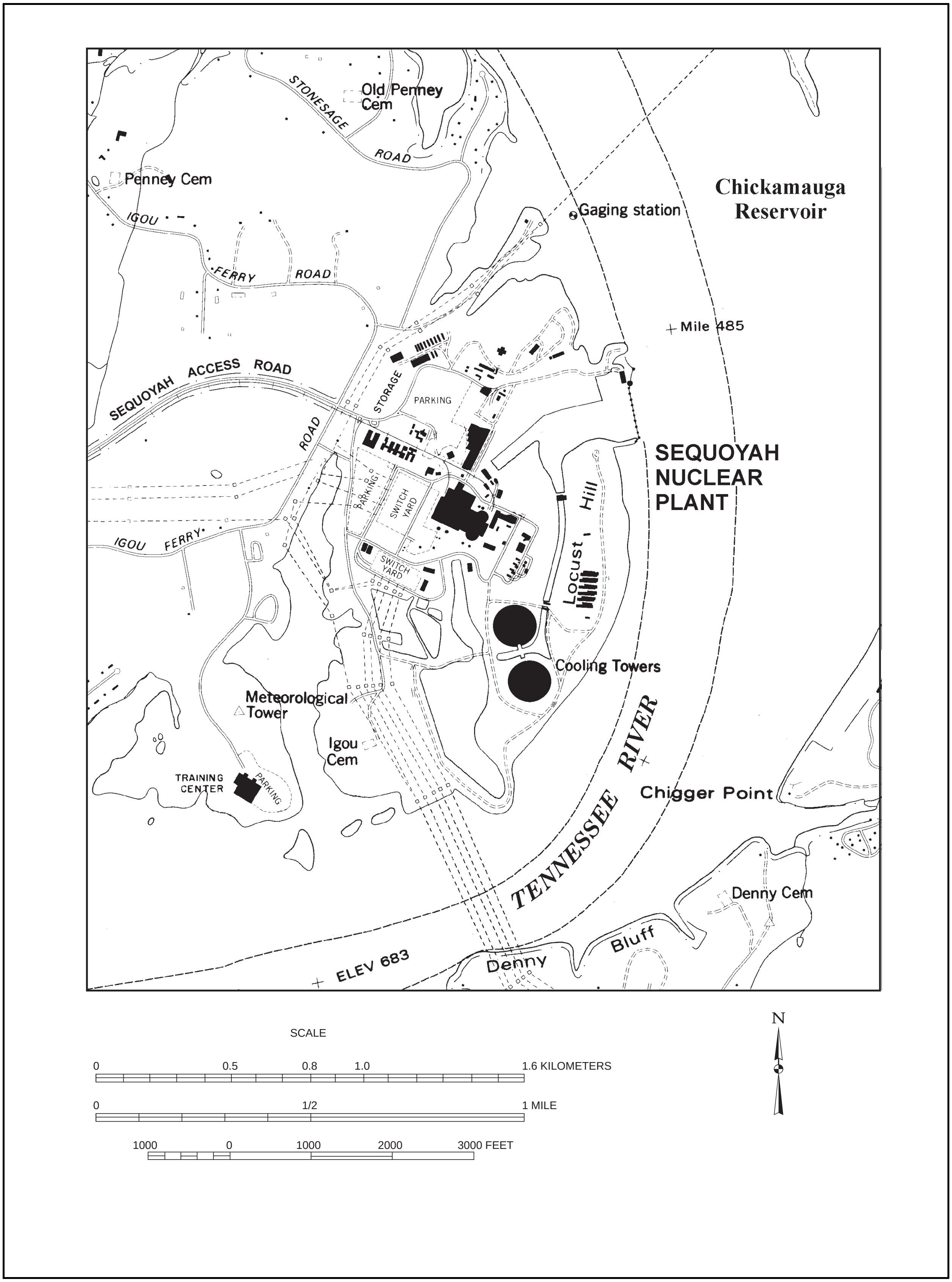


Figure S–7 Sequoyah Nuclear Plant

S.3.2.5.3 Bellefonte Nuclear Plant Units 1 and 2

Bellefonte 1 and 2 are partially completed reactors. They are situated on approximately 607 hectares (1,500 acres) on a peninsula at Tennessee River Mile 392, on the west shore of Guntersville Reservoir, about 11.3 kilometers (7 miles) northeast of Scottsboro, Alabama. The main land uses of the surrounding area are forestry and agriculture; however, urban-industrial development has grown over the past several years around the plant along the Guntersville Reservoir. The affected environment at the Bellefonte Nuclear Plant site is described in Section 4.2.3. The general arrangement of the Bellefonte Nuclear Plant is shown in **Figure S–8**.

The U.S. Atomic Energy Commission (now NRC) issued the construction permit for the Bellefonte Nuclear Plant in December 1974, and construction started in February 1975. On July 29, 1988, TVA notified NRC that Bellefonte was being deferred as a result of a lower load forecast for the near future. After three years of extensive study, TVA notified NRC on March 23, 1993, of its plans to complete Bellefonte 1 and 2. In December 1994, TVA announced that Bellefonte would not be completed as a nuclear plant without a partner and put further activities on hold until a comprehensive evaluation of TVA's power needs was completed. On April 29, 1996, TVA issued a Notice of Intent to prepare an EIS for the proposed conversion of the Bellefonte Nuclear Plant to a fossil fuel facility. The *Final Environmental Impact Statement for the Bellefonte Conversion Project*, which analyzed alternatives for such a conversion, was issued in October 1997. A Record of Decision for that EIS will not be made until it is determined whether Bellefonte 1 or both Bellefonte 1 and 2 will be used for tritium production.

The plant structures presently consist of two reactor containment buildings: a control building; a turbine building; an auxiliary building; a service building; a condenser circulating water pumping station; two diesel generator buildings; a river intake pumping station; two natural-draft cooling towers; a transformer yard; a 500-kilovolt switchyard and 161-kilovolt switchyard; a spent nuclear fuel storage pool; and sewage treatment facilities.

Additionally, there are office buildings to house engineering and other department personnel. Entrance roads, parking lots, railroad spurs, and a helicopter landing pad are in place and are capable of supporting a construction project.

No modifications to the original design would be necessary to complete Bellefonte 1 or Bellefonte 2 for operation, with or without TPBARs.

The plant systems and structures are maintained through active layup and preservation. Program activities include the following:

- Each unit's main turbine generators are rotated every other week.
- The diesel fire pumps are maintained in an operational status and are run monthly.
- The shell and tube sides of the main condensers (heat exchangers) are kept dry, and the tube side is maintained with a flow of warm, dehumidified air.
- The reactor coolant system is kept dry using a flow of warm, dehumidified air.

A workforce of approximately 80 personnel supports layup and preservation of the plant. Of that number, 38 are involved in operations and maintenance.

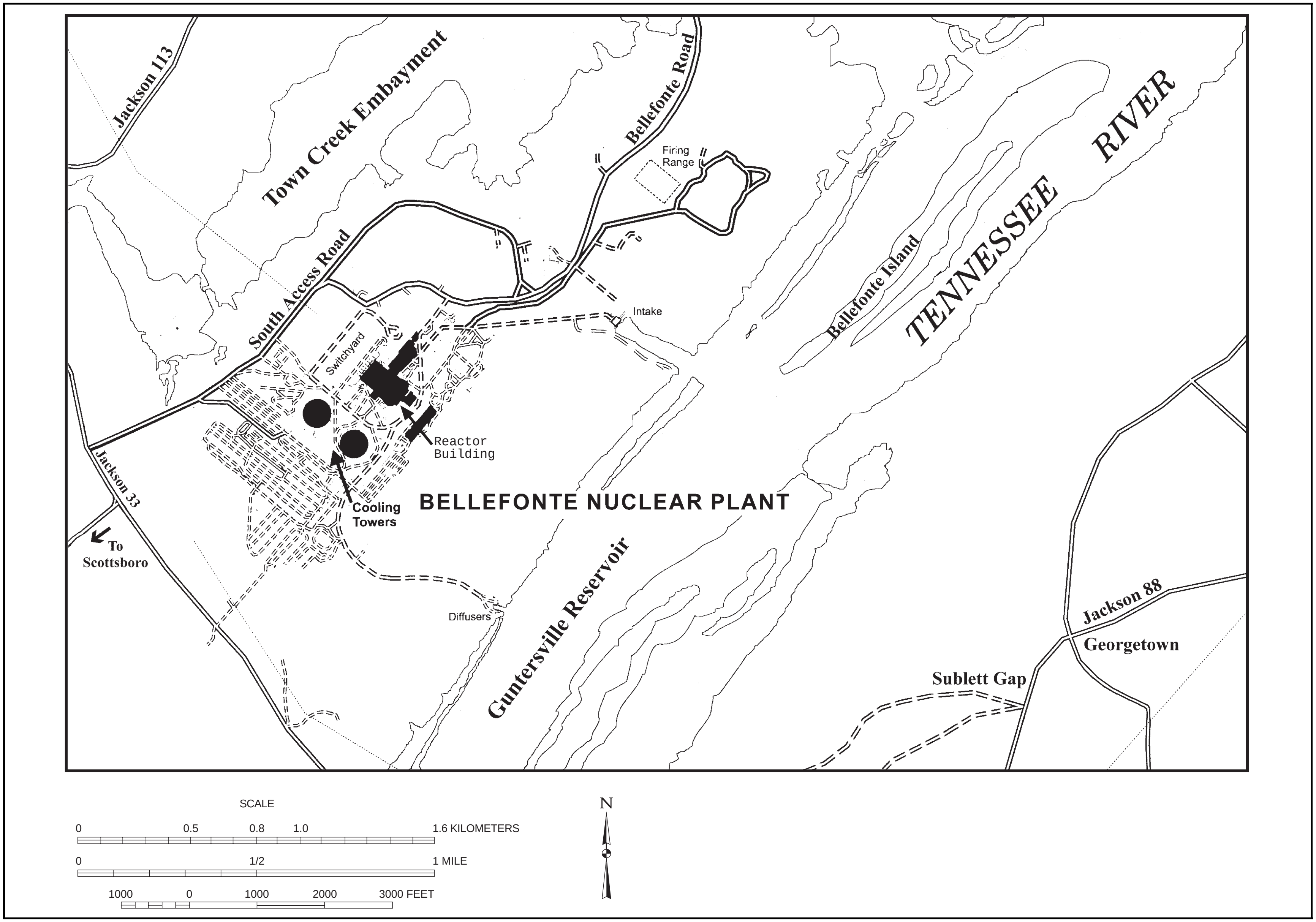


Figure S–8 Bellefonte Nuclear Plant

To complete Bellefonte 1 or both Bellefonte 1 and 2, additional engineering and construction activities would be required. These activities are summarized in the following paragraphs.

Engineering—Engineering for the original Bellefonte Nuclear Plant design is substantially complete. The additional engineering effort consists of completing analysis and design modifications that were not completed prior to deferral; updating the design basis documentation to current industry standards; and supporting construction, start up, and licensing of the plant. More specifically, the remaining engineering effort for Bellefonte 1 and 2 includes, but is not limited to, the following:

- Issuing detailed design modifications for certain mechanical and electrical systems to meet current requirements
- Updating the main control room drawings into computer-aided design electronic format
- Reviewing the control room design and upgrading the simulator and plant computers
- Reanalyzing piping and pipe supports
- Resolving industry issues (e.g., fire protection, electrical equipment qualification, station blackout, site security, communications, motor-operated valves) that were either not completed prior to deferral in 1988 or have arisen since deferral
- Developing fuel assembly and fuel cycle designs to facilitate the production of tritium
- Supporting submittals of the Final Safety Analysis Report and completing previous NRC position papers
- Supporting field change requests by the constructor

Construction—Construction activities required to complete Bellefonte 1 and 2 include, but are not limited to, the following:

- Completing the application of protective coatings to structures, piping, and components, and the installation of piping insulation
- Installing the Bellefonte 2 reactor coolant pump internals and motors [Some (less than 10 percent) of Bellefonte 1 reactor coolant instrumentation and pipe supports would have to be installed.]
- Installing limited major piping and components in the balance of the plant for Bellefonte 2
- Installing the steam piping for Bellefonte 2
- Installing and energizing a limited amount of the electric power equipment within the plant [The 161-kilovolt and 500-kilovolt offsite transmission lines are terminated in the switchyard, which is complete and energized.]
- Completing the Bellefonte 2 main control room [Substantial work would be required because the Bellefonte 1 main control room, although not complete, is functional and manned to monitor the ongoing preservation activities. The recommendations of the Control Room Design review would be factored into efforts to complete construction of both control rooms.]
- Preparing the intake structure for operation by desilting the intake water pump

- Constructing some new support buildings and installing additional equipment

S.3.2.6 Environmental Consequences

For the five TVA reactors being considered for tritium production (Watts Bar 1, Sequoyah 1, Sequoyah 2, Bellefonte 1, and Bellefonte 2), impacts are presented for the bounding case (i.e., the maximum number of TPBARs that could be irradiated in a reactor). For those resources where impacts would be significantly different for a lesser number of TPBARs, explanation is provided. The impacts of utilizing more than one CLWR for tritium production can be determined by adding the impacts of each individual CLWR together. The impacts of not producing tritium at any of these five reactors (the No Action Alternative) are presented first, as a baseline against which to compare the impacts of producing tritium. The summary of the environmental consequences is presented in **Table S-2** at the end of this summary.

S.3.2.6.1 No Action Alternative

Construction

Watts Bar 1 and Sequoyah 1 and 2. Under the No Action Alternative, Watts Bar 1 and Sequoyah 1 and 2 would continue to produce electricity, and no construction impacts would occur.

Bellefonte 1 and 2. Under the No Action Alternative, Bellefonte 1 and 2 would remain in deferred status, and no construction impacts would occur. TVA could also convert Bellefonte 1 and 2 to a fossil fuel plant, as described in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (see Volume 1, Section 1.5.2.4). Such conversion would be independent of this EIS and would not occur until a decision is made regarding the role of Bellefonte 1 and 2 in tritium production.

Operation

Watts Bar 1 and Sequoyah 1 and 2. Under the No Action Alternative, Watts Bar 1 and Sequoyah 1 and 2 would continue to produce electricity for the foreseeable future, and there would be no changes in the type and magnitude of environmental impacts that currently occur. In producing electricity, these reactor plants would continue to comply with all Federal, state, and local requirements. Impacts associated with the continued operation of Watts Bar 1 and Sequoyah 1 and 2 are described in the following paragraphs.

Under the No Action Alternative, water requirements at all three plants would continue to be met by existing water resources with no additional impacts, and water quality would not change, but would remain within regulatory limits. Air quality would also remain unchanged and stay within regulatory limits. Worker employment should remain steady at each of the sites, with no major changes to the regional economic areas as a result of plant operation. Worker exposure to radiation should remain well under the regulatory limit of 5 rem per year, with the average worker dose at approximately 90 to 100 millirems per year. Radiation exposure of the public from normal operations would also remain well within regulatory limits (3 rem per year) for each of the reactor sites. At Watts Bar 1, the total dose to the population within 80 kilometers (50 miles) would be approximately 0.55 person-rem per year. Statistically, this equates to one fatal cancer approximately every 3,570 years from operation of Watts Bar 1. At Sequoyah 1 or Sequoyah 2, the total dose to the population within 80 kilometers (50 miles) would be approximately 1.6 person-rem per year. Statistically, this equates to one fatal cancer approximately every 1,250 years from the operation of Sequoyah 1 or 2. Risks of accidents would remain unchanged.

Under the No Action Alternative, all categories of wastes would continue to be generated at each of the reactor plants, and they would be managed in accordance with regulations. Low-level radioactive wastes would continue to be generated at a rate of approximately 40 (Watts Bar 1) to 389 (Sequoyah 1 or Sequoyah 2) cubic meters per year and would be disposed of at the Barnwell disposal facility. For each of the reactors, spent fuel would also continue to be generated at a rate of approximately 80 fuel assemblies per year. Spent fuel would continue to be managed at each of the reactor plants in compliance with all regulatory requirements.

Bellefonte 1 and 2. Under the No Action Alternative, Bellefonte 1 and 2 would remain uncompleted nuclear reactors, and impacts on the environment would not change.

S.3.2.6.2 Impacts Associated with Tritium Production

Construction

Watts Bar 1 and Sequoyah 1 and 2. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, an ISFSI could eventually be required for Watts Bar 1, Sequoyah 1, or Sequoyah 2 to support tritium production. This could be the only construction necessary for tritium production. If such a facility were to be constructed, it would consist of three reinforced concrete slabs covering approximately 3.5 acres. Approximately 60-80 horizontal storage modules, each made of reinforced concrete, could be housed on the slabs. These horizontal storage modules would have a hollow internal cavity to accommodate a stainless steel cylindrical cask that would contain the spent nuclear fuel. Constructing such a facility would disturb approximately 5 acres and require approximately 50 construction workers. Premixed concrete would be used, and impacts to air quality, water, and biotic resources are expected to be small. Appropriate NEPA documentation would be prepared prior to the construction of a dry cask spent fuel storage facility.

Bellefonte 1 and 2. All major structures (e.g., containment buildings, cooling towers, turbine buildings, support facilities) have been constructed, so construction activities would largely consist of internal modifications to the existing facilities. No additional land would be disturbed in completing construction, and there would be no impacts on visual resources, biotic resources (including threatened and endangered species), geology and soils, and archaeological and historic resources. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility would eventually be required at Bellefonte 1 and 2. The impacts of constructing such a spent fuel storage facility would be similar to those described above for Watts Bar 1, Sequoyah 1, or Sequoyah 2. Appropriate NEPA documentation would be prepared before the construction.

Completing construction of Bellefonte 1 would have the greatest impact on socioeconomics, with construction activities taking place between 1999 and 2004. During the peak year of construction (2002), approximately 4,500 direct jobs could be created. As many as 4,500 secondary jobs (indirect jobs) would also be created. The total new jobs (9,000) would cause the regional economic area unemployment rate to decrease to approximately 4 percent from the current rate of 8.2 percent. Public finance expenditures/revenues would increase by over 30 percent in Scottsboro and about 15 percent in Jackson County. Rental vacancies would decline to near zero, and demand for all types of housing would increase substantially. Rents and housing prices could increase at double-digit percentage levels.

If Bellefonte 2 were also selected for completion, construction activities for both units would be drawn out, taking place between 1999 and 2005. The peak year of construction would shift, but the total number of direct and indirect jobs would be the same. The effects, therefore, on unemployment, public finance, rents, and housing prices would be the same as for the construction completion of Bellefonte 1.

Operation

Watts Bar 1 and Sequoyah 1 and 2. In a tritium production mode, these operating reactors would continue to comply with all Federal, state, and local requirements. Tritium production would have little or no effect on land use, visual resources, water use and quality, air quality, archaeological and historic resources, biotic resources (including threatened and endangered species), and socioeconomics. It could, however, have some incremental impacts in the following areas: radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation. Tritium production could also change the accident and transportation risks associated with these reactors. Each of these areas is discussed below.

> ***Health Effects Risk Factors Used in this EIS***
>
> *Health impacts of radiation exposure, whether from sources external or internal to the body, are generally identified as "somatic" (i.e., affecting the exposed individual), or "genetic" (i.e., affecting descendants of the exposed individual). Radiation is more likely to produce somatic effects than genetic effects. Except for leukemia, which can have an induction period (time between exposure to carcinogen and cancer diagnosis) of as little as 2 to 7 years, most cancers have an induction period of more than 20 years.*
>
> *For a uniform irradiation of the body, the incidence of cancer varies among organs and tissues; the thyroid and skin demonstrate a greater sensitivity than other organs. Such cancers, however, also produce comparatively low mortality rates because they are relatively amenable to medical treatment. Because of the readily available data for cancer mortality rates, somatic effects leading to cancer fatalities, rather than cancer incidence, are presented in this EIS. The numbers of cancer fatalities can be used to compare the risks of various alternatives.*
>
> *Risk factors are used to calculate the statistical expectance of the effects of exposing a population to radiation. For example, in a population of 100,000 people exposed only to natural background radiation (300 millirem per year), about 15 latent cancer fatalities per year would be expected (100,000 persons x 0.3 rem per year x 0.0005 latent cancer fatalities per person-rem = 15 latent cancer fatalities per year).*
>
> *The number of latent cancer fatalities corresponding to a single individual's exposure over a presumed 72-year lifetime to 0.3 rem per year is 0.011 (1 person x 0.3 rem per year x 72 years x 0.0005 latent cancer fatality per person-rem = 0.011 latent cancer fatality). Presented another way, this method estimates that approximately 1.1 percent of the population might die of cancers induced by background radiation. The same calculations apply to workers with one difference; the risk factor for workers is 0.004 latent cancer fatalities per person-rem instead of 0.005 cancer fatalities per person-rem for the general public.*
>
> *The health consequences of exposure to radionuclides from normal operation and accidents are converted to estimates of cancer fatality risks using dose conversion factors recommended by the International Commission on Radiological Protection. For individuals, the estimated probability of a latent cancer fatality occurring is reported for the noninvolved worker, the maximally exposed individual, and an average individual in the general population. These categories are defined as follows:*
>
> ***Noninvolved Worker:*** *An individual 640 meters (0.4 mile) from the radioactive material release point.*
>
> ***Maximally Exposed Offsite Individual:*** *A hypothetical individual who could potentially receive the maximum dose of radiation or hazardous chemicals.*
>
> ***General Population:*** *Individuals within an 80-kilometer (50-mile) radius of the facility.*

Radiation Exposure Tritium production could increase average annual worker radiation exposure by approximately 0.82–1.1 millirem per year. The resultant dose would be well within regulatory limits. Radiation exposure to the public from normal operations could also increase, but would still remain well within regulatory limits at each of the reactor sites. At either Watts Bar 1, Sequoyah 1, or Sequoyah 2, the total dose to the population within 80 kilometers (50 miles) could increase by a maximum of 1.9 person-rem per year. Statistically, this equates to one additional fatal cancer approximately every 1,000 years from the operation of Watts Bar 1, Sequoyah 1, or Sequoyah 2.

Spent Fuel Generation Given irradiation of 3,400 TPBARs (the maximum number of TPBARs without changing the reactor's fuel cycle), additional spent fuel would be generated at Watts Bar 1, Sequoyah 1, or Sequoyah 2. In the average 18-month fuel cycle, spent fuel generation could increase from approximately 80 spent fuel assemblies up to a maximum of 140, a 71 percent increase in spent fuel generation over the No Action Alternative. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility would eventually be needed. Storing the additional spent fuel should have minor impacts. Radiation exposures would remain below regulatory limits for both workers and the public, and less than 4 cubic feet of low-level radioactive waste would be generated annually. The impacts of accidents associated with dry cask spent fuel storage would be small. As previously mentioned, appropriate NEPA documentation would be prepared before the construction of a dry cask spent fuel storage facility at Watts Bar 1, Sequoyah 1, or Sequoyah 2. If fewer than approximately 2,000 TPBARs were irradiated, there would be no change in the amount of spent fuel produced by the reactors.

Spent Fuel Storage

The need for additional spent fuel storage is based on the assumption that 3,400 TPBARs would be irradiated in a reactor core for 18-month fuel cycles. However, if approximately 2,000 TPBARs or fewer were irradiated in each fuel cycle, no additional spent fuel would be generated.

The additional spent fuel generated from the tritium production over the duration of the program, would be accommodated at the site at an independent dry cask spent fuel storage installation (ISFSI). The EIS presents the environmental impacts of the construction, operation, and postulated accidents associated with a generic dry cask ISFSI at each of the sites.

The majority of operating ISFSIs are in the form of concrete casks. Concrete casks consist of either a vertical or horizontal concrete structure that houses a metal cask that confines the spent nuclear fuel. A horizontal storage module consists of a rectangular reinforced concrete block that has a hollow internal cavity to accommodate a stainless steel cylindrical cask that contains the spent nuclear fuel. The concrete block is 5.79 meters (19 feet) long, 2.96 meters (9.7 feet) wide, and 4.6 meters (15 feet) high.

The decay heat released from the stored spent fuel would be equal to the heat released to the atmosphere from two to six average cars. NRC regulations require that a minimum distance of 100 meters (328 feet) be maintained as a controlled area around the spent fuel casks. At 100 meters, the direct-scattered total dose rate to an individual was calculated to be in the range of 0.01 to 0.1 mrem/hr.

The environmental consequences of the construction and operation of a generic dry cask storage facility are minor.

Low-Level Radioactive Waste Generation Compared to the No Action Alternative, tritium production at Watts Bar 1, Sequoyah 1, or Sequoyah 2 would generate approximately 0.43 additional cubic meter per year of low-level radioactive waste. This would be a 0.1 (Sequoyah 1 or Sequoyah 2) to 1.0 (Watts Bar 1) percent increase in low-level radioactive waste generation over the No Action Alternative. Such an increase would amount to less than 1 percent of the low-level radioactive waste disposed of at the Barnwell disposal facility. The EIS also analyzes the impacts of this low-level radioactive waste disposal at the Savannah River Site. Disposing of 0.43 cubic meter per year of low-level radioactive waste would amount to less than 1 percent of the low-level radioactive waste disposed of at the Savannah River Site and less than 1 percent of the landfill's capacity.

Accident Risks Tritium production could change the potential risks associated with accidents at Watts Bar 1, Sequoyah 1, or Sequoyah 2. As described in the following text, these changes would be small. Potential impacts from accidents were determined using computer modeling. If a limiting design-basis accident occurred, tritium production at the 3,400 TPBAR level would increase the individual risk of a fatal cancer by 1.4×10^{-9} to an individual living within 80 kilometers (50 miles) of Watts Bar 1. Statistically, this equates to a risk to the individual of one fatal cancer approximately every 710 million years from tritium production. For an individual living within 80 kilometers (50 miles) of Sequoyah 1 or Sequoyah 2, there would be a 2.1×10^{-9} increased likelihood of a cancer fatality to an individual from a design-basis accident as a result of tritium production. Statistically, this equates to a risk to an individual of one additional fatal cancer approximately every 490 million years from tritium production. For a beyond design-basis accident (an accident that has a probability of occurring approximately once in a million years or less), tritium production would result in small changes in the consequences of an accident. This is due to the fact that the potential consequences of such an accident would be dominated by radionuclides other than tritium.

Transportation Tritium production at either Watts Bar 1, Sequoyah 1, or Sequoyah 2 would necessitate additional transportation to and from the reactor plants. Most of the additional transportation would involve nonradiological materials. Impacts would be limited to toxic vehicle emissions and traffic fatalities. At each of these reactors, the transportation risks would be less than one fatality per year. Radiological materials transportation impacts would include routine and accidental doses of radioactivity. The risks associated with radiological materials transportation would be less than one fatality per 100,000 years.

Bellefonte 1 and 2. Because neither Bellefonte 1 or Bellefonte 2 are currently operating, this EIS assesses the impacts of completing construction and operating these units for tritium production. Consequently, environmental impacts would occur in the following resources: visual resources, water use, biotic resources, socioeconomics, radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation. Tritium production would also change the accident and transportation risks associated with these reactors.

During operations, Bellefonte 1 and 2 would produce vapor plumes from cooling towers that would be visible up to 10 miles away. These plumes could create an aesthetic impact on the towns of Pisgah, Hollywood, and Scottsboro, Alabama.

During operation, Bellefonte 1 and 2 each would use less than 0.5 percent of the river flow from Guntersville Reservoir and would not have any adverse impacts on other users. Discharges from the plants would be treated and monitored before release and would comply with NPDES permits. Impacts on water quality would be minimal, and no standards would be exceeded as a result of Bellefonte operations. Operation of either Bellefonte 1 or both Bellefonte 1 and 2 for tritium production would have some effects on ecological resources typical to the operation of a nuclear power plant, regardless of tritium production. Impacts on ecological resources from the operation of Bellefonte 1 or both Bellefonte 1 and 2

Transportation

DOE takes many precautions to ensure the safe transportation of both its radioactive and nonradioactive shipments. These precautions satisfy U.S. Department of Transportation Regulations, NRC regulations, and DOE Orders. DOE would use Type A packages to transport materials with relatively low levels of radioactivity and Type B packages to transport materials with the highest levels of radioactivity. Type A packages are designed and tested to protect and retain their content under normal transportation conditions. They are tested to survive water spray, dropping during handling, compression by other packages, and penetration by falling objects. Type B packages are designed to protect and retain their contents in both normal and severe accident conditions. In addition, the U.S. Department of Transportation has stringent routing requirements for these shipments. These requirements include reducing the time in transit and the distance traveled, using interstate highways unless the state has designated a preferred alternative, and using beltways around cities where possible. The following are a few of the key safety measures the CLWR project will take to ensure safe shipment.

- *The fuel assemblies with the inserted TPBARs (or the TPBARs themselves) would be transported to the selected reactor(s) according to the fuel manufacturer's current operating practices. The nuclear containers used for fresh fuel shipment would be NRC-certified Type A packages and due to security requirements would have an escort.*
- *The transportation of irradiated TPBARs entails very stringent safety measures established by the NRC, the U.S. Department of Transportation, and DOE. TPBARs would be transported from the reactors to DOE's Savannah River Site in Type B packages that meet the NRC's stringent test requirements.*
- *Low-level radioactive waste would be transported in either certified Type A or Type B packages, depending on the level of the radioactivity of the contents.*

would result from radioactive and nonradioactive emissions of air pollutants to the atmosphere; thermal, chemical and radioactive effluent releases to surface waters; increases in human activity; and increases in noise levels. These impacts would be small considering that the units would operate in compliance with all Federal, state, and local requirements specifically promulgated to protect environmental resources. The estimated radiological doses to terrestrial and aquatic organisms are well below levels that could have any impact on plants or terrestrial and aquatic animals at the site. Other possible environmental impacts on the aquatic ecosystem of Guntersville Reservoir due to operation of the Bellefonte units would include fish losses at the cooling water intake screens, almost total loss of unscreened entrained organisms, and effects of thermal and chemical discharges. The effects of both thermal and chemical discharges would be small, as these discharges would comply with NPDES limitations.

Socioeconomics During operations, approximately 800 direct jobs would be created at Bellefonte 1, along with approximately an equal number of indirect jobs. The total new jobs (approximately 1,600) would cause the regional economic area unemployment rate to decrease to approximately 6.2 percent. Public finance expenditures/revenues would decline from the levels achieved during construction, but would remain 10 to 15 percent higher than they would be otherwise at Scottsboro and 5 to 10 percent higher in Jackson county. Housing prices would decline and could fall below the precompletion prices, depending on how much new construction of permanent housing took place during the completion period and how many construction workers chose to remain in the area once construction was completed. If Bellefonte 2 were also completed, a total of approximately 1,000 direct jobs would be created along with approximately 1,000 indirect jobs.

Radiation Exposure Reactor operations to produce tritium would cause worker radiation exposure to increase from 0 to approximately 105 millirem per year. This resultant dose would be well within regulatory limits of 5,000 millirem per year. Radiation exposure to the maximally exposed individual from normal operations would increase from 0 to 0.28 millirem. The total dose to the population within 80 kilometers (50 miles) would increase from approximately 0 to

Accident Scenarios

The accident analysis assessment considers a spectrum of potential accident scenarios. The range of accidents considered includes reactor design basis accidents, nonreactor design basis accidents, TPBAR-handling accidents, transportation cask-handling accidents, and beyond design basis accidents (i.e., severe reactor accidents).

***Reactor Design basis Accident**: A reactor design basis accident is designated a Condition IV occurrence. Condition IV occurrences are faults that are not expected to take place, but are postulated because they have the potential to release significant amounts of radioactive material. The postulated reactor design basis accident for this EIS is a large-break loss-of-coolant accident.*

***Nonreactor Design basis Accident**: A nonreactor design basis accident is designated a Condition III occurrence. The consequences of a Condition III occurrence would be less severe than those of a Condition IV occurrence. The release of radioactivity would not be sufficient to interrupt or restrict public use of those areas beyond the exclusion area. The postulated nonreactor design basis accident is an unexpected, uncontrolled release of the gases contained in a single gas decay tank due to the failure of the tank or associated piping.*

***TPBAR–Handling Accident**: The postulated TPBAR-handling accident scenario postulated that a TPBAR assembly containing 24 TPBARs was dropped when removing the assembly from an irradiated fuel assembly during the TPBAR consolidation process. The evaluation postulated that all TPBARs would be unprotected and would breach when they impacted the spent fuel pool floor.*

***Transportation Cask–Handling Accident**: Scenarios include loading a truck cask under water in the spent fuel pool cask loading pit with a single TPBAR consolidation container containing a maximum of 289 TPBARs, and loading a rail cask under water in the spent fuel pool cask loading pit with 3 to 12 TPBAR consolidation containers.*

***Beyond Design Basis Accident**: The beyond design basis accident is limited to severe reactor accidents. Severe reactor accidents are less likely than reactor design basis accidents; however, the consequences of these accidents could be more serious if no mitigative actions were taken. In the reactor design basis accidents, the mitigative systems are assumed to be available. The beyond design basis accidents analyzed are reactor core disruptive accidents with containment failure or bypass.*

approximately 2.3 person-rem per year for Bellefonte 1. If Bellefonte 2 were also operating, this dose would be approximately 4.6 person-rem per year. Statistically, this equates to one fatal cancer approximately every 435 years from the operation of Bellefonte 1 and 2.

Spent Fuel Generation Given production of the maximum amount of tritium in the average 18-month fuel cycle, spent fuel generation would increase from 0 up to a maximum of 141 spent fuel assemblies (i.e., 69 fuel assemblies over the normal refueling size). Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility could eventually be needed to store the additional assemblies. The impacts of storing the spent fuel in a dry cask spent fuel storage facility are described above for the existing operating reactor plants. As previously mentioned, appropriate NEPA documentation would be prepared before the construction of a dry cask spent fuel storage facility.

Low-Level Radioactive Waste Generation Compared to the No Action Alternative, reactor operation to produce tritium at Bellefonte 1 or Bellefonte 2 would generate approximately 40 cubic meters (80 cubic meters for both units) of low-level radioactive waste. This quantity would be a small fraction of the landfill capacity at the Barnwell disposal facility or the Savannah River Site's low-level radioactive waste disposal facility.

Accident Risks Compared to the No Action Alternative, there is a significant change in potential risks from tritium production. Risks due to accidents would increase during the construction and operation of Bellefonte 1 and 2, and during the operation of these units for production of tritium. Similar to Watts Bar 1 and Sequoyah 1 and 2, the potential impacts from the accidents at Bellefonte 1 or Bellefonte 2 were determined using computer modeling. If a limiting design-basis accident occurred, tritium production would increase the individual risk of a fatal cancer by 8.0×10^{-10} additional fatal cancers to an individual living within 80 kilometers (50 miles) of the units. Statistically this means that, for one individual, one fatal cancer would occur approximately every 1.3 billion years from tritium production at Bellefonte. If a beyond design-basis accident occurred (an accident that has a probability of occurring approximately once in a million years or less), tritium production would increase the risk of a fatal cancer by 0.00010 additional fatal cancers to an individual living within 80 kilometers (50 miles) of the Bellefonte Nuclear Plant.

Transportation Tritium production at either Bellefonte 1 or 2 would necessitate transportation of workers, construction material, and radiological and nonradiological material to and from the reactor plants. Most of the additional transportation would involve nonradiological materials. Impacts of this transportation are limited to toxic vehicle emissions and traffic fatalities. For Bellefonte 1 or 2, the transportation risks would be significantly lower than one fatality per year. Radiological materials transportation impacts would occur as a result of routine and accidental doses. In all instances the risks associated with radiological materials transportation would be less than one fatality per 100,000 years.

Table S-2 Summary of Environmental Consequences for the CLWR Reactor Alternatives

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
No Action			
All Resource/Material Categories	No construction or operational changes. Reactor unit continues to produce electricity. No change in environmental impacts.	No construction or operational changes. Reactor units continue to produce electricity. No change in environmental impacts.	No construction or operational changes. Reactor units remain uncompleted. No change in environmental impacts.
Annual Tritium Production			
Land Resources			
Land Use	*Construction:* Potential land disturbance - 5.3 acres for dry cask ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.1 acres for an ISFSI if constructed.	*Construction:* Potential land disturbance - 5.47 acres for ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.2 acres for an ISFSI if constructed.	*Construction:* Potential land disturbance - 4.9 acres for ISFSI if constructed and additional land for support buildings. *Operation:* Potential permanent land requirement - 3.4 acres for an ISFSI if constructed and additional land for support buildings.
Visual Resources	*Construction and Operation:* No additional impact to visual resources.	*Construction and Operation:* No additional impact to visual resources.	*Construction:* No additional impact to visual resources. *Operation:* Cooling tower vapor plumes would be visible up to 10 miles away.
Noise	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels except for construction vehicle traffic. Small impacts if an ISFSI is constructed. *Operation:* Increase in noise levels from 50 dBA (decibels A-weighted) to 51 dBA at nearest receptor. Increase in traffic noise onsite access roads from 50 dBA to 57 dBA due to commuter traffic and truck deliveries.

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
Air Quality Nonradioactive Emissions	*Construction:* No change from current air quality conditions. Small impacts if ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* No change from current air quality conditions. Small impacts if ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* Potential temporary dust emissions during construction. Small impacts if ISFSI is constructed. *Operation:* The increase in nonradioactive air pollutant concentrations would be well within established standards.
Air Quality Radioactive Emissions	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 106 Curies; given 3,400 TPBARs, 346 Curies, of which 5.6 Curies would be from normal operation without tritium production. The release of other radioactive emissions would be 283 Curies.
Water Resources Surface Water	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if ISFSI is constructed. *Operation:* No change to current surface water requirements, discharge, or water quality conditions.	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if ISFSI is constructed. *Operation:* No change to current surface water requirements, discharge, or water quality conditions.	*Construction:* Potential for increased storm water runoff. Small amount of surface water requirements. Small impacts if ISFSI is constructed. *Operation:* Increased surface water requirements and discharge. Water usage less than 1 percent of Tennessee River flow per year. All water quality parameters within established limits.
Radioactive Effluent	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 900 Curies; given 3,400 TPBARs, 3,060 Curies.	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 900 Curies; given 3,400 TPBARs, 3,060 Curies.	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 1,539 Curies; given 3,400 TPBARs, 3,699 Curies, of which 639 Curies would be from normal operation without tritium production. The release of other radioactive effluents would be 1.32 Curies.

Resource/Material Categories	*Watts Bar 1*	*Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 2*
Groundwater	*Construction:* No groundwater requirements or additional impacts to groundwater quality conditions. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* No groundwater requirements or additional impacts to groundwater quality conditions. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Groundwater would not be used during construction. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.
Ecological Resources	*Construction*: No additional impacts on ecological resources. Small impacts if ISFSI is constructed. *Operation*: Small or no impacts to ecological resources from additional tritium releases.	*Construction*: No additional impacts on ecological resources. Small impacts if ISFSI is constructed. *Operation*: Small or no impacts to ecological resources from additional tritium release.	*Construction:* Potential impacts to ecological resources due to the small amount of land disturbance. Small impacts if ISFSI is constructed. *Operation:* Additional impacts on ecological resources including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal plant operations.
Socioeconomics	*Construction:* No measurable impact. *Operation:* <1 percent impact on regional economy.	*Construction:* No measurable impact. *Operation:* <1 percent impact on regional economy.	*Construction:* 4,500 peak new direct jobs due to plant completion. Short-term increased costs and traffic for local jurisdictions. *Operation:* 800 to 1,000 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually), decrease in the unemployment rate (from 8.2 percent to approximately 6.2 percent), and minor impacts to school resources.

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
Public and Occupational Health and Safety			
Normal Operation	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 0.33 millirem. *Maximally Exposed Individual:* Dose increase by 0.013 millirem. *50-mile population:* Dose increase by 0.34 person-rem. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 1.1 millirem. *Maximally Exposed Individual:* Dose increase by 0.05 millirem *50-mile population:* Dose increase by 1.3 person-rem.	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 0.24 millirem. *Maximally Exposed Individual:* Dose increase by 0.017 millirem. *50-mile population:* Dose increase by 0.60 person-rem. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 0.82 millirem. *Maximally Exposed Individual:* Dose increase by 0.057 millirem *50-mile population:* Dose increase by 1.9 person-rem.	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 104.33 millirem, of which 104 millirem would be from normal operations without tritium production. *Maximally Exposed Individual:* Dose increase by 0.263 millirem, of which 0.26 millirem would be from normal operations without tritium production. *50-mile population:* Dose increase by 1.6 person-rem, of which 1.4 person-rem would be from normal operations without tritium production. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 105.1 millirem, of which 104 millirem would be from normal operations without tritium production. *Maximally Exposed Individual:* Dose increase by 0.28 millirem. *50-mile population:* Dose increase by 2.3 person-rem.
Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.4×10^{-8} (1 fatality in 29 million years). *Average individual in population:* 4.0×0^{-10} (1 fatality in 2.5 billion years). *Exposed population*: 0.000074 (1 fatality in 13 thousand years). *Noninvolved worker:* $4.2\text{x}10^{-10}$ (1 fatality in 2.4 billion years).	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual :* 7.9×10^{-9} (1 fatality in 130 million years). *Average individual in population:* 6.1×10^{-10} (1 fatality in 1.6 billion years). *Exposed population*: 0.00015 (1 fatality in 6.6 thousand years). *Noninvolved worker:* $1.3\text{x}10^{-10}$ (1 fatality in 7.7 billion years).	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.5×10^{-7} (1 fatality in 2.9 million years). *Average individual in population:* 2.6×10^{-10} (1 fatality in 3.8 billion years). *Exposed population*: 0.000070 (1 fatality in 14 thousand years). *Noninvolved worker:* $1.2\text{x}10^{-12}$ (1 fatality in 83 billion years).

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
	Involved worker, reactor design-basis accident: In the highly unlikely event that workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the waste gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.	*Involved worker, reactor design-basis accident:* In the highly unlikely event that workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the waste gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.	*Involved worker, reactor design-basis accident:* In the highly unlikely event that workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the waste gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.
	For 3,400 TPBARs: *Maximally Exposed Individual:* 1.1×10^{-7} (1 fatality in 9.1 million years). *Average individual in population:* 1.4×10^{-9} (1 fatality in 710 million years). *Exposed population*: 0.00026 (1 fatality in 3.8 thousand years). *Noninvolved worker:* $1.5\text{x}10^{-9}$ (1 fatality in 670 million years). *Involved worker:* Same as for 1,000 TPBARs.	For 3,400 TPBARs: *Maximally Exposed Individual :* 2.7×10^{-8} (1 fatality in 37 million years). *Average individual in population:* 2.1×10^{-9} (1 fatality in 480 million years). *Exposed population*: 0.00052 (1 fatality in 1.9 thousand years). *Noninvolved worker:* $4.5\text{x}10^{-10}$ (1 fatality in 2.2 billion years). *Involved worker:* Same as for 1,000 TPBARs.	For 3,400 TPBARs: *Maximally Exposed Individual:* 3.6×10^{-7} (1 fatality in 2.8 million years). *Average individual in population:* 8.0×10^{-10} (1 fatality in 1.3 billion years). *Exposed population*: 0.00022 (1 fatality in 4.6 thousand years). *Noninvolved worker:* $4.3\text{x}10^{-12}$ (1 fatality in 230 billion years). *Involved worker:* Same as for 1,000 TPBARs.

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
Beyond Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Average individual in population:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Exposed population*: Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Noninvolved worker:* Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual :* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Average individual in population:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Exposed population*: Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Noninvolved worker:* Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.3×10^{-8} (1 fatality in 30 million years). *Average individual in population:* $1.4x10^{-10}$ (1 fatality in 7.1 billion years). *Exposed population*: 0.00017 (1 fatality in 5.8 thousand years). *Noninvolved worker:* Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
	For 3,400 TPBARs: *Maximally Exposed Individual:* 1.0×10^{-10} (1 fatality in 10 billion years). *Average individual in population:* 1.0×10^{-11} (1 fatality in 100 billion years). *Exposed population*: 0.000011 (1 fatality in 88 thousand years). *Noninvolved worker:* Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.	For 3,400 TPBARs: *Maximally Exposed Individual :* 1.0×10^{-10} (1 fatality in 10 billion years). *Average individual in population:* 1.1×10^{-10} (1 fatality in 9.1 billion years). *Exposed population*: 0.00014 (1 fatality in 7.1 thousand years). *Noninvolved worker*: Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.	For 3,400 TPBARs: *Maximally Exposed Individual:* 3.3×10^{-8} (1 fatality in 30 million years). *Average individual in population:* 1.5×10^{-10} (1 fatality in 6.6 billion years). *Exposed population*: 0.00018 (1 fatality in 5.5 thousand years). *Noninvolved worker:* Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.
Waste Management	*Construction:* Potential non-hazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 0.43 cubic meters per year. Other waste types would be unaffected by tritium production.	*Construction:* Potential non-hazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 0.43 cubic meters per unit per year. Other waste types would be unaffected by tritium production.	*Construction:* Minor amounts of non-hazardous construction material waste generated during the completion of the plant. Potential non-hazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 41 cubic meters per unit per year, of which 40 cubic meters would be from normal operations without tritium production.
Spent Nuclear Fuel Management	*Operation:* No increase if less than 2,000 TPBARs are irradiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 56 fuel assemblies per fuel cycle.	*Operation:* No increase if less than 2,000 TPBARs are irradiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 60 fuel assemblies per fuel cycle.	*Operation:* The amount of spent fuel would increase from 0 to approximately 72 spent fuel assemblies for less than 2,000 TPBARs. For 3,400 TPBARs, the amount of spent fuel generation could increase from 0 to a maximum of 141 spent fuel assemblies per fuel cycle, of which 72 would be from normal operation without tritium production.
Transportation	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years. Traffic volumes on local roads could increase during construction and operations.

Resource/Material Categories	*Watts Bar 1*	*Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 2*
Fuel Fabrication	Not applicable for the reactor site.	Not applicable for the reactor site.	Not applicable for the reactor site.
Decontamination and Decommissioning	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required. For a generic discussion on impacts from decontamination and decommissioning, see Section 5.2.5.
License Renewal	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would not be required.

MEI = Maximally Exposed Offsite Individual
ISFSI = Independent Spent Fuel Storage Installation

Table S-3 Summary Comparison of Environmental Impacts Between CLWR Reactor Alternatives and the APT

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)[a]*
Land Resources			
Land Use	*Construction:* Potential land requirement—5.3 acres (Watts Bar) or 5.47 acres (Sequoyah) of previously disturbed industrial land for a dry cask ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.1 to 3.2 acres, respectively, of previously disturbed industrial land for an ISFSI if constructed.	*Construction:* Potential land requirement—4.9 acres of previously disturbed industrial land for an ISFSI, if constructed, and additional small amounts of land for support buildings. *Operation:* Potential permanent land requirement - 3.4 acres of previously disturbed industrial land for an ISFSI, if constructed, and additional small amounts of land for support buildings.	*Construction and Operation:* 250 acres of land converted to industrial use. Additional lands for new roads, bridge upgrades, rail lines, and construction landfill. Additional 12 acres required for modular design, if selected. Additional land required for electric power generating facility, if constructed (e.g., 110 acres for a natural gas-fired facility and 290 acres for a coal-fired facility).
Visual Resources	*Construction and Operation:* No additional impact to visual resources.	*Construction:* No additional impact to visual resources. *Operation:* Vapor plumes under certain meteorological conditions would be visible up to 10 miles away.	*Construction:* No additional impact to visual resources. *Operation:* Vapor plumes under certain meteorological conditions would be visible.
Noise	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels except for construction vehicle traffic. Small impacts if an ISFSI is constructed. *Operation:* Increase in noise emissions from the plant from 50 dBA to 51 dBA at nearest receptor. Increase in traffic noise on site access roads from 50 dBA to 57 dBA due to commuter traffic and truck deliveries.	*Construction:* No change from current levels except for construction vehicle traffic. *Operation:* Increase in noise emissions from the new APT facility, electric power generating facility (if constructed), and support facilities.
Air Quality			
Non-radiological Emissions	*Construction:* No change from current air quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* Potential temporary dust emissions during construction. Small impacts if an ISFSI is constructed. *Operation:* The increase in nonradioactive emissions would be within established standards.	*Construction:* Potential temporary dust emissions during construction. *Operation:* The increase in nonradiological emissions would be within standards. Large increase in carbon dioxide emissions from any electric power generating facility.

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Radioactive Emissions	*Construction:* No radiological emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radiological emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 106 Curies; given 3,400 TPBARs, 346 Curies, of which 5.6 Curies would be from normal operation without tritium production. The release of other radioactive emissions would be 283 Curies.	*Construction:* No radiological emissions. *Operation:* The maximum potential increase in annual radioactive emissions of tritium would be 30,000 Curies in oxide form and 8,600 Curies in elemental form. The release of other radioactive emissions would be 2,250 Curies. Potential for an additional 2,000 Curies from electric power generating facility if power is acquired through market transaction (APT Final EIS p. C-46 & Draft EIS p. 4-80).
Water Resources Surface Water	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change to current surface water requirements, discharge, or water quality conditions.	*Construction:* Potential for increased storm water runoff. Small amount of surface water requirements. Small impacts if an ISFSI is constructed. *Operation:* Increased surface water requirements and discharge. Water usage less than 1 percent of Tennessee River flow per year. All water quality parameters within established limits.	*Construction:* Increased storm water runoff and impacts from dewatering. Surface water requirements. *Operation:* Increased surface water requirements and discharge. Potential for additional water requirements from an electric power generating facility, if constructed—4.7 billion gallons per day (coal-fired) and 1.4 billion gallons per day (natural gas-fired). All water quality parameters within established limits (APT Draft EIS p. 4-81).
Water Resources Radioactive Effluent	*Construction:* No radiological effluent. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 900 Curies; given 3,400 TPBARs, 3,060 Curies.	*Construction:* No radiological effluent. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 1,539 Curies; given 3,400 TPBARs 3,699 Curies, of which 639 Curies from normal operation without tritium production. The release of other radioactive effluents would be 1.32 Curies.	*Construction:* No radiological effluent. *Operation:* The maximum potential increase in annual radioactive tritium effluents would be 3,000 Curies and 0.0031 Curies from other radioactive emissions. Potential for an additional 19,000 Curies from the electric power generating facility if power is acquired through market transaction (APT Final EIS p. C-43 & Draft EIS 4-80).
Groundwater	*Construction and Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Groundwater would not be used during construction. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Due to below-ground construction of the APT, groundwater would be withdrawn and discharged to surface water. *Operation:* Potential for a 6,000 gallons per minute withdrawal of groundwater for APT cooling water (APT Draft EIS p. 4-3).

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Ecological Resources	*Construction:* No additional impacts on ecological resources. Small impacts if an ISFSI is constructed. *Operation:* Small or no impacts to ecological resources from tritium production.	*Construction:* Potential impacts to ecological resources due to the small amount of land disturbance. Small impacts if an ISFSI is constructed. *Operation:* Impacts on ecological resources, including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal plant operations.	*Construction:* Potential impacts to ecological resources due to land disturbance. *Operation:* Impacts on ecological resources, including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal operations. Potential additional impacts on ecological resources from electric power generating plant, if constructed.
Socioeconomics	*Construction:* No measurable impact. *Operation:* less than 1 percent impact on regional economy.	*Construction:* 4,500 peak new direct jobs due to plant completion. Short-term increased costs and traffic for local jurisdictions. *Operation:* 800 to 1,000 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually), decrease in the unemployment rate (from 8.2 percent in 1997 to approximately 6.2 percent), and minor impacts to school resources.	*Construction:* 1,400 peak new direct jobs. Short-term increased costs and traffic for local jurisdictions. Additional 1,100 peak jobs associated with new electric power generating facility, if constructed (APT Draft EIS p. 4-80). *Operation:* 500 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions, decrease in the unemployment rate, and minor impacts to school resources. Additional 200 jobs associated with new electric power generating facility, if constructed (APT Draft EIS p. 4-80).

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Public and Occupational Health and Safety Normal Operation	Annual dose for 1,000 TPBARs: *Workers*: Total dose - 112.35 person-rem (Watts Bar) and 132.35 person-rem (Sequoyah). *Maximally Exposed Individual*: Dose increase by 0.013 millirem (Watts Bar) and 0.017 millirem (Sequoyah). *50-mile population*: Dose increase by 0.34 person-rem (Watts Bar) and 0.60 person-rem (Sequoyah). Annual dose for 3,400 TPBARs: *Workers*: Total dose 113.2 person-rem (Watts Bar) and 133.2 person-rem (Sequoyah). *Maximally Exposed Individual*: Dose increase by 0.05 millirem (Watts Bar) and 0.057 millirem (Sequoyah). *50-mile population*: Dose increase by 1.2 person-rem (Watts Bar) and 1.9 person-rem (Sequoyah).	Annual dose for 1,000 TPBARs: *Workers*: Total dose—112.35 person-rem per unit; 112 person-rem per unit from normal operations without tritium production. *Maximally Exposed Individual*: Dose increase by 0.263 millirem per unit, of which 0.26 millirem per unit would be from normal operation without tritium production. *50-mile population*: Dose increase by 1.6 person-rem per unit, of which 1.4 person-rem per unit would be from normal operation without tritium production. Annual dose for 3,400 TPBARs: *Workers*: Total dose—113.2 person-rem; 112 person-rem from per unit normal operations without tritium production. *Maximally Exposed Individual*: Dose increase by 0.28 millirem per unit, of which 0.26 millirem per unit would be from normal operation without tritium production. *50-mile population*: Dose increase by 2.3 person-rem per unit, of which 1.4 person-rem per unit would be from normal operation without tritium production.	Annual dose *Workers*: Total dose - 72 person-rem (APT Draft EIS p. 4-39). *Maximally Exposed Individual*: Dose increase by 0.053 millirem (APT Final EIS p. C-52). *50-mile population*: Dose increase by 3.1 person-rem (APT Final EIS p. C-52).

Resource/Material Categories	***Watts Bar 1 or Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 1 and Bellefonte 2***	***CLWR No Action (APT at the Savannah River Site)***[a]
Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.4×10^{-8} (1 fatality in 29 million years - Watts Bar) and 7.9×10^{-9} (1 fatality in 130 million years - Sequoyah). *Average individual in population:* 4.0×10^{-10} (1 fatality in 2.5 billion years - Watts Bar) and 6.1×10^{-10} (1 fatality in 1.6 billion years - Sequoyah). *Exposed population:* 0.000074 (1 fatality in 13 thousand years - Watts Bar) and 0.00015 (1 fatality in 6.6 thousand years). *Noninvolved worker:* 4.2×10^{-10} (1 fatality in 2.4 billion years - Watts Bar) and 1.3×10^{-10} (1 fatality in 7.7 billion years - Sequoyah). For 3,400 TPBARs: *Maximally Exposed Individual:* 1.1×10^{-7} (1 fatality in 9.1 million years - Watts Bar) and 2.7×10^{-8} (1 fatality in 37 million years - Sequoyah). *Average individual in population:* 1.4×10^{-9} (1 fatality in 710 million years - Watts Bar) and 2.1×10^{-9} (1 fatality in 480 million years - Sequoyah). *Exposed population:* 0.00026 (1 fatality in 3.8 thousand years - Watts Bar) and 0.00052 (1 fatality in 1.9 thousand years). *Noninvolved worker:* 1.5×10^{-9} (1 fatality in 670 million years - Watts Bar) and 4.5×10^{-10} (1 fatality in 2.2 billion years - Sequoyah).	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.5×10^{-7} (1 fatality in 2.9 million years). *Average individual in population:* 2.6×10^{-10} (1 fatality in 3.8 billion years). *Exposed population:* 0.000070 (1 fatality in 14 thousand years). *Noninvolved worker:* 1.2×10^{-12} (1 fatality in 830 billion years). For 3,400 TPBARs: *Maximally Exposed Individual:* 3.6×10^{-7} (1 fatality in 2.8 million years). *Average individual in population:* 8.0×10^{-10} (1 fatality in 1.3 billion years). *Exposed population:* 0.00022 (1 fatality in 4.6 thousand years). *Noninvolved worker:* 4.3×10^{-12} (1 fatality in 230 billion years).	Increased likelihood of a cancer fatality per year due to tritium production. Design-basis seismic event: 2.6 fatalities every 2,000 years.

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Waste Management	*Construction:* Potential nonhazardous waste if an ISFSI is constructed. *Operation*: Low-level radioactive waste increase by approximately 0.43 cubic meters per unit per year. Other waste types would be unaffected by tritium production.	*Construction:* Minor amounts of nonhazardous construction material waste generated during the completion of the plant. Potential for additional nonhazardous waste material generated if an ISFSI is constructed. *Operation*: Low-level radioactive waste increase by approximately 41 cubic meters per unit per year, of which 40 cubic meters would be from normal operation without tritium production. Other waste types would also be generated due to tritium production.	*Construction:* 30,000 cubic meters of construction material generated and deposited in onsite landfill. Potential for additional nonhazardous waste material generated if new electric power generating facility is constructed. *Operation:* Low-level radioactive waste increase by approximately 1,400 cubic meters per year. Potential for additional 10,000 units of nuclear solid waste if power is acquired through market transaction (APT Draft EIS p. 4-80). Other waste types would also be generated due to tritium production and electric power generation (APT Draft EIS p. 4-26).
Spent Nuclear Fuel Management	*Operation:* No increase if less than 2,000 TPBARs are radiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 60 (Sequoyah), and 56 (Watts Bar) fuel assemblies per fuel cycle.	*Operation:* The amount of spent fuel would increase from 0 to approximately 72 spent fuel assemblies for less than 2,000 TPBARs. For 3,400 TPBARs, the amount of spent fuel generation could increase from zero to a maximum of 141 spent fuel assemblies per fuel cycle, of which 72 would be from normal operation without tritium production.	*Operation:* Spent nuclear fuel would be generated under the market transaction/existing capacity alternative for electric power generation.
Transportation	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years. Traffic volumes on local roads could increase during construction and operations.	Transportation within the Savannah River Site only.
Fuel Fabrication	Not applicable for reactor site.	Not applicable for reactor site.	Not applicable for APT facility. Yes for electric-generating facility.
Decontamination and Decommissioning	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required. For a generic discussion on impacts from decontamination and decommissioning, see Section 5.2.5.	Decontamination and decommissioning would be required.
License Renewal	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would not be required.	Licensing renewal is not applicable.

[a] Based on tritium production of 3 kilograms of tritium per year.

AVAILABILITY OF THE CLWR Final EIS

Copies of the CLWR Final EIS may be obtained by calling DOE's Office of Defense Programs at 1-800-332-0801.

General questions concerning the NEPA process, under which EISs are prepared, may be addressed to:

Ms. Carol Borgstrom
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington DC 20585
Telephone (202) 586-4600, or leave message at 1-800-472-2756

COVER SHEET

Responsible Agency: United States Department of Energy

Cooperating Agency: Tennessee Valley Authority

Title: Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor

Contact: For additional information on this Final Environmental Impact Statement, write or call:

Jay Rose
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U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Attention: CLWR EIS
Telephone: (202) 586-5484

For copies of the CLWR Final EIS call: 1-800-332-0801

For general information on the DOE National Environmental Policy Act (NEPA) process, write or call:

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Abstract: The U.S. Department of Energy (DOE) is responsible for providing the nation with nuclear weapons and ensuring that these weapons remain safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other materials utilized in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically. Currently the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to continue supporting the nation's stockpile. The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS), DOE/EIS-0161, issued in October 1995, evaluated the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at five DOE sites for four different production technologies. This Programmatic EIS also evaluated the impacts of using a commercial light water reactor (CLWR) without specifying a reactor location. In the Record of Decision for the Final Programmatic EIS (60 FR 63878), issued December 12, 1995, DOE decided to pursue a dual-track approach on the two most promising tritium supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or reactor irradiation services; and (2) to design, build, and test critical components of an accelerator system for tritium production. At that time, DOE announced that the final decision would be made by the Secretary of Energy at the end of 1998.

On December 22, 1998, Secretary of Energy Bill Richardson announced that the CLWR would be DOE's primary option for tritium production, and the proposed linear accelerator at the Savannah River Site would be the back-up option. The Secretary designated the Tennessee Valley Authority's (TVA) Watts Bar and Sequoyah Nuclear Plants as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

This *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) evaluates the environmental impacts associated with producing tritium at one or more of the following five CLWRs: (1) Watts Bar Nuclear Plant Unit 1 (Spring City, Tennessee); (2) Sequoyah Nuclear Plant Unit 1 (Soddy Daisy, Tennessee); (3) Sequoyah Nuclear Plant Unit 2 (Soddy Daisy, Tennessee); (4) Bellefonte Nuclear Plant Unit 1 (Hollywood, Alabama); and (5) Bellefonte Nuclear Plant Unit 2 (Hollywood, Alabama). Specifically, this EIS analyzes the potential environmental impacts associated with fabricating tritium-producing burnable absorber rods (TPBARs); transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; irradiating TPBARs in the reactors; and transporting irradiated TPBARs from the reactors to the proposed tritium extraction facility at the Savannah River Site in South Carolina.

The public comment period on the CLWR Draft EIS extended from August 28 to October 27, 1998. During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. An additional public meeting was held in Evensville, Tennessee, on December 14, 1998. The CLWR Draft EIS was made available through mailings and requests to DOE's CLWR Office and at DOE's Public Reading Rooms. In preparing the CLWR Final EIS, DOE considered comments received via mail, fax, submission at public hearings, recorded telephone messages, and the Internet. In addition, comments and concerns identified during discussions at the public hearings were recorded by a court reporter and were transcribed for consideration by DOE.

The CLWR Final EIS contains revisions and new information in response to the comments on the CLWR Draft EIS and technical details disclosed since the Draft EIS was issued. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger changes. Volume 2 (Comment Response Document) of the CLWR Final EIS contains the comments received during the public review of the CLWR Draft EIS and DOE's responses to these comments.

No sooner than 30 days after the notice of filing this EIS with the U.S. Environmental Protection Agency, DOE expects to issue a Record of Decision.

PREFACE

The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS) (DOE/EIS-0161), which was completed in October 1995, assessed the potential environmental impacts of technology and siting alternatives for the production of tritium for national security purposes. On December 5, 1995, DOE issued a Record of Decision for the Final Programmatic EIS that selected the two most promising alternative technologies for tritium production and established a dual-track strategy that would, within 3 years, select one of those technologies to become the primary tritium supply technology. The other technology, if feasible, would be developed as a backup tritium source. Under the dual-track strategy, DOE would: (1) initiate the purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) design, build, and test critical components of an accelerator system for tritium production. Under the Final Programmatic EIS Record of Decision, any new facilities that might be required, i.e., an accelerator and/or a tritium extraction facility to support the commercial reactor alternative, would be constructed at DOE's Savannah River Site in South Carolina.

The Final Programmatic EIS described a two-phase strategy for compliance with the National Environmental Policy Act (NEPA). The first phase included completion of the Final Programmatic EIS and subsequent Record of Decision. The second phase included the preparation of site-specific NEPA documents tiered from the Final Programmatic EIS. These EISs address the environmental impacts of specific project proposals. As a result of the Final Programmatic EIS and the Record of Decision, DOE determined to prepare three site-specific EISs: the *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT) (DOE/EIS-0270), the *Environmental Impact Statement for the Production of Tritium in a Comercial Light Water Reactor* (CLWR) (DOE/EIS-0288), and the *Environment Impact Statement, Construction and Operation of a Tritium Extraction Facility at Savannah River Site* (TEF) (DOE/EIS-0271). Each of these EISs presents an analysis of alternatives which do not affect the alternatives in the other EISs, with one exception. This exception is one alternative in the TEF EIS which would require the use of space in the APT. For this alternative to be viable, the APT would have to be selected as the primary source of tritium.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and the Sequoyah Units 1 and 2 reactors near Soddy-Daisy, Tennessee, as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the "backup" technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. Finally, selection of the CLWR reaffirms the December 1995 Final Programmatic EIS Record of Decision to construct and operate a new tritium extraction capability at the Savannah River Site.

DOE has completed the final EISs for the APT, CLWR, and TEF. No sooner than 30 days after publication in the *Federal Register* of the Environmental Protection Agency's Notice of Availability of the final EISs for APT, CLWR, and TEF, DOE intends to issue a consolidated Record of Decision to: (1) formalize the programmatic announcement made on December 22, 1998; and (2) announce project-specific decisions for the three EISs. These decisions will include, for the selected CLWR technology, the selection of specific CLWRs to be used for tritium supply and the location of a new tritium extraction capability at the Savannah River Site. For the backup APT technology, technical and siting decisions consistent with its backup role will be made.

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ACRONYMS AND ABBREVIATIONS

APT	Accelerator Production of Tritium
BEIR	Biological Effects of Ionizing Radiation
Bellefonte 1	Bellefonte Nuclear Plant Unit 1
Bellefonte 2	Bellefonte Nuclear Plant Unit 2
CFR	Code of Federal Regulations
CLWR	Commercial light water reactor
DOE	U.S. Department of Energy
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HEPA	High-efficiency particulate air
IAEA	International Atomic Energy Agency
ISFSI	Independent spent fuel storage installation
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
Sequoyah 1	Sequoyah Nuclear Plant Unit 1
Sequoyah 2	Sequoyah Nuclear Plant Unit 2
START	Strategic Arms Reduction Treaty
TPBAR	Tritium-producing burnable absorber rod
TVA	Tennessee Valley Authority
U.S.C.	United States Code
Watts Bar 1	Watts Bar Nuclear Plant Unit 1
Watts Bar 2	Watts Bar Nuclear Plant Unit 2

1. INTRODUCTION

Chapter 1 provides an overview of the U.S. Department of Energy's (DOE) commercial light water reactor proposal. This chapter discusses the scope and development of the *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*, the reactor procurement process, and the reactor alternatives. Chapter 1 also includes background information on nuclear weapons; the Tennessee Valley Authority, operator of the candidate commercial light water reactors; the role of tritium in the weapons; and DOE's compliance with the National Environmental Policy Act for the Commercial Light Water Reactor program. The chapter concludes with a section on the organization of the document, the public scoping and hearings process used to obtain public input on the issues addressed in this environmental impact statement, a summary of the major public comments, and a description of the changes made to the Commercial Light Water Reactor Draft Environmental Impact Statement.

1.1 OVERVIEW

1.1.1 General

The U.S. Department of Energy (DOE) is responsible for providing the nation with nuclear weapons and ensuring those weapons remain safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other nuclear materials used in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically.

At present, the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to support the nation's current and future stockpile. Pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 *et seq*.), and the DOE regulations implementing NEPA (10 CFR 1021), this *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) analyzes the potential consequences to the environment associated with the production of tritium using one or more commercial light water reactors (CLWR). In the Record of Decision for this CLWR EIS, DOE anticipates selecting one or more reactors for tritium production.

Concurrent with the preparation of this environmental impact statement (EIS), DOE evaluated the feasibility of various CLWR alternatives through its standard procurement process (see Section 1.1.4). This EIS evaluates the environmental impacts associated with tritium production for all Tennessee Valley Authority (TVA) reactor plants offered by TVA during the procurement process (see Section 1.2 for a list of these reactors). DOE is considering only the purchase of irradiation services, not the purchase of a reactor. Purchase of a reactor is no longer being considered because none were offered for sale during the procurement process.

1.1.2 Proposed Action and Scope

The CLWR EIS evaluates the potential direct, indirect, and cumulative environmental impacts associated with producing tritium in one or more CLWRs for a 40-year period. In addition, this EIS evaluates the environmental impacts of the No Action Alternative. Under the No Action Alternative, the stockpile requirements for tritium would have to be met by the construction and operation of an accelerator at DOE's Savannah River Site in South Carolina (see Section 1.5.2.1). For the purpose of this EIS, a No Action Alternative (i.e., no tritium production would occur at the CLWR) was evaluated for each candidate CLWR.

DOE proposes to use one or more CLWRs to provide tritium in sufficient quantities to support the nation's nuclear weapons stockpile requirements for at least the next 40 years. The proposed action includes: the manufacture of tritium-producing burnable absorber rods (TPBARs) at a commercial facility; the irradiation of the TPBARs at one or more of five operating or partially constructed TVA nuclear reactors; the possible completion of TVA's nuclear reactors; the transportation of nonirradiated and irradiated materials; and the management of spent nuclear fuel and low-level radioactive waste.

More specifically, as depicted in **Figure 1–1**, this EIS analyzes the potential environmental impacts associated with the proposed action: (1) fabricating TPBARs; (2) transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; (3) irradiating TPBARs in the reactors; and (4) transporting irradiated TPBARs from the reactors to the proposed Tritium Extraction Facility at the Savannah River Site. This EIS further analyzes the potential environmental impacts associated with both the management of spent nuclear fuel and the transportation and management of low-level radioactive waste generated from CLWR tritium production.

1.1.3 Development of the CLWR EIS

The CLWR EIS is a tiered document that follows the December 1995 Record of Decision (60 FR 63878) for the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS) (DOE 1995b). In that Programmatic EIS, DOE considered a range of reasonable alternatives for obtaining the required quantities of tritium. In the December 1995 Record of Decision, DOE decided to pursue a dual-track approach on the two most promising tritium-supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator system for tritium production (the Savannah River Site was selected as the location for an accelerator, should one be built). DOE committed to selection of one of these approaches by the end of 1998 to serve as the primary source of tritium. The other alternative, if feasible, would continue to be developed as a backup tritium source. Production of tritium in an accelerator is analyzed in the *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT EIS), DOE/EIS-0270 (DOE 1997e, DOE 1999a) (see Section 1.5.2.1).

On December 22, 1998, Energy Secretary Bill Richardson announced that tritium production in one or more CLWRs would be the primary tritium supply technology and that the accelerator would be developed, but not constructed, as a backup to CLWR tritium production (DOE 1998f). Secretary Richardson further stated that the Watts Bar and Sequoyah reactors have been designated as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site.

1.1.4 The CLWR Procurement Process

The production of tritium in a CLWR would require a contract/interagency agreement between DOE and the owner/operator of the CLWR. Accordingly, on June 3, 1997, DOE issued in final form a request for proposals from owners/operators for irradiation services or sale of a CLWR (DOE 1997a). In September 1997, DOE received proposals for producing tritium using operating or partially completed reactors. The proposals for the Watts Bar and Bellefonte Nuclear Plants received from TVA were the only proposals determined to be responsive to the requirements of the procurement request. Under Federal procurement law, a proposal is "responsive" if it meets the criteria set forth in the agency's request for proposals. In addition to the responsive

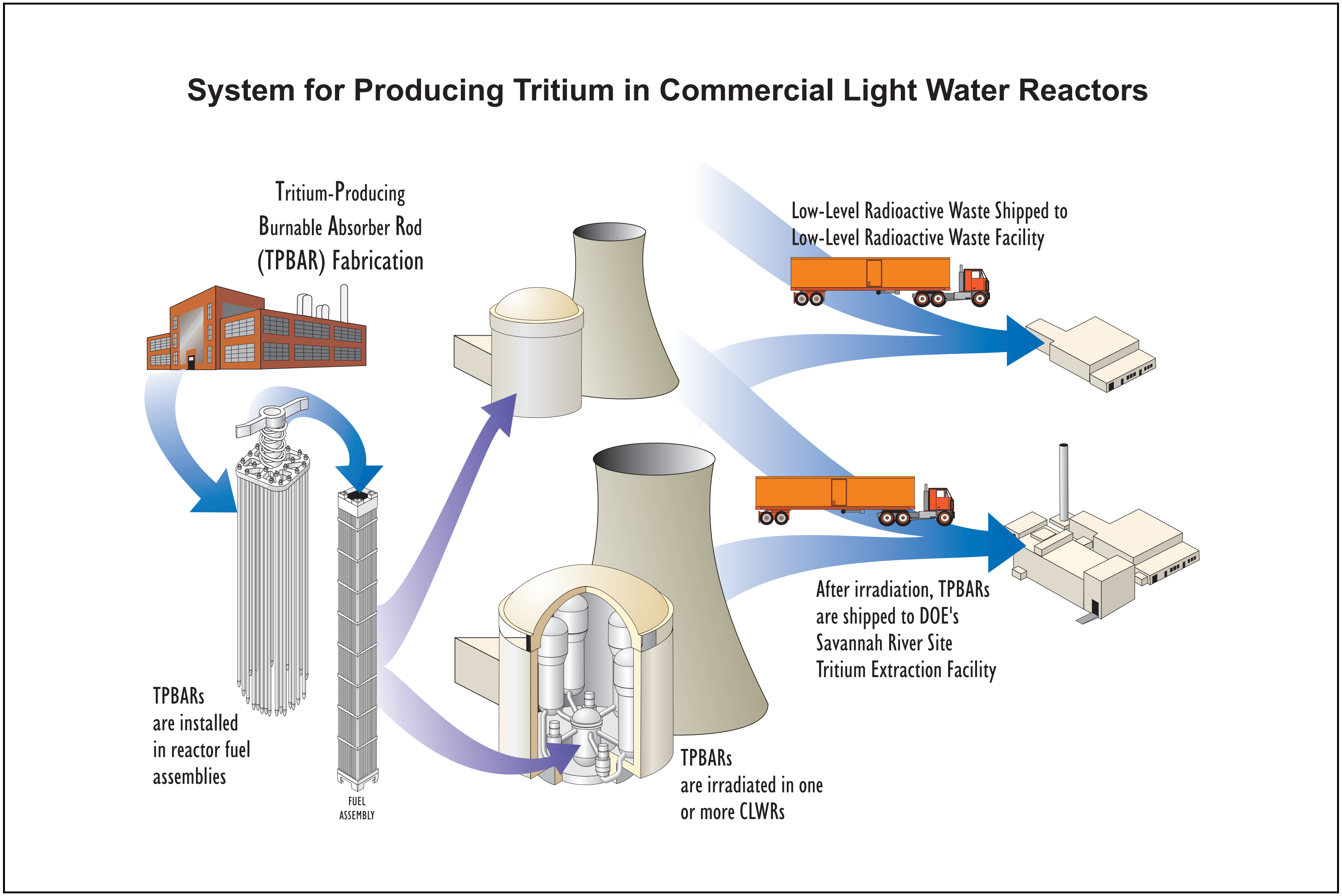

Figure 1–1 Schematic of Process for Producing Tritium in CLWRs

bids discussed in this EIS, DOE received one nonresponsive bid. That bid did not offer to produce tritium. TVA initially offered Watts Bar Nuclear Plant Unit 1 (Watts Bar 1) and Bellefonte Nuclear Plant Unit 1 (Bellefonte 1). Since Bellefonte 1 is a partially completed unit, in the event that it could not be completed and licensed in time to support DOE's requirements for tritium production, TVA, through the procurement process, also offered to make Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2) available to meet the need for tritium. In addition, Bellefonte Nuclear Plant Unit 2 (Bellefonte 2) was considered a reasonable alternative. These reasonable reactor alternatives are identified in Section 1.2. A description of each of these reactor facilities is presented in Section 3.2.5 of this EIS.

Because both TVA and DOE are Federal agencies, an interagency agreement between them could be reached via the Economy Act (31 U.S.C. 1535). The Economy Act is a Federal law that allows two government agencies to enter into an interagency agreement similar to the contractual agreement that a Federal agency would enter with a nonfederal party through the competitive procurement process. The Federal procurement process for the CLWR program explicitly allows for an interagency agreement via the Economy Act.

Subsequent to the initial proposals from TVA, in May 1998 TVA allowed its initial procurement proposal for selling irradiation services at the Sequoyah and Watts Bar reactors to expire. However, because the TVA proposals are also subject to the Economy Act, this action did not affect the TVA reactor alternatives. Thus, the CLWR Draft EIS assessed all five of the TVA reactors as reasonable alternatives for tritium production. In November 1998, Secretary Richardson asked TVA to submit a revised proposal for irradiation services at the Watts Bar and Sequoyah reactors, as well as final proposals for completion of Bellefonte, so that he would have a comprehensive set of options on which to base the technology decision. In December 1998, TVA submitted revised proposals for both the Watts Bar and Sequoyah reactors, as well as for Bellefonte. Consequently, all of the alternatives that were evaluated in the CLWR Draft EIS remain as reasonable alternatives in the CLWR Final EIS.

DOE may enter into an interagency agreement with TVA, contingent on completion of the NEPA process, for production of the tritium required to support the nuclear weapons stockpile. Only those actions that are determined not to have an adverse effect and not to limit the choice of reasonable alternatives would be permitted prior to the completion of the NEPA process. However, before completion of the CLWR EIS and its associated Record of Decision, DOE and TVA have taken and will continue to take appropriate actions (e.g., studies, analyses) related to the potential submission of licensing documents to the U.S. Nuclear Regulatory Commission (NRC). The NRC must approve the use of TPBARs in licensed reactors.

1.2 COMMERCIAL LIGHT WATER REACTOR FACILITIES ANALYZED IN THIS CLWR EIS

This EIS evaluates the environmental impacts associated with producing tritium at one or more of the following reactor facilities:

- Watts Bar Nuclear Plant Unit 1 (Watts Bar 1), Spring City, Tennessee (operating)
- Sequoyah Nuclear Plant Unit 1 (Sequoyah 1), Soddy-Daisy, Tennessee (operating)
- Sequoyah Nuclear Plant Unit 2 (Sequoyah 2), Soddy-Daisy, Tennessee (operating)
- Bellefonte Nuclear Plant Unit 1 (Bellefonte 1), Hollywood, Alabama (partially complete)
- Bellefonte Nuclear Plant Unit 2 (Bellefonte 2), Hollywood, Alabama (partially complete)

These reactors, whose locations are shown in **Figure 1–2**, are owned and operated by the U.S. Government. Because tritium production could occur in one or more of these reactor facilities, this EIS evaluates each reactor for the maximum number of TPBARs that could be irradiated in the reactor. This bounds potential environmental impacts associated with any of the reactor facilities. This EIS also qualitatively evaluates the irradiation of a lesser number of TPBARs and a TPBAR design with higher tritium production and shorter refueling cycles (see Section 5.2.9).

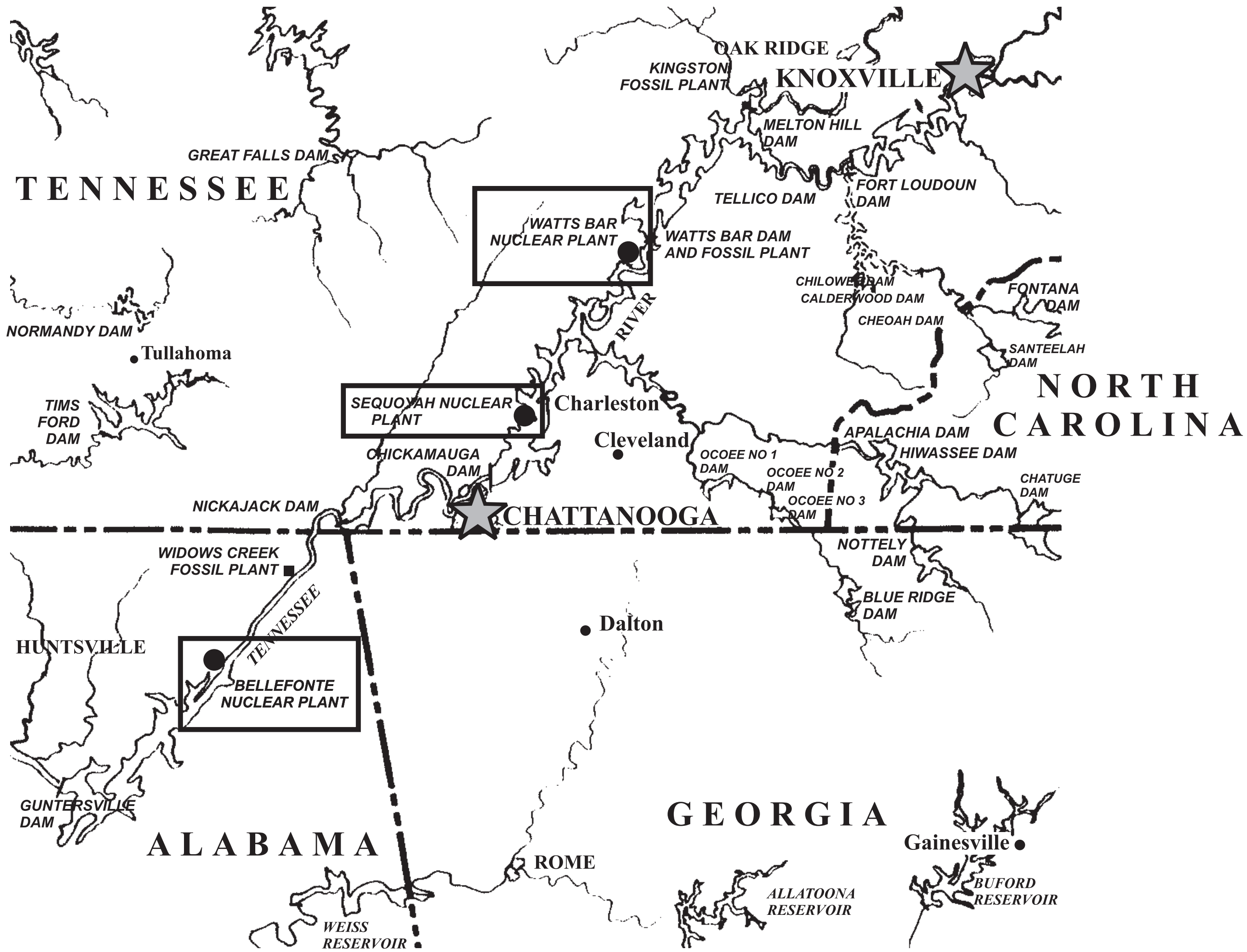

Figure 1–2 Locations of Candidate CLWRs for Tritium Production

In accordance with Council on Environmental Quality regulations, this EIS also evaluates the No Action Alternative. Under the No Action Alternative, DOE would not produce tritium in a CLWR. Consistent with Energy Secretary Bill Richardson's announcement on December 22, 1998 (DOE 1998f), the stockpile demands for tritium would have to be met by the backup technology option, which is the construction and operation of an accelerator at the Savannah River Site (see Section 1.5.2.1).

1.3 Background

1.3.1 Defense Programs Mission

Since the inception of the nuclear weapons program in the 1940s, DOE and its predecessor agencies have been responsible for designing, manufacturing, maintaining, and retiring the nuclear weapons in the nation's stockpile. In response to the end of the Cold War and changes in the world political regime, the emphasis of the United States' nuclear weapons program has shifted dramatically over the past few years from producing weapons to dismantling weapons. Accordingly, the nuclear weapons stockpile is being greatly reduced; the United States is no longer producing new-design nuclear weapons; and DOE has closed or consolidated many former weapons production facilities.

Additionally, in 1991 President Bush declared a moratorium on underground nuclear testing, and in 1995 President Clinton decided to pursue a zero-yield Comprehensive Test Ban Treaty. Despite these significant changes, DOE's responsibilities for the nuclear weapons stockpile continue, and the President and Congress have directed DOE to continue to maintain the safety and reliability of the nuclear weapons stockpile and to provide the tritium necessary to satisfy national security requirements. As explained in Chapter 2, the United States will need a new tritium production source by approximately 2005.

The size of the nation's nuclear weapons stockpile is determined by the President through a classified process. The Secretaries of Defense and Energy, in coordination with the Nuclear Weapons Council, jointly sign and submit the Nuclear Weapons Stockpile Memorandum. The Nuclear Weapons Stockpile Memorandum transmits the Nuclear Weapons Stockpile Plan to the President for final approval. **Figure 1–3** depicts this process. The Nuclear Weapons Stockpile Plan covers an 11-year period, specifies the types and quantities of weapons required, and sets limits on the size and nature of stockpile changes that can be made without additional approval from the President. As such, the Nuclear Weapons Stockpile Plan is the basis for all weapons planning in DOE. The President takes the Nuclear Weapons Stockpile Memorandum under advisement and issues a National Security Directive to DOE and the U.S. Department of Defense approving the Nuclear Weapons Stockpile Plan for implementation. Based upon this Presidential directive, DOE determines the tritium requirements. The most recent Presidential direction, which is contained in the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive, mandates that new tritium must be available by approximately 2005 if a CLWR is the selected option for tritium production. Chapter 2 provides a description of the tritium requirements this EIS is intended to support.

1.3.2 Nuclear Weapons

A general understanding of a nuclear weapon, including the components that make up the weapon and the physical processes involved, is helpful in understanding the purpose and need addressed in this EIS. **Figure 1–4** presents a simplified diagram of a modern nuclear weapon. An actual U.S. nuclear weapon is much more complicated, consisting of many thousands of parts.

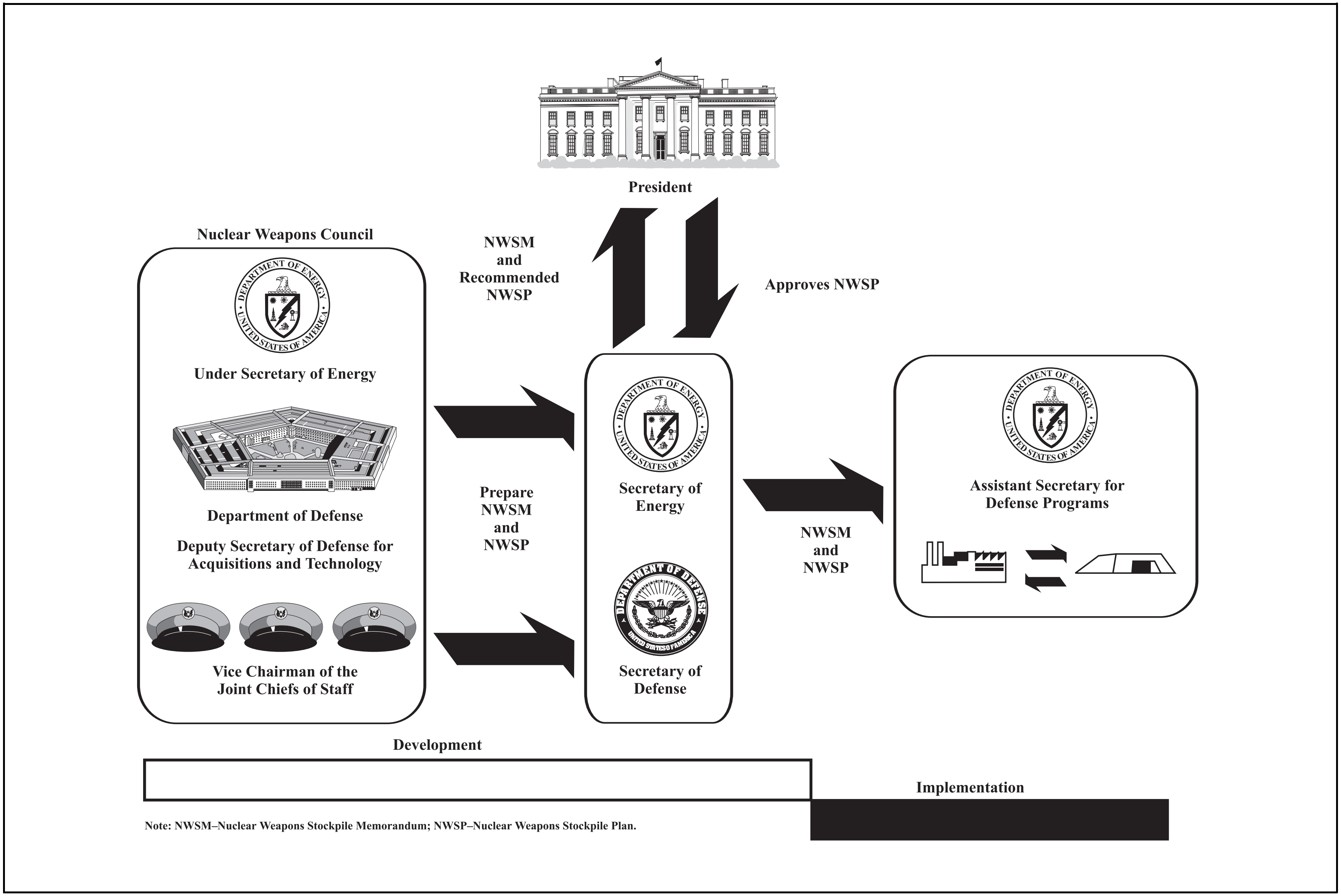

Figure 1–3 Nuclear Weapons Stockpile Memorandum and Plan Process

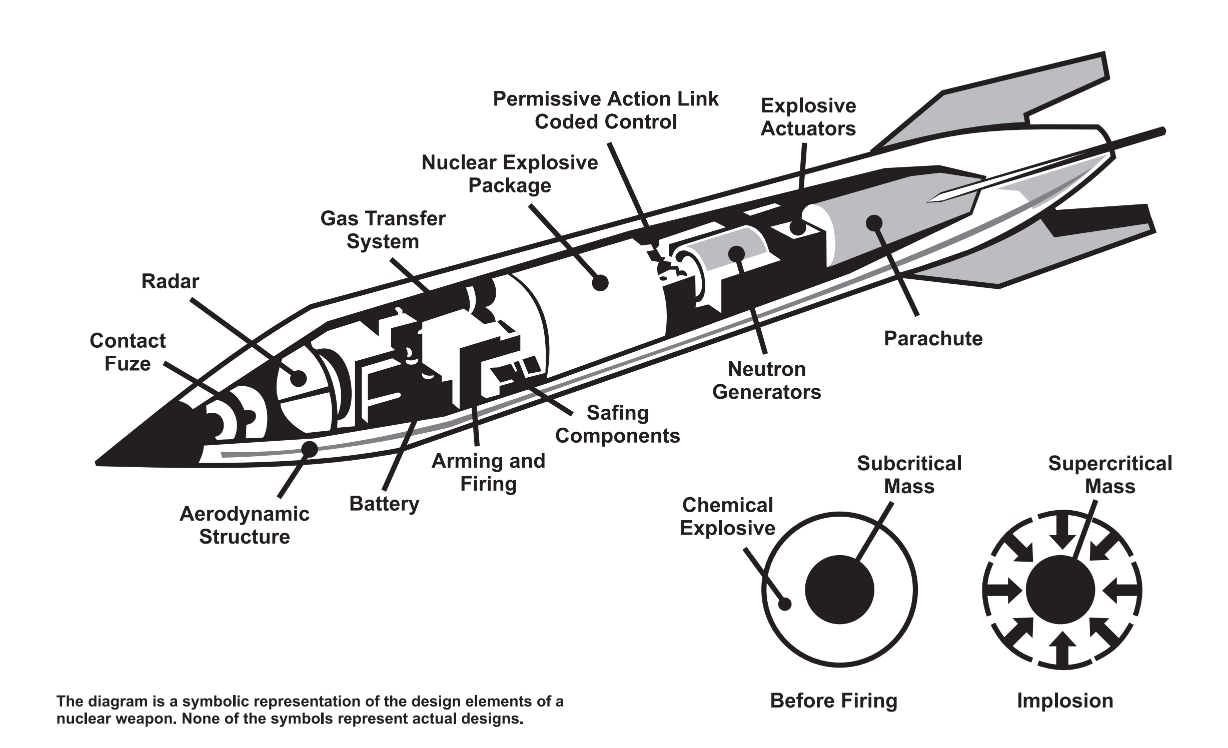

Figure 1–4 Diagram of a Modern Nuclear Weapon

The nuclear weapon primary is composed of a central core called a pit, which is usually made of plutonium-239 and/or highly enriched uranium. This is surrounded by a layer of high explosive which, when detonated, compresses the pit and initiates a nuclear reaction. This reaction is generally thought of as the nuclear fission "trigger" that activates the secondary assembly component to produce a thermonuclear hydrogen fusion reaction. The remaining nonnuclear components consist of everything from arming and firing systems to batteries and parachutes. The assembly of these components into a weapon or the dismantlement of an existing weapon is done at the weapons assembly/disassembly facility.

Tritium is not a fissile material and cannot be used by itself to construct a nuclear weapon. However, tritium is a key component of all nuclear weapons presently in the nation's nuclear weapons arsenal. Tritium enables weapons to produce a larger fission yield while reducing the overall size and weight of the warhead. This process is called "boosting." Boosting is accomplished by injecting a mixture of tritium gas and deuterium gas, a naturally occurring, nonradioactive hydrogen isotope, into the pit. The deuterium and tritium are stored in reservoirs (depicted as the "gas transfer system" in Figure 1–4) until the gas transfer system is initiated. The implosion of the pit along with the onset of the fissioning process heats the deuterium-tritium mixture to the point that the atoms undergo fusion. The fusion reaction releases large quantities of very high energy neutrons that flow through the compressed pit material and produce additional fission reactions. Such boosting has allowed the development of today's sophisticated delivery systems.

In the absence of new weapons designs and the total redesign of all warheads and delivery systems, the nation requires a reliable source of tritium to maintain a nuclear deterrent. Furthermore, total redesign of all warheads would require nuclear testing, which would be contrary to the President's pursuit of a Comprehensive Test Ban Treaty.

1.3.3 Brief History of the Production of Tritium

Tritium is so rare in nature that useful quantities must be manufactured. DOE has constructed and operated over a dozen nuclear reactors for the production of nuclear materials at the Savannah River Site, South Carolina, and the Hanford Site, Washington, starting with the early part of the Manhattan Project during World War II. None of these reactors is currently operational. The last one, the K-Reactor at the Savannah River Site, was shut down in 1988 for major environmental, safety, and health upgrades to comply with today's stringent standards. DOE discontinued the K-Reactor Restart Program in 1993 when smaller stockpile requirements delayed the need for tritium. As explained in the Final Programmatic EIS, the K-Reactor is not a reasonable alternative for tritium production.

In recent years, international arms control agreements have caused the nuclear weapons stockpile to be reduced in size. Reducing the stockpile has allowed DOE to recycle the tritium removed from dismantled weapons for use in supporting the remaining stockpile. However, due to the decay of tritium, the current inventory of tritium will not meet national security requirements past approximately 2005. Therefore, the most recent Presidential direction, contained in the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive, mandates that new tritium be available by approximately 2005 if a CLWR is the selected option for tritium production. If the accelerator is the selected option for tritium production, the Presidential directive mandates that new tritium must be available by 2007. Tritium needs during the period 2005-2007 would be met by using the five-year tritium reserve or by a contingency tritium supply source.

1.3.4 Production of Tritium in a CLWR

The production of tritium in a CLWR is technically straightforward and requires no elaborate, complex engineering development and testing program. All the nation's supply of tritium, as mentioned previously, has been produced in reactors. Most existing commercial pressurized water reactors utilize 12-foot-long rods containing an isotope of boron (boron-10) in ceramic form. These rods are sometimes called burnable absorber rods. The rods are inserted in the reactor fuel assemblies to absorb excess neutrons produced by the uranium fuel in the fission process for the purpose of controlling power in the core at the beginning of an operating cycle. DOE's tritium program has developed another type of burnable absorber rod in which neutrons are absorbed by a lithium aluminate ceramic rather than boron ceramic. These TPBARs would be placed in the same locations in the reactor core as the standard burnable absorber rods. There is no fissile material (uranium or plutonium) in the TPBARs.

While the two types of rods function in a very similar manner to absorb excess neutrons in the reactor core, there is one notable difference: when neutrons strike the lithium aluminate ceramic material in a TPBAR, tritium is produced. This tritium is captured almost instantaneously in a solid zirconium material in the rod, called a "getter." The solid material that captures the tritium as it is produced in the rod is so effective that the rod will have to be heated in a vacuum at much higher temperatures than normally occur in the operation of a light water reactor to extract the tritium for eventual use in the nuclear weapons stockpile. Depending upon tritium needs, as many as 3,400 TPBARs could be placed in a CLWR for irradiation.

1.3.5 Nonproliferation

Nuclear proliferation refers to the spread of nuclear weapons to nonnuclear weapons states. In an effort to limit nuclear proliferation, the United States, along with other signatories to the Nuclear Nonproliferation Treaty, has sought to preclude nonnuclear weapons states from acquiring fissile materials (highly enriched uranium or plutonium) for weapons or explosive use. Under the terms of the Nuclear Nonproliferation Treaty, the United States is a weapons state and, as such, is allowed to conduct nuclear weapons activities. The production of tritium is one such activity. Accordingly, the use of a CLWR for the production of tritium is not inconsistent with the terms of the Nuclear Nonproliferation Treaty.

Along with other weapons-state signatories to the Nuclear Nonproliferation Treaty, the United States, under Article VI, undertakes to pursue negotiations on nuclear disarmament. Production of tritium in a CLWR in no way conflicts with these commitments. Since the end of the Cold War, the United States has significantly reduced the size of its nuclear weapons stockpile. At the present time, the United States is further downsizing the nuclear weapons stockpile consistent with the terms of the Strategic Arms Reduction Treaty (START) I. The United States has ratified the START II Treaty and is hopeful Russia also will ratify this treaty soon. Additionally, the United States has ceased production of fissile materials and the manufacture of new-design nuclear weapons and has closed several weapons production facilities.

Negotiations required for further reductions in United States nuclear weapons and, ultimately, total nuclear disarmament, likely will stretch well into the next century. United States production of tritium in a CLWR will support the U.S. nuclear weapons stockpile during this process. Such support of a decreased nuclear weapons stockpile is not inconsistent with the long-range goal of total nuclear disarmament.

The International Atomic Energy Agency (IAEA) is charged with detecting and deterring the spread of nuclear weapons. The United States has offered its commercial power plants for inspection by the IAEA as an act of good faith and to encourage other nations to be equally open about their nuclear programs. Commercial reactor tritium production would not change this commitment. The commercial reactors would remain open for IAEA inspection whether they are producing tritium or not. Furthermore, the IAEA has indicated that CLWR production of tritium would not alter the existing IAEA Safeguards Program.

In accordance with the direction provided in the Fiscal Year 1998 National Defense Authorization Act (P.L. 105-85) conference report, DOE facilitated a high-level interagency review of the policy issues associated with the use of commercial reactors to make tritium for national security purposes. The participants in the interagency review included the NRC, the U.S. Department of Defense, and the U.S. Department of State Arms Control offices. This process was completed in July 1998 and is documented in the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress* (DOE 1998d). The report concluded that the nonproliferation policy issues associated with the use of a CLWR are manageable and that DOE should continue to pursue the reactor option as a viable source for future tritium production. This conclusion was based upon a number of considerations including the following:

1. The use of CLWRs for tritium production is not prohibited by law or international treaty.

2. Historically, there have been numerous exceptions to the practice of differentiating between U.S. civil and military facilities, including the operation of the N-Reactor at Hanford, Washington; the dual-use nature of the U.S. enrichment program; the use of defense program plutonium production reactors to produce radioisotopes for civilian purposes; and the sale of tritium produced in the defense reactors in the U.S. commercial market.

3. Although the CLWR alternative raised initial concerns because of its implications for the policy of maintaining separation between U.S. civil and military nuclear activities, these concerns could be adequately addressed, given the particular circumstances involved. These circumstances include the fact that the reactors would remain eligible for IAEA safeguards and the fact that, if TVA were the utility selected for the tritium mission, the reactors used for tritium production would be owned and operated by the U.S. Government, making them roughly comparable to past instances of government-owned dual-purpose nuclear facilities.

In addition to those examples referred to in the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress* (DOE 1998d), there are other instances in which military nuclear programs have been commingled with civilian programs. These instances include: (1) Atomic Energy Commission purchase of plutonium separated from commercial reactor spent fuel for unrestricted use, including defense purposes; (2) fabrication of both military and commercial reactor fuel by commercial reactor fuel fabricators; and (3) TVA generation of electricity for use in the production of fissile military materials.

1.3.6 Background on the Tennessee Valley Authority

TVA was established by an Act of Congress in 1933 (U.S.C. 831-831dd) as a Federal corporation to improve the navigability of and provide flood control for the Tennessee River; to provide reforestation and ensure the proper use of marginal lands in the Tennessee Valley; to provide agricultural and industrial development of the Tennessee Valley; to provide for the national defense; and for other purposes. Within a few years of its establishment, TVA built a series of multipurpose dams on the Tennessee River system. One of the purposes of these dams was production of abundant, inexpensive electricity. The hydroelectric power generated by these dams met most of the rapidly increasing needs of the region through the 1940s. By the early 1950s, however, the growing demand was quickly outstripping the capacity of the dams and the Watts Bar Fossil Fuel Plant, which began operation in 1942. During the next 20 years, TVA built 11 large, coal-fired, electricity-generating plants to meet the region's growing needs. Some of these plants were the largest, first-of-their-kind coal-fired units in the world. The 1960s brought even greater growth to the region. To meet the anticipated need for more power, TVA began an ambitious program of nuclear plant construction.

Today TVA is one of the largest producers of electricity in the United States, generating 4 to 5 percent of all electricity in the nation. TVA's power system serves almost 8 million people in a seven-state region encompassing some 207,200 square kilometers (80,000 square miles). TVA's electricity is distributed to homes and businesses through a network of 159 power distributors, including municipally owned utilities and electric cooperatives. TVA also sells power directly to approximately 60 large industrial customers and Federal facilities.

TVA's power system, which is self-financed, has a generating capacity of 28,000 megawatts-electric. Its generating system consists of 11 coal-fired plants (53 percent of total generating capacity), 5 nuclear generating units at three sites (20 percent), 29 hydroelectric dams (15 percent), 48 combustion turbine units at four sites (7 percent), and one pumped-storage facility (5 percent). These plants are owned and operated by the U.S. Government. The TVA power system is linked by 25,750 kilometers (16,000 miles) of transmission lines that carry power to 750 wholesale delivery points, as well as 57 interconnections with 13 neighboring utilities.

In December 1995, with the publication of *Energy Vision 2020, Integrated Resource Plan/Environmental Impact Statement* (TVA 1995d), TVA projected demands for electricity in the TVA power service area through the year 2020 and evaluated different ways of meeting these projected increases. Since the Integrated Resource Plan was completed in 1995, TVA has continued to evaluate and select the best resource options based on the latest proposals and TVA's forecast of power needs. The total system generating capacity has been increased with the successful completion of Watts Bar 1 and the return to service of Browns Ferry Nuclear Plant Unit 3 in Athens, Alabama. Both units have operated above expectations and have proven to be very reliable.

Current projections show the demand for electricity (including reserves) will exceed TVA's 1998 generating capacity by about 5,200 megawatts-electric in 2005; this projection is slightly less than the 1998-2005 medium load forecast of 5,450 megawatts-electric in *Energy Vision 2020, Integrated Resource Plan/Environmental Impact Statement* (TVA 1995d). About 2,800 megawatts-electric of additional generating capacity will be needed by the year 2001. A portion of this could be met by the proposed Red Hills Power Project. The remainder will be met by option purchase agreements, forward contracts for delivery of electricity to TVA, and internal TVA projects to increase net dependable capacities for TVA's combustion turbines, fossil plants, and pumped-storage units. An additional 2,400 megawatts-electric of capacity will be required between 2001 and 2005. The completion of the Bellefonte unit(s) would offset some of this planned capacity.

Producing tritium in a TVA reactor would be consistent with the Congressional purposes that established TVA—namely, to provide for the industrial development of the Tennessee Valley and for national defense. Producing tritium in a TVA reactor would also enable TVA to maximize the utilization of its resources and potentially increase its electricity-generating capacity. TVA, as a Federal agency, in order to fulfill NEPA responsibilities, chose to be a cooperating agency on this EIS. A cooperating agency is defined by Council on Environmental Quality regulations as any Federal agency other than a lead agency having jurisdiction by law or special expertise with respect to any environmental issue involved in a proposal (40 CFR 1508.5).

1.4 NEPA Strategy

DOE's strategy for compliance with NEPA has been to make decisions on programmatic alternatives in the Final Programmatic EIS (DOE 1995b) and the subsequent Record of Decision (60 FR 63878), followed by site-specific analyses to implement the programmatic decisions. The decisions made in the December 12, 1995, Final Programmatic EIS Record of Decision have resulted in DOE preparing this EIS and the following NEPA documents:

1. *Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE 1998c, DOE 1999b)

2. *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (DOE 1997e, DOE 1999a)

3. *Environmental Assessment, Lead Test Assembly Irradiation and Analysis, Watts Bar Nuclear Plant, Tennessee, and Hanford Site, Richland, Washington* (DOE 1997c)

The relationship of the CLWR EIS with these, as well as other relevant NEPA documents, is explained in Section 1.5.

1.5 Other Relevant NEPA Reviews

This section explains the relationship between the CLWR EIS and other relevant NEPA documents. Completed NEPA actions are addressed in Section 1.5.1; ongoing actions are discussed in Section 1.5.2.

1.5.1 Completed NEPA Actions

1.5.1.1 Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling

The Final Programmatic EIS DOE/EIS-0161, (DOE 1995b) evaluated the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at each of five DOE candidate sites (the Idaho National Engineering and Environmental Laboratory; the Nevada Test Site; the Oak Ridge Reservation, Tennessee; the Pantex Plant, Texas; and the Savannah River Site, South Carolina) for four different production technologies (heavy water reactor, modular high temperature gas-cooled reactor, advanced light water reactor, and accelerator production of tritium). This Final Programmatic EIS also evaluated the impacts of using a CLWR, but did not analyze specific locations or reactor sites. Issued in October 1995, the Final Programmatic EIS was followed by a Record of Decision on December 12, 1995 (60 FR 63878). In the Record of Decision, DOE decided to pursue a dual-track approach on the two most promising tritium supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or reactor irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator system for tritium production (the Savannah River Site was selected as the location for a tritium production accelerator, should one be built) (60 FR 63878). The Record of Decision also called for the construction of a proposed new Tritium Extraction Facility at the Savannah River Site. The CLWR EIS is intended to provide the NEPA analysis necessary to implement the 1995 Final Programmatic EIS Record of Decision, which will select the technology and specific site for a tritium production facility.

On December 22, 1998, Secretary of Energy Bill Richardson announced that tritium production in one or more CLWRs would be the United States' primary tritium supply technology and that the accelerator would be developed, but not constructed, as a backup to CLWR tritium production (DOE 1998f). Secretary Richardson further stated that the Watts Bar and Sequoyah reactors have been designated as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

1.5.1.2 Lead Test Assembly Environmental Assessment

This NEPA analysis addressed the environmental impacts associated with the fabrication of the TPBARs at Pacific Northwest National Laboratory, Washington; the irradiation of these TPBARs in Watts Bar 1; post-irradiation examination of the TPBARs at Pacific Northwest National Laboratory, Washington, and Argonne National Laboratory-West, Idaho; and impacts of transporting TPBARs to and from Watts Bar 1 (DOE 1997c). In the past, the United States produced all necessary tritium in government-owned nuclear reactors. The purpose of the Lead Test Assembly demonstration is to confirm and provide confidence to regulators and the public that tritium production in a CLWR is technically straightforward and safe. DOE issued a Finding of No Significant Impact in July 1997 (DOE 1997d). Subsequently, the TPBARs were placed in Watts Bar 1 on September 25, 1997, and they are presently being irradiated during the normal 18-month fuel cycle. Following irradiation, the TPBARs will undergo post-irradiation examination. To meet its own NEPA requirements, TVA adopted the Lead Test Assembly Environmental Assessment and issued a Finding of No Significant Impact on August 19, 1997 (TVA 1998a). Additionally, NRC prepared an independent environmental assessment and issued its own Finding of No Significant Impact on September 11, 1997 (62 FR 47835).

1.5.1.3 EISs for the Operation of Watts Bar 1 and Sequoyah 1 and 2 and for Construction of Bellefonte 1 and 2

EISs analyzing the environmental impacts associated with operation of the Watts Bar and Sequoyah Nuclear Plants and the construction of the Bellefonte Nuclear Plant (AEC 1974, NRC 1978, TVA 1971, TVA 1972, TVA 1974a, TVA 1974b, TVA 1978, TVA 1993, TVA 1994b, TVA 1995a,) have been completed and serve to a great extent as a baseline on which the environmental impacts associated with tritium production are assessed. For the partially completed Bellefonte 1 and 2, the CLWR EIS also evaluates the environmental impacts associated with the completion and subsequent operation of these units for 40 years.

1.5.2 Ongoing NEPA Actions

1.5.2.1 Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site

This EIS analyzes the potential environmental impacts associated with the construction and operation of an accelerator for the production of tritium at the Savannah River Site. On a programmatic level, the accelerator for the production of tritium at the Savannah River Site represents the No Action Alternative for the CLWR EIS. A summary of the APT EIS, DOE/EIS-0270 (DOE 1997e, DOE 1999a), is presented in Section 5.2.11, Volume 1, of this CLWR EIS. The APT Draft EIS was issued in December 1997. The APT Final EIS for the accelerator was issued concurrently with the CLWR EIS. As a result of the announcement by Secretary of Energy Bill Richardson on December 22, 1998 (DOE 1998f), that the accelerator would be a backup to CLWR tritium production, DOE will continue with developmental activities associated with the accelerator. However, the accelerator will not be constructed. The APT EIS is incorporated in the CLWR EIS by reference.

1.5.2.2 Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site

This EIS analyzes the potential environmental impacts associated with the construction and operation of a Tritium Extraction Facility at the Savannah River Site. The Draft EIS for the Tritium Extraction Facility was issued in May 1998; a Final EIS was issued concurrently with the CLWR EIS. The purpose of the Tritium Extraction Facility would be to extract the tritium from the TPBARs or from targets of similar design. TPBARs irradiated at the selected CLWRs would be sent to the Tritium Extraction Facility for extraction of the tritium-containing gases. A summary of the environmental impacts of the *Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271 (DOE 1998c, DOE 1999b), is presented in Section 5.3.4, Volume 1, of this CLWR EIS. The Tritium Extraction Facility EIS is incorporated in the CLWR EIS by reference.

1.5.2.3 Environmental Assessment for the Tritium Facility Modernization and Consolidation Project at the Savannah River Site

This environmental assessment (DOE 1998a) addresses the potential impacts of consolidating the tritium activities currently performed in Building 232-H into the newer Building 234-H. Tritium extraction functions would be transferred to the Tritium Extraction Facility under the Preferred Alternative. The overall impact would be to reduce emissions by up to 50 percent. Another effect would be to reduce the amount of low-level radioactive waste generated. Effects on other resources would be negligible. Therefore, impacts from these actions were not included in the cumulative impacts of the CLWR EIS.

1.5.2.4 Final Environmental Impact Statement for the Bellefonte Conversion Project

This EIS, issued by TVA, addresses the environmental impacts anticipated from: (1) the conversion of partially completed Bellefonte 1 and 2 to fossil fuel electricity-generating facilities, and (2) the No Action Alternative of maintaining the facilities as partially completed nuclear facilities. The EIS was completed in October 1997. The issuance of a Record of Decision on the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997f) will not be made until it is determined whether one or both of these reactor plants will be used for tritium production. The No Action Alternative of the CLWR EIS involves the continued deferral of Bellefonte 1 or both Bellefonte 1 and 2 while TVA explores arrangements with outside entities to complete the units as nuclear facilities. If these reactor plants will not be utilized in the CLWR program, one of the five alternatives addressed in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* could be selected in the Record of Decision for that EIS. If the CLWR EIS Record of Decision indicates that Bellefonte 1 or both Bellefonte 1 and 2 will be used for tritium production, then the construction of the reactor(s) would be completed and the reactor(s) would be operated for both tritium production and electricity production.

1.6 Organization of this EIS

This CLWR Final EIS comprises two volumes. Volume 1 contains the main text; Volume 2 contains the comments received on the Draft EIS during the public review period and the DOE responses. Volume 1 contains 11 chapters and 8 appendices. The main analyses are included in the chapters, and additional project information is provided in the appendices. A summary also is available.

The 11 chapters in Volume 1 provide the following information:

Chapter 1—Introduction: CLWR EIS background and the NEPA process

Chapter 2—Purpose and Need: Reasons why the action is needed and the proposed objectives of the action

Chapter 3—CLWR Program Alternatives: Proposed ways to meet the specified need and achieve the objectives; basic assumptions; the development of the reasonable alternatives; and descriptions of the No Action and Preferred Alternatives [The chapter also includes a summary of the potential environmental impacts of the reactor alternatives, as well as a comparison of the environmental impacts between the CLWR alternatives and the accelerator option.]

Chapter 4—Affected Environment: Aspects of the environment that could be affected by the EIS alternatives

Chapter 5—Environmental Consequences: Analyses of the potential impacts of the EIS alternatives on the environment

Chapter 6—Regulatory Requirements: Environmental, safety, and health regulations that would apply for this EIS's alternatives and the agencies consulted for their expertise [The chapter also contains the regulatory history of TVA's reactors.]

Chapters 7-11—References; a list of preparers; a list of agencies, organizations, and persons to whom copies of this EIS are being sent; a glossary; and an index

The eight appendices of technical information contain the following information: CLWR tritium production operations, methods for assessing environmental impacts, normal operational impacts on human health, facility accident impacts on human health, evaluation of human health effects of overland transportation, the public scoping process, environmental justice, and contractor disclosure.

1.7 PUBLIC SCOPING PROCESS

Scoping is a process by which the public and stakeholders provide comments directly to the Federal agency on the scope of the EIS. This process is initiated by the publication of the Notice of Intent in the *Federal Register*.

On January 21, 1998, DOE published in the *Federal Register* a notice of intent to prepare the CLWR EIS (63 FR 3097). In this notice of intent, DOE invited public comment on the CLWR EIS proposal. Subsequent to this notice, DOE held public scoping meetings in Rainsville, Alabama, on February 24, 1998, and in Evensville, Tennessee, on February 26, 1998. The 700 comments received both orally and in writing at these meetings or via letters, fax, the Internet, or the 1–800 phone line during the public comment period were reviewed by DOE for consideration in preparing this EIS. A summary of the comments received during the public scoping process, as well as DOE's consideration of these comments, is provided as Appendix F of this EIS.

Of the approximately 700 comments received from citizens, interested groups, and Federal, state, and local officials during the public scoping period, 156 were verbal comments made during the public meetings. The remainder of the comments (513) were submitted at the public meetings in written form or via mail, Internet, fax, or phone over the entire scoping period. Commentors who spoke at the public meetings often read from written statements that were later submitted during or after the meetings. Where this occurred, each comment provided by an individual commentor in both verbal and written form was counted as a single comment. In addition to the comments, four petitions totaling 1,586 signatures were submitted in support of completing the Bellefonte plant for tritium production purposes.

The majority of the verbal and written comments received during the public scoping period favored producing tritium at one or more of TVA's nuclear power plants. Comments from residents of northern Alabama were particularly supportive of completing the Bellefonte plant for tritium production. Reasons given for this support mostly involved potential socioeconomic benefits such as job creation, a greater abundance of inexpensive electricity, attraction of new businesses to the area, and increased local revenues.

Many of the comments received from residents of the local areas near the TVA plants also communicated an understanding that the United States will begin producing tritium in the near future–either at the Savannah River Site (the accelerator option) or at one of TVA's nuclear power plants. These commentors expressed confidence in the safety of the TVA plants and the capabilities of area workers to provide the skills needed for tritium production. They also said they believe nuclear power plants are a more sensible choice for tritium production because reactors are a proven technology and the total project cost would be less than the cost of building an accelerator.

A significant number of other comments received during the scoping period opposed tritium production in general and the use of a nuclear power plant for this purpose in particular. This group disagreed with the Presidential and Congressional decision to produce tritium and denied there is any real defense-related need for new tritium production because they believe other options are available. Among the options cited were unilateral disarmament, commercial purchases, recycling the material from deactivated nuclear weapons, and/or extending the half-life of tritium.

Several commentors voiced concerns about the environmental, health, and safety risks they believe are inherent to tritium production. DOE representatives were urged to thoroughly evaluate the potential consequences of the proposed action on local water resources and the health and safety of area residents and wildlife. Concerns also were raised about the safety of TVA's nuclear power plants and how the security of the plants would be managed if tritium production were to begin.

Waste production and disposal were other issues. Some commentors correctly stated that tritium production in a nuclear reactor would increase the amount of spent fuel wastes generated. Questions were posed as to how this additional waste would be dealt with, both on site and in the long term.

Many commentors also viewed the U.S. Government's decision to produce tritium as a violation of its own policies and commitments under the International Nonproliferation and Strategic Arms Limitation Treaties. They accused the U.S. Government of hypocrisy and asserted that tritium production in a commercial light water reactor would blur the historical line between U.S. civilian and military nuclear programs. This action, they warned, would encourage other countries to use their own commercial plants to produce weapons materials and to increase their weapons stockpiles.

The public comments and materials submitted during the scoping period were carefully logged as they were received and placed in the Administrative Record of this EIS. Their disposition is described in Appendix F of this EIS.

1.8 PUBLIC COMMENT PERIOD

In August 1998, DOE issued the CLWR Draft EIS (DOE/EIS-0288D). This document explained the need for a domestic tritium production source to maintain the U.S. nuclear deterrent and described and analyzed the environmental impacts associated with tritium production at one or more nuclear power plants operated by

TVA. The 60-day public comment period on the CLWR Draft EIS began on August 28, 1998, and ended on October 27, 1998.

During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. The public was encouraged to submit comments via the U.S. mail service, e-mail to a special DOE web site on the Internet, a toll-free 800-number phone line, and a toll-free fax line.

The public hearings were conducted using a modified traditional public hearing format that allowed two-way interaction between DOE representatives and members of the public and also encouraged public comments on the document. A neutral facilitator was present at each hearing to direct and clarify discussions and comments. A court reporter was present at each hearing to record the proceedings and provide a transcript of the public comments and the dialogue between the public and the DOE and TVA representatives.

Comments from the public hearings were combined with comments received by other means (mail, e-mail, 800 number, fax, etc.) during the comment period. The written comments were date-stamped and assigned a sequential document number in the order in which they were received. Volume 2 of this CLWR EIS, the Comment Response Document, describes the public comment process in detail (Chapter 1); provides scanned images of all the comment documents received (Chapter 2); summarizes the public hearing comments (Chapter 2); and provides DOE's responses to the public comment summaries (Chapter 3).

Prior to fulfilling the requirement to reach a technology decision by the end of 1998, Energy Secretary Richardson asked TVA to submit final proposals for its Watts Bar and Sequoyah reactors, as well as for completion of its Bellefonte reactor. These proposals were provided to DOE the first week of December 1998, after the October 27, 1998, closing of the public comment period for the CLWR Draft EIS. After receiving these offers, Secretary Richardson directed that this information be presented to the public so they could review the latest TVA offers and provide their comments prior to his reaching the technology decision. To enable this, in spite of the short notice, a public meeting was scheduled and conducted on December 14, 1998. At this meeting, DOE presented information on the new proposals; answered questions; and accepted comments on the proposals, as well as on CLWR tritium production in general. The public was encouraged to comment on the new TVA proposals via U.S. mail, fax, toll-free 800-number phone line, or e-mail. Although the comments received as a result of this December 14, 1998, meeting were submitted after the public comment period, DOE responded to all of these comments as though they were received during the public comment period and they are included in Volume 2, the Comment Response Document.

During the public comment period, approximately 800 comments were received. An additional 230 comments were in conjunction with the December 14, 1998, public meeting. Most of the comments focused on a limited number of major issues. These issues and DOE's responses are summarized below.

By far, a majority of comments supported the completion and operation of the Bellefonte Nuclear Plant for tritium production because it would promote economic development in a depressed area and provide other, similar benefits. Other commentors generally opposed the completion of the Bellefonte plant as a nuclear power plant, particularly for tritium production. In response to these comments, DOE acknowledged there is both public support and opposition for the Bellefonte alternative. The CLWR EIS addresses all of the benefits cited by the commentors who favored the Bellefonte alternative, as well as the concerns expressed by opponents. DOE's response to these and other related comments may be found in Volume 2, Chapter 3 of this EIS, under Category 7: General Support/Opposition.

The cost-effectiveness of the CLWR and APT tritium production alternatives was another frequent theme among many commentors. Most asked for cost-related information and/or expressed the opinion that cost should be the major determining factor in a tritium production decision. In addition, some commentors questioned the accuracy of the cost information that DOE provided at the public hearings and the December

14, 1998, public meeting, and many believed there was little possibility that TVA could complete the Bellefonte plant for the cost estimates cited. Other commentors stated they felt the large expenditures required for CLWR tritium production would be better spent on other, more urgent social needs such as education and environmental restoration. Some commentors were concerned about possible costs to TVA ratepayers resulting from tritium production.

In response to the cost-related comments, DOE stated that the CLWR EIS was prepared in accordance with NEPA, the Council on Environmental Quality's regulations on implementing NEPA (40 CFR Parts 1500-1508), and DOE's NEPA regulations (10 CFR 1021). None of these regulations require the inclusion of a cost analysis in an EIS. As discussed in Volume 1, Chapter 3, Section 3.2.1, the basic objective of the CLWR EIS is to provide the public and DOE decision-makers with a description of the reasonable alternatives for CLWR tritium production and information about their potential impacts on public health and safety and the environment. While costs could be an important factor in the ultimate Record of Decision, the purpose of this and other EISs is to address the environmental consequences of the proposed action. DOE distributed cost information comparing the CLWR and APT alternatives (DOE 1998e) at the public hearings in October 1998, however, and this information is available upon request. In response to comments concerning the accuracy of TVA's cost estimates for completing the Bellefonte plant, DOE considers TVA's cost estimates to be both accurate and conservative, given that the plant is nearly complete and TVA's cost estimates were evaluated by an external reviewer. In response to comments that CLWR funds would be better spent on other, more urgent social needs, DOE noted that Congress determines how funds are allocated, and DOE does not determine Federal spending priorities. Furthermore, such spending priorities are beyond the scope of this EIS. In response to the concerns of TVA ratepayers about potential costs resulting from tritium production, DOE responded that no additional costs to ratepayers are expected. DOE's responses to the cost-related public comments are found in Volume 2, Chapter 3 of this EIS, under Category 23: Cost Issues.

Many commentors questioned the need for nuclear weapons and/or the present need for tritium. Other commentors expressed a belief that the amount of tritium needed to support current and future nuclear weapons stockpiles is less than the amount stated in the CLWR EIS. In response, DOE cited its responsibilities for maintaining the nation's nuclear weapons stockpile under the Atomic Energy Act of 1954 and the requirements of the 1996 Nuclear Weapons Stockpile Plan and accompanying Presidential Decision Directive, which established the size and composition of the nation's nuclear weapons stockpile and the need for a new tritium production source by approximately 2005. DOE stated that sufficient quantities of tritium no longer can be obtained from weapons being retired from the existing stockpile, as cited in the most recent Presidential Decision Directive. DOE's responses to comments concerning the need for tritium are found in Volume 2, Chapter 3 of this EIS, under Category 2: Purpose and Need for Tritium.

Several commentors expressed concern that tritium production in a commercial reactor would violate U.S. policy regarding the separation of commercial and military uses of nuclear energy, would hinder nonproliferation efforts, and would encourage other nations to use their own commercial facilities for nuclear weapons purposes. In response to these concerns, DOE cited the conclusions of a high-level study entitled, *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress* (DOE 1998d). This interagency review concluded that any nonproliferation issues associated with the production of tritium in a CLWR were manageable and that DOE should continue to pursue the CLWR option, as stated in Volume 1, Chapter 1, Section 1.3.5, of the CLWR EIS. DOE also stated that there is no U.S. policy, law, or treaty that prohibits the production of tritium that ultimately will be used in weapons in a commercial reactor. In addition, DOE stated that the United States is a declared weapons state, and the purpose of nonproliferation efforts is to keep nonweapons states from acquiring nuclear weapons while the declared weapons states work toward total disarmament. DOE noted that other nations already operate dual-purpose reactors that serve both civilian and military needs. DOE's responses to comments on nonproliferation, the separation of civilian and military nuclear facilities, and other policy issues are found in Volume 2, Chapter 3 of this EIS, under Category 1, Policy Issues.

Many commentors were concerned with public and occupational health and safety issues. Some specifically questioned TVA's past history and practices related to plant safety. In response to these concerns, DOE stated that the environmental impacts and potential radiological doses to both workers and the public resulting from tritium production would be well below the limits considered acceptable by Federal and state regulatory authorities. Public and occupational health and safety issues are discussed in Volume 1, Chapter 5, of the CLWR EIS. DOE also stated that prior to irradiation of any TPBARs, an NRC safety evaluation would be required to amend the operating license of the reactors for tritium production. This review specifically would look at all potential health and safety issues. DOE's responses to public and occupational health and safety comments are found in Volume 2, Chapter 3 of this EIS, under Category 14: Occupational and Public Health and Safety - Normal Conditions.

Several commentors stated that DOE has a history of polluting and contaminating every site they have operated and wanted to know why the proposed action would be any different. In response, DOE acknowledged having a number of older facilities in need of environmental cleanup, and an aggressive cleanup program is underway to upgrade these facilities and ensure their continued compliance with Federal and state regulations. All of the CLWR tritium production alternatives involve the use of state-of-the-art TVA reactors. These reactors have excellent environmental compliance records and exemplary environmental, health, and safety programs to ensure their continued compliance with Federal and state regulations. In addition, DOE expressed confidence that tritium production in a CLWR would be safe and is technically straightforward. To commentors who expressed concern that CLWR tritium production expenditures would drain DOE's budget for its facility cleanup activities, DOE responded that the funding for both of these programs would come from separate Congressional appropriations. Funding for CLWR tritium production would not be obtained from funding already allocated for facility cleanup activities. DOE's responses to comments about past DOE practices and conflicts between DOE's cleanup activities and tritium production are found in Volume 2, Chapter 3 of this EIS, under Category 8: Past DOE Practices.

Some commentors suggested that the CLWR EIS was deficient and inadequate as a NEPA document. In response, DOE stated that it believes that the EIS is adequate and fully complies with NEPA. The EIS evaluates all reasonably foreseeable environmental impacts for all reasonable alternatives, in accordance with the requirements of the Council on Environmental Quality's regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. DOE's responses to NEPA-related comments are found in Volume 2, Chapter 3 of this EIS, under Category 5: NEPA Process.

Other commentors stated that the relationship between the CLWR , APT, and Tritium Extraction Facility EISs was not clearly explained in the CLWR Draft EIS. In response, DOE added a Preface to the CLWR Final EIS to better describe the relationship between the CLWR EIS, the APT EIS, and the Tritium Extraction Facility EIS. This Preface also addresses Energy Secretary Richardson's December 22, 1998, announcement (DOE 1998f) that the CLWR would be the primary tritium supply technology. DOE's response to comments concerning the relationship between the CLWR , APT, and Tritium Extraction Facility EISs is found in Volume 2, Chapter 3 of this EIS, under Category 5: NEPA Process (Comment Summary 05.01).

Several commentors were concerned about the additional spent nuclear fuel that would be generated by tritium production. DOE responded that additional spent nuclear fuel would be generated if more than 2,000 TPBARs were irradiated in a single reactor, as stated in Section 3.2.1 of the CLWR Final EIS. DOE also stated that the CLWR EIS evaluates the environmental impacts of additional spent fuel generation resulting from a maximum number of 3,400 TPBARs. DOE stated that it would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel. In the event a suitable repository is not available, as required by law, the additional spent nuclear fuel generated as a result of tritium production would be stored on site in a dry cask independent spent fuel storage installation. DOE's responses to spent nuclear fuel comments are found in Volume 2, Chapter 3 of this EIS, under Category 17: Spent Fuel Management.

Several commentors suggested that the production of tritium in a CLWR would make TVA reactors an attractive target for terrorists and that DOE should address the consequences of such an attack in the EIS. In response, DOE stated that, prior to loading TPBARs in TVA's Watts Bar reactor as part of the Lead Test Assembly Program, a thorough security review was conducted. This review found existing security provisions to be adequate to protect against such a threat. Prior to utilizing Watts Bar or other TVA reactors for tritium production, additional DOE and NRC reviews would be required to ensure safeguard and security provisions are adequate. DOE's responses to these and other security-related comments are found in Volume 2, Chapter 3 of this EIS, under Category 22: Safeguards and Security.

1.9 CHANGES FROM THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

In response to comments on the CLWR Draft EIS and as a result of information that was unavailable at the time of the issuance of the Draft, Volume 1 of the CLWR Final EIS contains revisions and new information. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger additions. Volume 2, Comment Response Document, contains the comments received during public review of the CLWR Draft EIS and DOE's responses to those comments. A brief discussion of the most important changes is provided in the following paragraphs.

TPBAR Failures

In analyzing the potential releases of tritium to the environment from the proposed action, the CLWR Draft EIS assumed that two of the TPBARs under irradiation would fail and the entire inventory of tritium would be available to be released to the environment under normal operating conditions. The same two-TPBARs failure assumption was made in the analysis of transportation accidents. The assumption was based on the failure statistics of standard burnable absorber rods, i.e., two failures out of 29,700 rods through July 1980. Since the issuance of the CLWR Draft EIS, additional information obtained from Westinghouse (WEC 1998b) revealed that both failures were attributed to early manufacturing defects that have been corrected. The failures were attributed to slumping of the absorber material—a condition that cannot occur in the TPBARs. Since the two early failures, more than 500,000 Westinghouse burnable absorber rods have been used without a single observed failure. Consequently, the CLWR Final EIS still analyzes the impacts to the health and safety of the public from the potential failure of two TPBARs, but characterizes the event of such a failure as an abnormal event during an irradiation cycle, rather than a continuous, normal-operation occurrence. This change in assumptions results in changes in the potential tritium releases and estimated doses to the public under normal reactor operation and some accident conditions (i.e., the nonreactor design-basis accident) for all reactor alternatives.

The Secretary's Technology Announcement

The CLWR Draft EIS was issued in August 1998. At the time, the decision on the primary and backup technologies to be used for tritium production had not been made. On December 22, 1998, Energy Secretary Bill Richardson announced that the CLWR would be DOE's primary option for tritium production and the proposed linear accelerator at the Savannah River Site would be the backup option (DOE 1998f). In addition, the Secretary designated TVA's Watts Bar and Sequoyah Nuclear Plants as the preferred CLWR facilities. The CLWR Final EIS was revised to reflect the Secretary's announcement and include the Preferred Alternative. Changes were made primarily in the introductory sections of the CLWR Final EIS for accuracy. The evaluation of the impacts was not affected.

Clarification of TVA Proposals

In response to public comments about the status of the TVA proposals to provide irradiation services or the sale of a CLWR, Section 1.1.4 was revised. The discussion of the procurement process clarifies that DOE is considering only the purchase of irradiation services, not the purchase of a reactor. Additionally, the section clarifies that TVA submitted several proposals to DOE during the ongoing negotiations. An earlier TVA proposal for the use of Watts Bar expired. However, in December 1998, TVA submitted to DOE another offer to provide irradiation services at Watts Bar and Sequoyah, as well as additional proposals for Bellefonte. TVA's offer to provide irradiation services at one or more of the three proposed sites is still viable.

Nonproliferation Policy Issues

In response to public comments requesting DOE to provide examples of the commingling of civilian nuclear programs with military nuclear programs, Section 1.3.5 was revised. The discussion of nonproliferation now includes an explanation and some background information on the issue, as well as examples of the commingling of civilian and military uses of nuclear power.

Water Quality Analysis

In response to public comments expressing concern about impacts to public water withdrawals downstream of the Bellefonte Nuclear Plant, sections of Chapters 4 and 5 were revised. The discussion of surface water use for Bellefonte (Section 4.2.3.4) identifies nearby intakes downstream. The discussions of potential impacts to surface water near the three reactor sites (Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4) include the tritium concentration at various locations downstream. In addition, Section 5.2.3.4 was revised to include potential chemical concentrations downstream of Bellefonte.

Accident Analysis

During the preparation of the CLWR Final EIS, data related to the design and fabrication of the TPBARs indicated that the release of tritium from an accidental breach of a TPBAR more likely would be time-dependent than instantaneous and finite, as was assumed in the Draft EIS (PNNL 1999). Consequently, the analysis for the TPBAR handling accident and the transportation cask handling accident at the reactor site (Appendix D), and the transportation cask accident en route (Appendix E), were revised to reflect the more recent data.

Environmental Justice

Figures in Appendix G were revised to improve their quality. New figures were added to show the location of minority and low-income populations within a 16.1-kilometer (10-mile) radius. In addition, a representative average individual dose at 40.2 kilometers (25 miles) to each of the 16 principal directions has been overlaid onto the 80.5-kilometer (50-mile) radius to show the potential dose to minority and low-income populations.

Tritium Requirements and Supply

In response to public comments expressing concerns about the disparity between the amount of tritium needed and the amount that could be supplied by one CLWR, Section 3.2.1 was revised. The discussion explains that the exact amount of tritium needed is classified information, however, for the purposes of analysis, it is not expected to exceed 3 kilograms per year (6.6 pounds per year). It further clarifies that one reactor with 3,400 TPBARs would be expected to satisfy a steady state tritium requirement in most years.

Comparison of the APT and CLWR Alternatives

In response to public comments requesting additional information about the No Action Alternative, Section 3.2.6 was expanded to include a table comparing the impacts of producing tritium under the accelerator and CLWR options. A document comparing the costs of the technology options is available upon request from DOE (DOE 1998e).

Source of Uranium-235 for Tritium Production

In response to public comments concerning the source of blended-down uranium-235 that could be used as nuclear fuel for tritium production, Section 5.2.7 was revised for clarification. A discussion of the environmental impacts resulting from blending-down activities of highly enriched uranium was also added.

Mitigation Measures

The CLWR Draft EIS discusses the need for mitigation measures, if such a need were warranted, right after the presentation of the impacts for each environmental resource. A new Section 5.5 was added to the CLWR Final EIS to summarize these discussions.

Sensitivity Analysis

An additional variation from the baseline analysis has been included in Section 5.2.9 of the CLWR EIS, that is, the possibility of producing tritium at some date later than 2005.

Miscellaneous Revisions and Editorial Changes

Several sections in the CLWR Final EIS were revised to reflect the availability of more recent data, or to include corrections on erroneous information, improvements in the presentation, and other editorial changes. None of these revisions affect the environmental impact assessment of the EIS. The sections with these types of revisions are:

3.2.3	Reasonable Alternatives
4.2.1.1	Affected Environment, Land Resources, Watts Bar
4.2.1.3	Affected Environment, Air Quality, Watts Bar
4.2.1.8	Affected Environment, Socioeconomics, Watts Bar
4.2.2.1	Affected Environment, Land Resources, Sequoyah
4.2.2.3	Affected Environment, Air Quality, Sequoyah
4.2.2.4	Affected Environment, Water Resources, Sequoyah
4.2.2.6	Affected Environment, Ecological Resources, Sequoyah
4.2.2.8	Affected Environment, Socioeconomics, Sequoyah
4.2.3.3	Affected Environment, Air Quality, Bellefonte
4.2.3.4	Affected Environment, Water Resources, Bellefonte
4.2.3.6	Affected Environment, Ecological Resources, Bellefonte
5.2.1.8	Environmental Consequences, Socioeconomics, Watts Bar
5.2.3.6	Environmental Consequences, Ecological Resources, Bellefonte
5.2.3.8	Environmental Consequences, Socioeconomics, Bellefonte
5.2.3.9	Environmental Consequences, Public and Occupational Health and Safety, Chemical Hazards, Bellefonte
	Environmental Consequences, Public and Occupational Health and Safety, Energizing Transmission Lines, Bellefonte
5.2.7	Fabrication of TPBARs

5.3	Cumulative Impacts
6.2.2	Environmental Protection Permits
6.3.1	Environmental Protection, Endangered Species Act
	Environmental Protection, National Historic Preservation Act
6.3.3	Worker Safety and Health
6.4	DOE Regulations and Orders
6.5.2.1	NRC Performance, Civil Penalties–Watts Bar 1
6.5.3.1	NRC Performance, NRC Notices of Violation and Enforcement Action, Sequoyah
Chapter 7	References
A.3.2	Physical Description of the TPBAR
Appendix B	Methods for Assessing Environmental Impact
C.3.4	Radiological Releases to the Environment and Associated Impacts
D.1.1.10	Beyond Design-Basis Accidents
G.5	Environmental Justice Analysis, Results for the Sites

2. PURPOSE AND NEED

Chapter 2 discusses the U.S. Department of Energy's purpose and need to provide a tritium supply capability. The purpose of the Department's action is to produce, in one or more commercial light water reactors, the tritium required to maintain the nation's nuclear weapons stockpile.

Since nuclear weapons came into existence in 1945, a nuclear deterrent has been a cornerstone of the nation's defense policy and national security. Both President Clinton and the Congress have reiterated this principle in public statements and through legislation. The President has stated on a number of occasions his commitment to maintaining a nuclear deterrent capability. Most recently, in May 1997, the President stated in *A National Security Strategy for a New Century* (White House 1997) that, ". . . our nuclear deterrent posture is one of the most visible and important examples of how U.S. military capabilities can be used effectively to deter aggression and coercion. Nuclear weapons serve as a hedge against an uncertain future, a guarantee of our security commitments to allies, and a disincentive to those who would contemplate developing or otherwise acquiring their own nuclear weapons."

U.S. strategic nuclear systems are based on designs that use tritium gas. Since tritium decays at a rate of about 5.5 percent per year (i.e., every 12.3 years one half of the tritium has decayed), periodic replacement is required as long as the United States relies on a nuclear deterrent. The nation, therefore, requires a reliable source of tritium to maintain its nuclear weapons stockpile.

As explained in Section 1.3.1, the size of the nation's nuclear weapons stockpile is determined by the Secretaries of Defense and Energy who, in coordination with the Nuclear Weapons Council, jointly sign and submit to the President the Nuclear Weapons Stockpile Memorandum. This Memorandum transmits the Nuclear Weapons Stockpile Plan to the President for final approval. Many factors are considered in the development of the Nuclear Weapons Stockpile Plan, including the status of the currently approved stockpile, arms control negotiations and treaties, Congressional constraints, and the status of the nuclear material production and fabrication facilities. Under this plan, the Department of Energy (DOE) can determine the amount of tritium necessary to support the approved stockpile.

Tritium is a radioactive isotope of hydrogen and an essential component of every warhead in the current and projected U.S. nuclear weapons stockpile. These warheads depend on tritium so they can perform as designed. Tritium's relatively short radioactive half-life necessitates the periodic replenishment of tritium in nuclear weapons to ensure that they will function as designed. Over the past 40 years, DOE has built and operated over a dozen nuclear reactors (five of them at the Savannah River Site in South Carolina) to produce tritium and other nuclear materials for weapons purposes. Today, none of these reactors are operational, and DOE has not produced tritium for addition to the stockpile since 1988. According to the Atomic Energy Act of 1954, however, DOE is responsible for developing and maintaining the capability to produce the nuclear materials, such as tritium, that are necessary for the defense of the United States (40 U.S.C. 2011).

Until a new tritium supply source is operational, DOE will continue to support tritium requirements by recycling tritium from weapons retired from the nation's stockpile. However, because of the tritium decay rate, recycling can only meet the tritium demands for a limited time, even with the reduction in stockpile requirements and no identified need for new-design weapons in the foreseeable future. Current projections, derived from the most recently approved, classified projections of future stockpile scenarios, indicate that recycled tritium will support the nation's nuclear weapons stockpile adequately until approximately 2005 **(Figure 2–1)**.

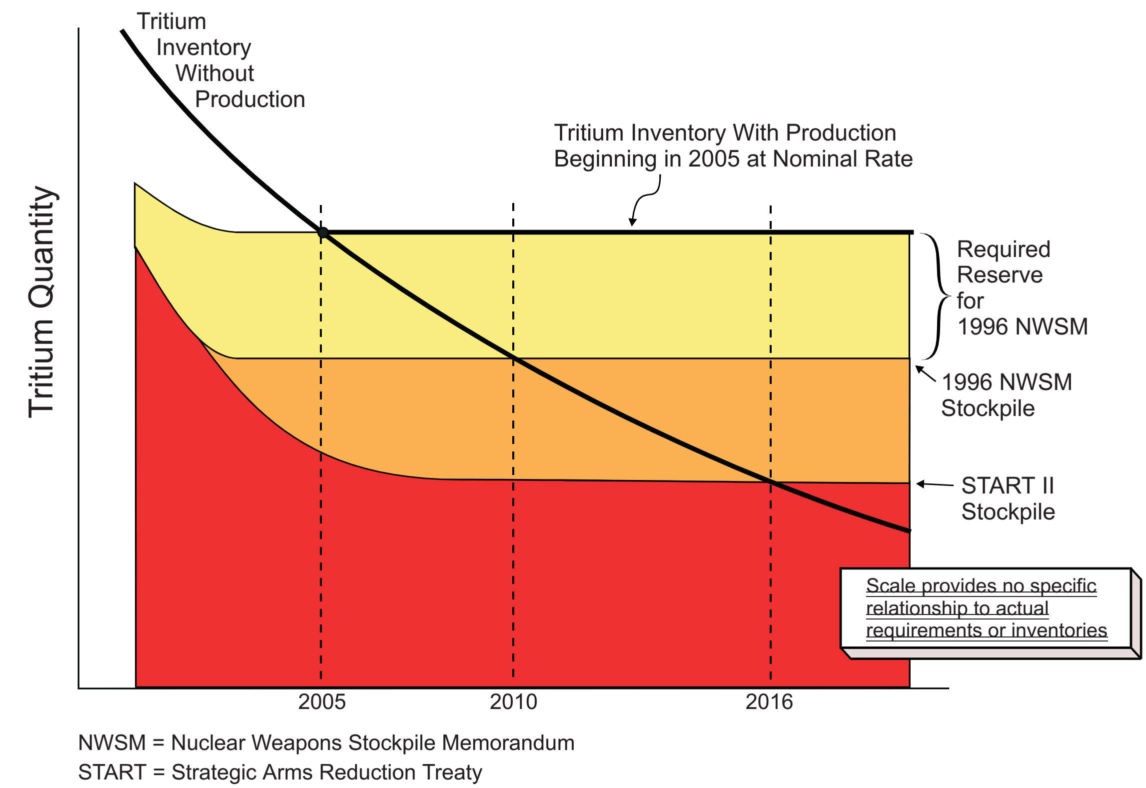

Figure 2–1 Estimated Tritium Inventory and Reserve Requirements

Even with a reduced nuclear weapons stockpile and no identified requirement for new nuclear weapons production in the foreseeable future, an ensured long-term tritium supply and recycling capability will be required to maintain the weapons determined to be needed for national defense under the prevailing Nuclear Weapons Stockpile Plan. Presently, no U.S. source of new tritium is available. The effectiveness of the U.S. nuclear deterrent capability depends not only on the nation's current stockpile of nuclear weapons or the effectiveness of those it can produce, but also on its ability to reliably and safely provide the tritium needed to maintain these weapons.

To meet requirements mandated by the President and supported by the Congress, the United States will need a new source of tritium production by approximately 2005. For planning purposes, the operational life of the new production source would be about 40 years. Without a new supply source, after 2005 the United States would have to use its five-year reserve of tritium to maintain the readiness of the nuclear weapons stockpile. The five-year reserve contains a quantity of tritium maintained for emergencies and contingencies. In such a scenario, the complete depletion of the five-year tritium reserve would degrade the nuclear deterrent capability because not all weapons in the stockpile would be able to function as designed. Eventually, the United States would lose its nuclear deterrent. The purpose of DOE's action is to produce, in one or more commercial light water reactors, the tritium needed to maintain the nation's nuclear weapons stockpile.

The Tennessee Valley Authority's (TVA) purpose and need relative to this environmental impact statement are to maximize the use of its resources while simultaneously providing support to national defense. National defense support has been one of TVA's historic multipurpose missions (see Section 1.3.6).

3. COMMERCIAL LIGHT WATER REACTOR PROGRAM ALTERNATIVES

Chapter 3 describes the physical process used to produce tritium in a commercial light water reactor, the proposed action, the planning assumptions and basis for the environmental impact analysis, and the development of reasonable alternatives. The chapter also describes each of the candidate commercial light water reactors, explains the No Action Alternative and the Preferred Alternative, and summarizes the environmental impacts associated with the alternatives.

3.1 PRODUCTION OF TRITIUM IN A COMMERCIAL LIGHT WATER REACTOR

A commercial light water reactor (CLWR) is a nuclear reactor designed and constructed to produce electric power for commercial sale. As discussed in Section 1.3.4, tritium can be produced during the normal operation of a CLWR. The process uses tritium-producing burnable absorber rods (TPBARs), which are specially fabricated rods that replace standard burnable absorber rods in the reactor core. Burnable absorber rods absorb excess neutrons and help control the power in a reactor to ensure an even distribution of heat and extend the reactor's fuel cycle. Tritium is produced when the TPBAR is exposed to radiation during the normal operation of the CLWR.

This section provides a general description of the process of producing tritium using a CLWR. It includes: (1) a brief description of the normal process of generating electric power in a typical CLWR plant; (2) a description of the TPBARs that are inserted in the reactor and the standard burnable absorber rods that they replace; and (3) a summary of the operational differences this replacement introduces—differences that would give rise to environmental impacts in addition to those associated with the normal operation of the reactor. A more detailed description of the process of producing tritium in a CLWR and some background information on the operation of CLWRs in a tritium-producing mode are included in Appendix A.

3.1.1 Generation of Electric Power in Nuclear Power Plants

Nuclear, coal-fueled, and oil-fueled power plants all generate electricity by heating water to create steam, which is used to turn a turbine that powers a generator. The principal difference between nuclear and fossil-fueled power plants is that, instead of using a boiler to heat water for steam, a nuclear power plant heats the water with heat generated in the core of the reactor during nuclear fission.

Nuclear fission is the process of splitting fissionable atoms. When an atom is forced to split, energy is released. Some of this energy is converted to heat. In a nuclear reactor, certain types of uranium atoms are made to fission, or split, and release heat. The amount of heat generated (the power) is controlled by two types of control rods, movable and fixed. The movable control rods are used to start or stop the reactor. The fixed control rods, also called burnable absorber rods, ensure an even distribution of heat and extend the fuel cycle. The term "burnable" in this context means "capable of being consumed," rather than "flammable," the conventional definition.

Water is pumped through the reactor core to carry away the heat produced by the nuclear fission. Power reactors in the United States are called light water reactors because they are cooled by ordinary or "light" water. There are two types of light water reactors—boiling water reactors and pressurized water reactors. In boiling water reactors, the water boils to steam in the reactor vessel and goes directly to the turbine.

In pressurized water reactors, the water is pressurized to prevent it from boiling. The pressurized water (the primary coolant) is heated as it passes through the pressurized core. Next, the pressurized water is pumped to a steam generator where it passes through tubes (heat exchangers) and heats water in a "secondary" system. When this secondary water boils, steam is created. The steam then passes through the turbine, which powers the generator and produces electricity. With both types of reactor plants, the steam, after passing through the turbine, is cooled and condensed by another water system, which is usually supplied from a lake, river, or ocean. See **Figure 3–1** for a schematic drawing of a typical pressurized water reactor.

Light water reactor fuel consists of pellets of uranium dioxide stacked in approximately 12-foot long tubes called fuel rods. Fuel rods are grouped together as fuel assemblies, where they are held side-by-side at fixed distances by metal grids. Although power reactor fuel assemblies differ somewhat, depending on the design of the reactor, a typical fuel assembly for a pressurized water reactor contains 289 positions: 264 fuel rod and 25 nonfuel rod positions in a 17 x 17 array. The nonfuel positions are used for moveable control rods, instrumentation, neutron source rods, or burnable absorber rods. Pressurized water reactors are suited for the production of tritium because the TPBARs can be inserted into the nonfuel positions of the fuel assemblies to replace standard burnable absorber rods. For this reason, only pressurized water reactors have been considered for the production of tritium in CLWRs. **Figure 3–2** shows cross-sections of a fuel assembly.

3.1.2 Description of Tritium-Producing Burnable Absorber Rods

To produce tritium in a CLWR, TPBARs would be inserted into the reactor core. The TPBARs are long, thin tubes that contain lithium-6, a material that produces tritium when it is exposed to neutrons in the reactor core. The exterior dimensions of the TPBARs are similar to the burnable absorber rods (see **Table 3–1**), so that they can be installed in fuel assemblies where burnable absorber rods are normally placed. To ease the insertion and removal from fuel assemblies, the TPBARs would be attached to a base plate. See **Figures 3–3** and **3–4** for a sketch of a typical TPBAR assembly and components. In addition to producing tritium, TPBARs would fill the same role as burnable absorber rods in the operation of the reactor.

The neutron absorber material in the TPBARs would be enriched in the isotope lithium-6, instead of the boron usually used in the burnable absorber rods. When the TPBARs are inserted into the reactor core, neutrons would be absorbed by the lithium-6 isotope, thereby initiating a nuclear process that would turn it into lithium-7. The new isotope would then split to form helium 4 and tritium (see Appendix A for a more detailed discussion of this process). The tritium then would be captured in a solid metal nickel-plated zirconium material in the TPBAR called a "getter." The tritium would be chemically bound in the TPBAR "getter" until the TPBAR is removed from the reactor during refueling and transported to the proposed Tritium Extraction Facility at the U.S. Department of Energy's (DOE) Savannah River Site in South Carolina. There the tritium would be extracted by heating the TPBARs in a vacuum to temperatures in excess of 1,000°C (1,800°F). Following extraction, the tritium would be purified. More details on the design of the TPBARs are included in Appendix A.

The current DOE TPBAR design is based on the numerous studies and tests performed for an original design to be used in Washington Nuclear Plant Unit 1, a Babcock and Wilcox (now Framatome Technologies, Inc.) reactor design, as part of new production reactor efforts in the early 1990s. The characteristics of a TPBAR design, as shown in Table 3–1, show that TPBAR assemblies can be used in either a Westinghouse (Watts Bar or Sequoyah) or a Babcock and Wilcox (Bellefonte) reactor design. The TPBARs, as currently designed, are being irradiated at the Watts Bar Nuclear Plant. The final TPBAR design has been completed and is being reviewed by the U.S. Nuclear Regulatory Commission (NRC) (63 FR 43732). The analyses of environmental impacts presented in this Environmental Impact Statement (EIS) are based on design parameters for tritium production and a maximum leakage rate of tritium for each TPBAR. These parameters are independent of the type of reactor design used.

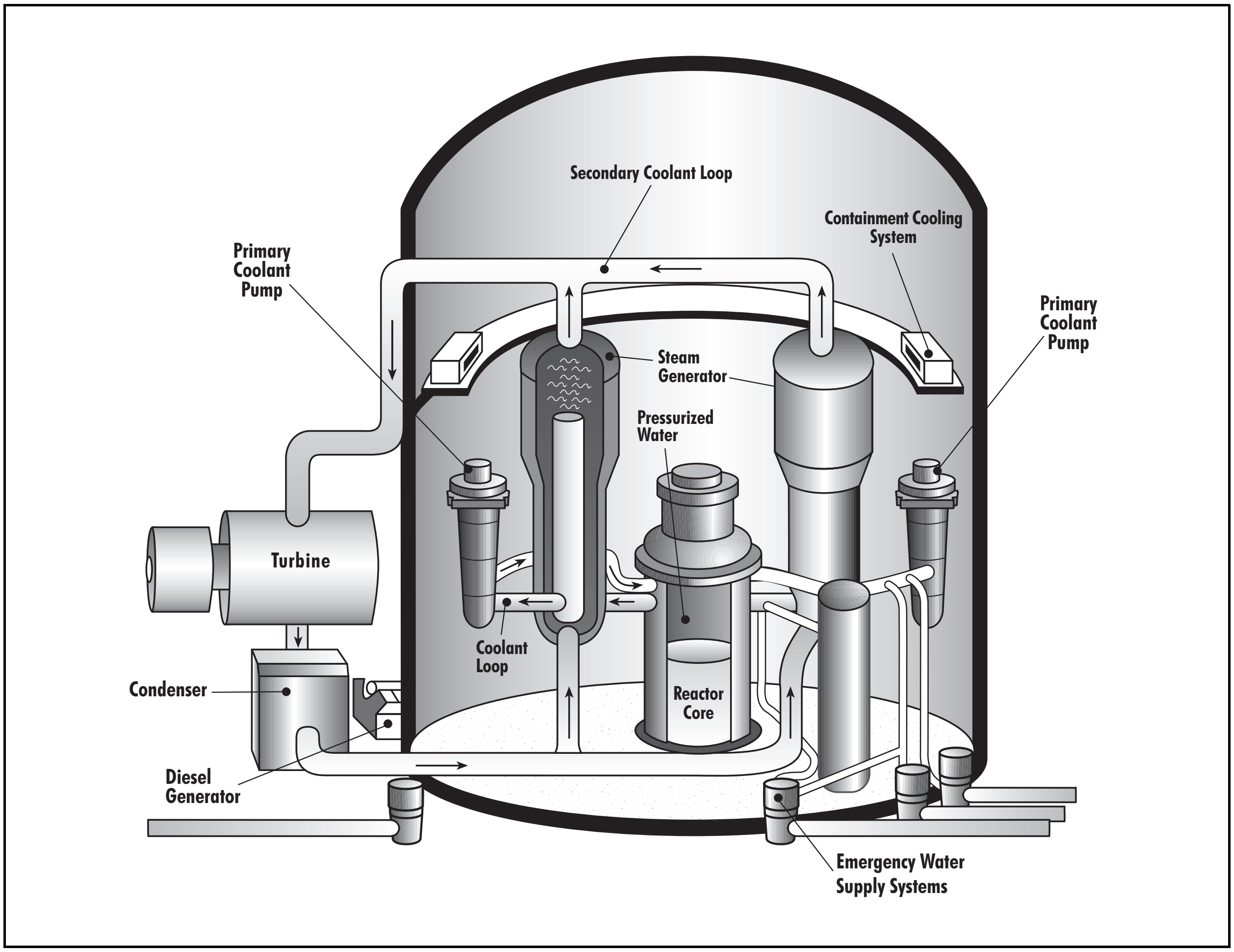

Figure 3–1 Typical Pressurized Water Reactor Schematic

The complete process of producing tritium in a CLWR can be explained in the following way. Nuclear reactors require periodic refueling. In a tritium-producing CLWR, spent fuel would be removed during periodic reactor refueling, and fresh fuel assemblies and TPBARs would be inserted in the reactor core. These new TPBARs would be transported from the TPBAR fabrication facility to the reactor site inside fresh fuel assemblies as part of the regular fresh fuel supply. During the reactor's normal operations cycle (approximately 18 months), the TPBARs would be irradiated, and the tritium generated would be chemically bound in the tritium "getter." During the subsequent refueling period, the fuel assemblies containing the TPBARs would be removed from the reactor core and transferred to the spent fuel pool, where the irradiated TPBAR assemblies would be removed from the fuel assemblies. After removal from the fuel assemblies, the TPBARs would be mechanically separated from the hold-down assembly (see Figure 3–3) and placed in a 12-foot long consolidation container. The consolidation container, which in cross-section resembles the 17 × 17 array matrix of the fuel assembly, provides 289 positions for individual TPBARs. The consolidation container with the 289 TPBARs, separated from their hold-down assemblies, would be placed in a shipping cask, sealed, placed on a truck or train, and transported to the proposed Tritium Extraction Facility at the Savannah River Site. The tritium would be extracted in a high-temperature heating/vacuum process. The base plates and any other low-level radioactive waste attributed to tritium production would be placed in a different transportation package and transported to the Barnwell disposal facility for commercial low-level

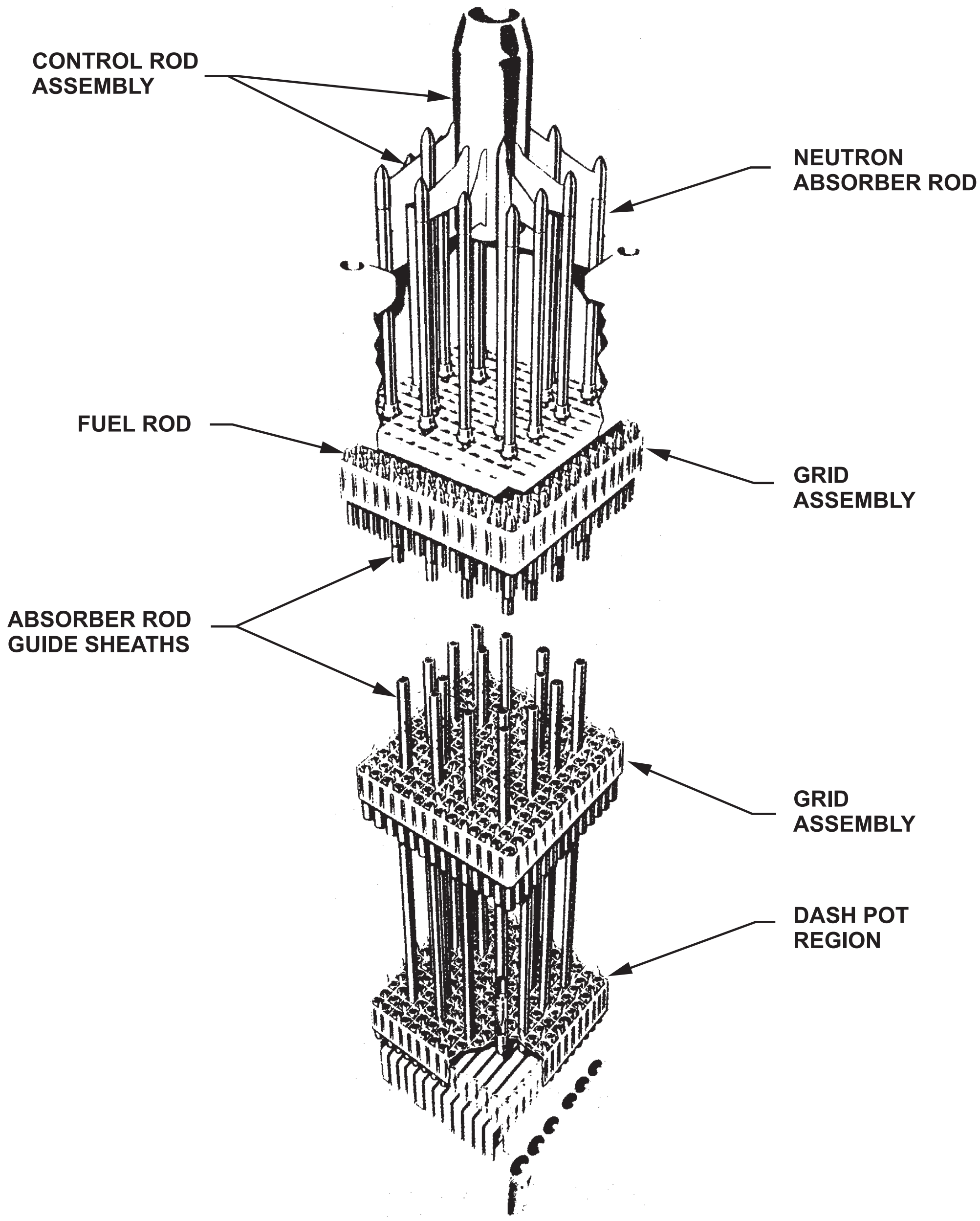

Figure 3–2 Typical Fuel Assembly Cross-Sections

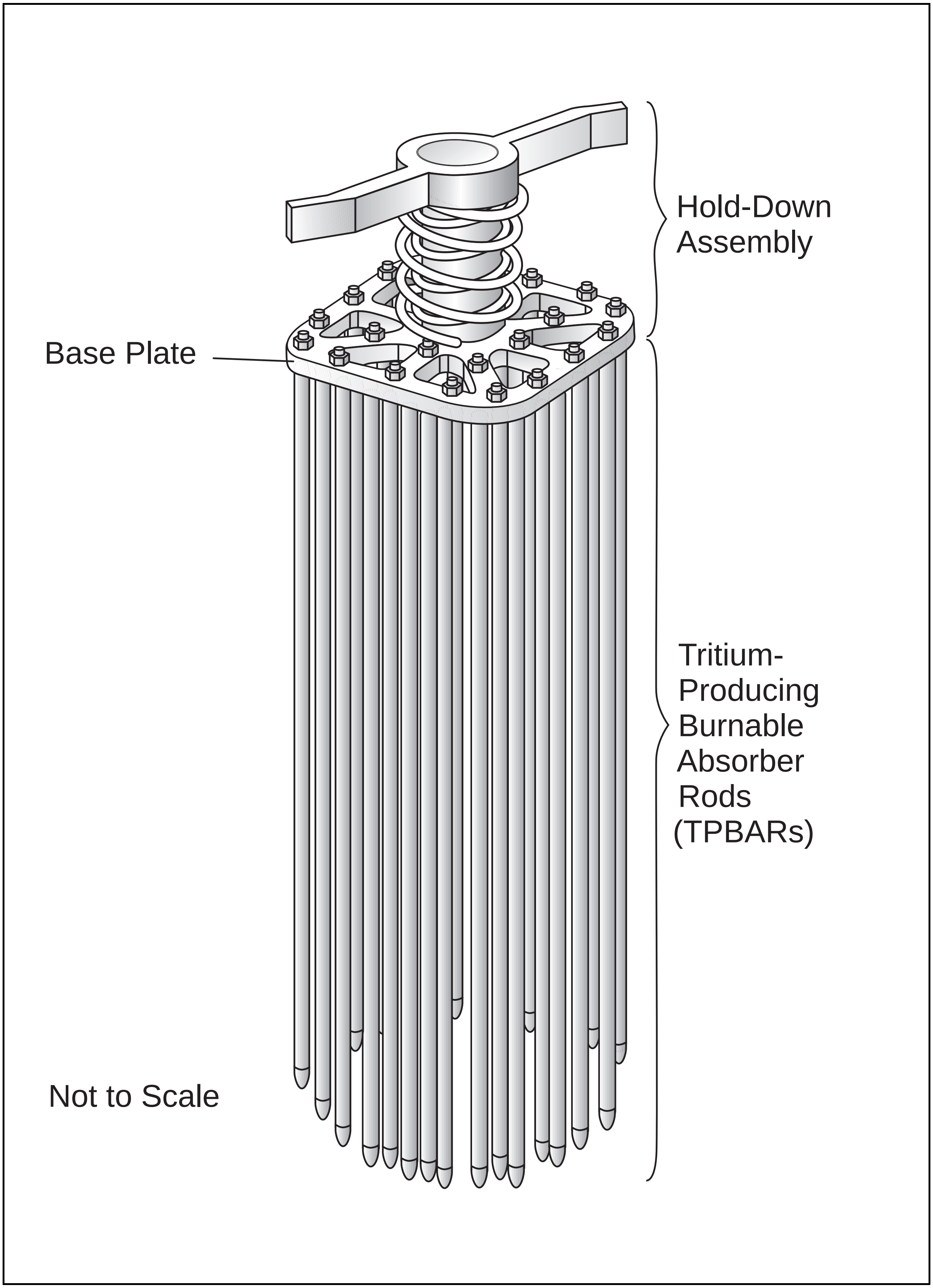

Figure 3–3 Typical TPBAR Assembly

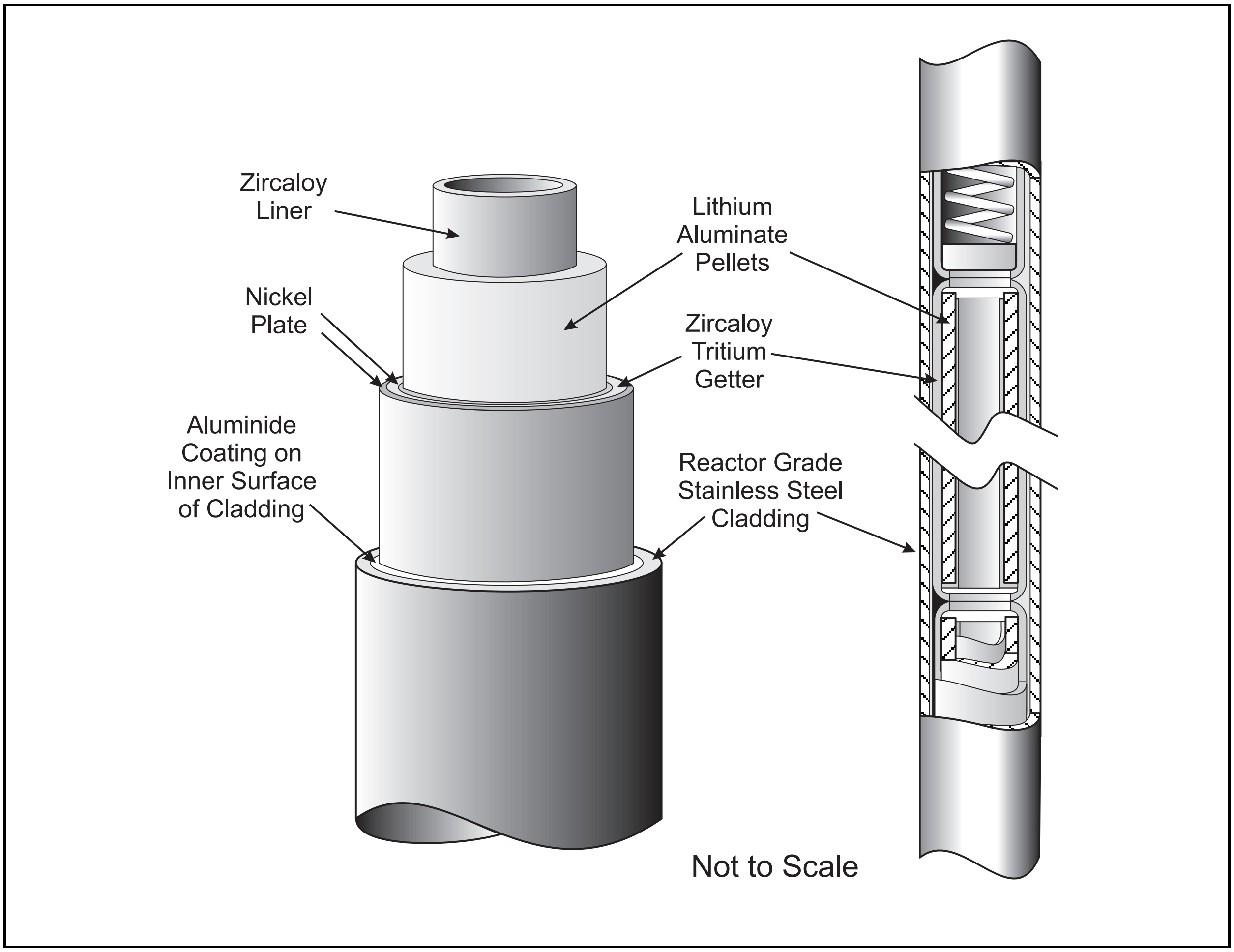

Figure 3–4 Sketch of TPBAR Components

radioactive waste or the Savannah River Site's low-level radioactive waste facility, both in South Carolina. The cycle from TPBAR fabrication and assembly through reactor irradiation and shipment to the Savannah River Site's proposed Tritium Extraction Facility is depicted in Figure 1–1.

Table 3–1 Comparison of TPBAR with Typical Burnable Absorber Rod Characteristics

Parameter	*Burnable Absorber Rod 17×17 Fuel Assembly*	*TPBAR 17×17 Fuel Assembly*
Overall length (inches)	152	152
Total weight (pounds)	1.8	2.26
Absorber length (inches)	142	~142
Absorber outside diameter (inches) Thickness (inches)	[ ][a] [ ][a]	0.303 0.040
Absorber material	Silicon-boron oxides (SiO_2-B_2O_3)	Lithium aluminate ($LiAlO_2$)
Outer cladding outside diameter (inches)	0.381	0.381
Cladding material	Stainless steel type 304SS	Stainless steel type 316SS

[a] Denotes proprietary data of burnable absorber rod vendor.
Source: PNNL 1997a.

3.1.3 Impacts of Tritium Production on Reactor Operations

The replacement of burnable absorber rods with TPBARs should have few impacts on the normal operation of the reactor. The normal power distribution within the core and reactor coolant flow and its distribution within the core would remain within existing technical specification limits. Some tritium is expected to permeate through the TPBARs during normal operation, which would increase the quantity of tritium in the reactor's coolant water system. Since tritium is a type, or isotope, of the hydrogen atom, once the tritium is in the reactor's coolant water system, it could combine with oxygen to become part of a water molecule and could eventually be released to the environment.

The operational differences between a tritium production reactor and a nuclear power plant without tritium production were determined by evaluating each environmental resource area and identifying the operational parameters that would change in a typical CLWR as a result of operating in a tritium production mode. The summarized operational differences are:

- Accident conditions—The physical changes to the reactor core would involve replacing some burnable absorber rods with TPBARs. This change would increase the estimated quantity of radionuclides assumed to be released in the analysis.
- Personnel—Additional TPBAR handling and shipping activities would create new jobs and possibly require the hiring of extra personnel at the CLWR sites.
- Effluent—The tritium content in the liquid effluent and gaseous emissions is expected to increase as a result of the presence of TPBARs in the reactor.
- Waste—Additional activities associated with handling, processing, and shipping TPBAR assemblies are expected to increase low-level radioactive waste generation rates.
- Spent fuel—Additional spent fuel could be generated when a reactor operates in a tritium-producing mode. Depending on existing spent fuel capacity, additional storage for spent fuel could be required.
- Public and worker exposure—The increased levels of tritium in the reactor coolant and the additional activities required in the handling and processing of TPBARs would result in increased radiation exposure for the public, operations workers, and maintenance personnel.
- Transportation and handling—Irradiated TPBAR assemblies would be packaged and transported from the CLWR sites to the Savannah River Site for tritium extraction and purification. Some additional risks of an accident en route would be expected. In addition, low-level radioactive waste associated with the TPBARs would be packaged and transported for disposal at the Barnwell disposal facility or the Savannah River Site.

The environmental impacts associated with these operational differences are evaluated in Chapter 5 of the CLWR EIS as they affect each environmental resource area (e.g., land resources, air resources, water resources, socioeconomics). In addition, this EIS evaluates the environmental impacts associated with any construction necessary to complete the currently unfinished Bellefonte 1 and 2.

3.2 DEVELOPMENT OF ALTERNATIVES

3.2.1 Planning Assumptions and Basis for Analysis

The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS) (DOE 1995b) identified two options for producing tritium in a CLWR: (1) DOE purchase of an existing operating or partially completed CLWR and conversion of the facility to tritium production for defense purposes; and (2) DOE purchase of irradiation services from an operating CLWR to produce tritium using DOE-supplied TPBARs. Pursuing these options, on June 3, 1997, DOE issued a request for proposal (DOE 1997a) to all pressurized water reactor operators in the United States, delineating the technical requirements and financial conditions necessary for implementing these options.

Under this EIS, DOE proposes to produce, in one or more CLWRs, the tritium needed to maintain the nation's nuclear stockpile. The CLWRs were identified through a procurement process. The procurement process discussed in Section 1.1.4 identified the following CLWRs where tritium could be produced: the Watts Bar Nuclear Power Plant Unit 1 (Watts Bar 1); the Sequoyah Nuclear Power Plant Units 1 and/or 2 (Sequoyah 1 and/or 2); and the Bellefonte Nuclear Power Plant Units 1 and/or 2 (Bellefonte 1 and/or 2). All of these reactor units are owned and operated by the U.S. government. Watts Bar 1 and Sequoyah 1 and 2 are currently operating units, while Bellefonte 1 and 2 are partially completed units that would have to be completed before tritium could be produced. Based on the procurement process, DOE considers this set of five TVA reactor units to be suitable alternatives for tritium production. Descriptions of these reactor plants are included in Section 3.2.5.

This EIS evaluates the direct, indirect, and cumulative impacts associated with fabrication of the TPBARs, the irradiation and handling of the TPBARs at the reactor facility, and the transportation of all nonirradiated and irradiated materials (including wastes associated with tritium production) to and from the appropriate facilities. The planning assumptions and considerations that form the basis of the analyses and impact assessments presented in this EIS are listed below:

- The purpose of DOE's action is to produce tritium in a CLWR. Tritium is needed to maintain the nation's nuclear weapons stockpile. For the purposes of analysis in this EIS, DOE assumed that the CLWR program would be designed to produce up to 3 kilograms of tritium per year. Three kilograms of tritium represent a production goal applicable if the tritium reserve, which is maintained for emergencies and contingencies, were ever lost or used (see Figure 2-1). Considering the current design of the TPBARs and the efficiency of the tritium extraction process, this would involve the irradiation of up to 6,000 TPBARs (DOE 1996c) in an 18-month refueling cycle (4,000 TPBARs per year). The maximum number of TPBARs that could be irradiated at each reactor unit without significantly disturbing the normal electricity-producing mode of reactor operation is approximately 3,400 TPBARs; the exact number depends on the specific design of the reactor. Steady-state tritium requirements, which are classified and would vary depending upon the specific requirements of the Nuclear Weapons Stockpile Plan, are less than 3 kilograms of tritium per year. This EIS evaluates the impacts at each reactor site by considering a range of 1,000 to 3,400 TPBARs. A sensitivity analysis of the irradiation of fewer than 1,000 TPBARs is included in Section 5.2.9.

  Producing 3 kilograms of tritium per year likely would be a short-term objective to reconstitute the tritium reserve. In such a case, it is technically feasible to produce larger quantities of tritium in a single reactor by changing some of the design parameters of the TPBARs and/or some technical parameters of the host reactor core, including shortening the refueling cycle. DOE does not foresee the implementation of this mode of production in any of the reactor units considered in this CLWR EIS. For the purpose of completeness, however, the sensitivity analysis in Section 5.2.9 also addresses the environmental impacts of changing the existing design parameters of the TPBARs and some of the operating parameters of the host reactors to maximize tritium production.

- For alternatives involving currently operating reactor units, this EIS assesses the environmental impacts of the changes to existing operations resulting from the insertion of the TPBARs into the reactors. These environmental impact changes would be additional to the normal environmental impacts of the ongoing operation of the reactors. For alternatives involving partially completed reactors, the EIS assesses the impacts resulting from construction to complete the reactors and from operation of the reactors.

- The EIS addresses the impacts of the No Action Alternative for each of the reactor units by assuming the continuation of the current status and current activities at each site. Because the TVA units are the only potential CLWR units considered as a result of the procurement process, the No Action Alternative means that no tritium would be produced in any CLWR. For this reason, this EIS, consistent with the Record of Decision on the Final Programmatic EIS (60 FR 63878), summarizes the impacts of producing tritium in a linear accelerator. The impacts of constructing and operating the accelerator are described in detail in the *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT EIS) (DOE 1997e, DOE 1999a) (see Section 5.2.11).

- The EIS assesses the environmental impacts of tritium production in CLWRs for a period of 40 years, starting with the delivery of irradiated TPBARs at the Tritium Extraction Facility in approximately the year 2005. For alternatives involving the partially completed reactor(s), it is assumed that any construction activities needed for the completion of Bellefonte 1 (and any other startup tests and activities) would take place during the time period between 1999 and 2004, at which time the completed reactor would be fully operational. In the event Bellefonte 2 was also selected for completion, Bellefonte 1 would come on line in approximately 2005, while Bellefonte 2 would begin operation in approximately 2007.

- CLWRs are licensed by the NRC to operate for 40 years. Currently operating reactors are not in a position to continue operation beyond 40 years without NRC approval for "life extension." Some of the environmental impacts associated with life extension activities would be attributable to tritium production. The NRC has addressed the generic impacts of life extension in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NRC 1996a). The life extension impacts associated with alternatives involving the currently operating units are based on this publication and are discussed in Section 5.2.4 of this EIS. Tritium production is not expected to affect relicensing. Life extension impacts for a partially completed reactor would not be an issue, since it would be expected to operate for 40 years after its completion.

- Tritium production in a currently operating reactor would not be expected to affect the radiological condition of the reactor at the end of its life. Therefore, environmental impacts associated with decommissioning and decontamination activities would be attributed to the normal operation of the reactor as an electricity-producing unit. For alternatives involving a partially completed reactor, the impacts from decommissioning and decontamination activities are evaluated in this EIS. Decommissioning and decontamination impacts are discussed in Section 5.2.5 of the EIS and are based on the generic EIS issued by the NRC entitled *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* (NRC 1988).

- Fabrication of the TPBARs would take place in a commercial facility that normally fabricates and assembles the components for the fresh fuel used in the CLWRs. A description of the fabrication process and any differences between fabricating standard burnable absorber rods versus TPBARs and material resources are included in Section 5.2.7. Impacts of the transportation of the nonirradiated TPBARs to the reactor facilities are evaluated in this EIS by considering a number of possible commercial fabrication and assembly facilities.

- An analysis of the environmental impacts of the transportation of nonirradiated and irradiated materials is presented in Section 5.2.8. The analysis for the transportation impacts assumes that 4,000 irradiated TPBARs per year are transported from the tritium production sites to the Savannah River Site. This EIS assumes that the transportation of irradiated TPBARs would be made by truck-sized casks of the type used to transport spent nuclear fuel in the United States. In addition to the transportation of irradiated TPBARs, the CLWR EIS considers the transportation of the irradiated TPBAR hardware, which would be separated from the rods at the reactor site, and other low-level radioactive waste directly attributed to tritium production. The CLWR EIS assumes that this low-level radioactive waste is transported in separate packages to either the Savannah River Site, where it would be disposed at the low-level radioactive waste facility, or the Barnwell disposal facility, where the low-level radioactive waste of the TVA reactor facilities is normally transported and disposed. Both truck routes and rail routes are evaluated. Details on the assumptions, method, and consequences of the transportation of TPBARs and low-level radioactive waste are presented in Appendix E.

- The radiological exposures from normal operation and accident conditions are evaluated for the general public and the workers at the reactor sites. For alternatives involving currently operating reactors, the CLWR EIS assesses the exposures from any additional radioactive releases that would result from the irradiation and consolidation of the TPBARs at the reactor. [Note: Consolidation occurs when the TPBARs from several fuel assemblies are inserted into a container for shipment off site in a transportation cask.] For alternatives involving a partially completed reactor, in addition to irradiation and consolidation of TPBARs, this EIS also assesses the exposures from all radioactive releases that could result from both normal operation and accident conditions. Details on the assumptions used for radiological releases are included in Appendix C for normal operation and in Appendix D for accidents.

- Production of tritium in a CLWR would increase the generation rate of spent fuel if more than approximately 2,000 TPBARs are irradiated in a fuel cycle (WEC 1999). Normally (i.e., during normal operation with no tritium production), fuel assemblies are used in more than one cycle. However, in order to maximize tritium production, TPBARs would be inserted in fresh fuel assemblies. In accordance with the Nuclear Waste Policy Act of 1982, DOE is planning to manage all spent nuclear fuel at a national repository. Siting and development of a repository is ongoing, and the location and opening date for a suitable repository has not yet been determined. Accordingly, for the purposes of this EIS, the initial management of any additional spent nuclear fuel that may be generated as a result of tritium production is assumed to be stored on site in a generic dry cask independent spent fuel storage installation (ISFSI) pending the availability of a suitable repository. The environmental impacts from the construction and operation of an ISFSI are addressed in Section 5.2.6. However, no decision will be made to either construct or operate an ISFSI as a result of this EIS. Appropriate National Environmental Policy Act (NEPA) documentation would be prepared prior to the construction of an ISFSI.

- The methodology used to assess the environmental impacts of tritium production in CLWRs is described in Appendix B.

3.2.2 Reactor Options Considered

Currently, there are 105 CLWRs licensed to operate in the United States, of which 72 are pressurized water reactors. Only pressurized water reactors are suitable for producing tritium with the current TPBAR design. There are also a number of pressurized water reactors for which construction activities have stopped. Construction work on all of the partially completed reactors has been canceled, with the exception of three: Bellefonte 1, Bellefonte 2, and Watts Bar Nuclear Plant Unit 2 (Watts Bar 2). For these, construction has been deferred indefinitely.

DOE issued a request for proposals for the CLWR production of tritium. DOE stated in the request for proposals its intent to select one or both of two approaches: (1) the acquisition of CLWR irradiation services for tritium production, or (2) the purchase of an operating CLWR by DOE for production of tritium. As discussed in Section 1.1.4, the only qualified response to DOE's solicitation came from TVA, the operator of Watts Bar 1 and Sequoyah 1 and 2. TVA also maintains the partially completed units of Watts Bar 2 and Bellefonte 1 and 2.

As a result of DOE's procurement process, all CLWRs except five of the pressurized water reactor units operated by TVA were eliminated from consideration as reasonable alternative reactor options. A sixth TVA reactor, Watts Bar 2, was considered but eliminated because, compared to the other five TVA reactor units that have a design suitable for tritium production, utilizing Watts Bar 2 would involve significantly higher construction costs. The cost to complete Watts Bar 2 (which is 50 percent complete) has been estimated to be roughly twice the cost to complete Bellefonte 2 (which is 57 percent complete). Much of the difference in costs between finishing Watts Bar 2 and Bellefonte 2 is attributable to the resolution of design and construction issues that exist for Watts Bar 2, but not for Bellefonte 2. Moreover, construction completion plans for Watts Bar 2 have not reached the level of refinement and reliability associated with those plans for Bellefonte 1 and 2. Consequently, relative to the other five TVA reactor units whose impacts are analyzed in this EIS, Watts Bar 2 is not a reasonable alternative reactor option and has been eliminated from detailed study.

Also eliminated from detailed study was the completion and operation of Bellefonte 2 without completion and operation of Bellefonte 1. Bellefonte 1 is 90 percent complete; Bellefonte 2 is only 57 percent complete. The costs associated with completion of Bellefonte 1 include all the necessary systems and equipment that would be shared between the two units—equal to approximately 70 percent of the total cost for completion of both units. Therefore, completion of Bellefonte 2 without completion of Bellefonte 1 is economically impractical.

3.2.3 Reasonable Alternatives

The reasonable alternatives presented in the EIS are formed by the options available to DOE in implementing the project. These options include the fabrication facility options, the reactor facility options, and the transportation alternative modes, routes, and destinations.

The fabrication facility options include all commercial facilities that fabricate TPBARs and the pressurized water reactor fuel and its components for the currently operating reactor facilities. These are Framatome-Cogema Fuels, Lynchburg, Virginia; Asea Brown-Boveri/Combustion Engineering, Hematite, Missouri; BWX Technologies, Inc., Lynchburg, Virginia; Siemens Power Corporation, Richland, Washington; and Westinghouse Electric, Columbia, South Carolina. These fuel fabrication facilities could fabricate TPBARs with minimal startup time with some technology transfer on the particular TPBAR components not typically used by the nuclear industry (i.e., tritium getters and aluminized cladding), and with quality assurance standards in place and working. Another commercial facility, General Electric in Wilmington, North Carolina, would only manufacture TPBARs. Following the manufacture of TPBARs, final assembly would take place at one of the other facilities. Environmental impacts of the fabrication of TPBARs are discussed in Section 5.2.7.

To supply tritium to meet national security requirements, DOE could use one or more reactors. Considering that a maximum number of 3,400 TPBARs could be irradiated in a single reactor, at least two reactors would be needed for 6,000 TPBARs based on an 18-month refueling cycle. Considering also that additional spent nuclear fuel generation attributed to tritium production starts with the irradiation of approximately 2,000 TPBARs in a single reactor, DOE could use as many as three reactors to irradiate 6,000 TPBARs without increasing the amount of spent nuclear fuel. Mathematically, DOE has the option of selecting 1 of the 18 combinations of reactor units presented in **Table 3–2**. These 18 combinations form the reasonable alternatives of the irradiation element of the project. For the purpose of simplicity, the analysis of the environmental impacts for each reactor site is performed using conditions and assumptions that would bracket the impacts at each site. The impacts for each of the 18 irradiation alternatives would be the sum of the impacts at each of the sites involved. For example, the impacts associated with Alternative #5 in Table 3–2 would be the sum of the impacts of the operation of Watts Bar 1 and the impacts of the operation of Sequoyah 1. The environmental impacts by reactor site are discussed in Section 5.2 and summarized in Section 3.2.6.

Table 3–2 CLWR Tritium Production Program Reasonable Alternatives

Alternative	*Watts Bar 1 Operation*	*Sequoyah 1 Operation*	*Sequoyah 2 Operation*	*Bellefonte 1 Complete Construction and Operation*	*Bellefonte 2 Complete Construction and Operation*[a]
One Reactor[b]					
1	●				
2		●			
3			●		
4				●	
Two Reactor Combinations					
5	●	●			
6	●		●		
7	●			●	
8		●	●		
9		●		●	
10			●	●	
11				●	●
Three Reactor Combinations					
12	●	●	●		
13	●	●		●	
14	●		●	●	
15	●			●	●
16		●	●	●	
17		●		●	●
18			●	●	●

[a] Construction on Bellefonte 2 may be completed only if Bellefonte 1 is completed and operating.
[b] The one-reactor alternative could not produce 3 kilograms of tritium per year on an 18-month refueling cycle.

The transportation of nonirradiated and irradiated TPBARs presents options in transportation modes (truck versus rail), alternative transportation routes between facilities, alternative fabrication locations, and alternative low-level radioactive waste destinations. The full development of the various transportation options and the associated environmental impacts from these options are discussed in Section 5.2.8 and Appendix E. Transportation impacts are summarized in Section 3.2.6.2.

3.2.4 No Action Alternative

On December 22, 1998, Secretary of Energy Bill Richardson announced that CLWRs would be the primary tritium supply technology and that the accelerator would be developed, but not constructed, as a backup to CLWR tritium production (DOE 1998f). Based on this announcement, if tritium is not produced in a CLWR, it will be produced in an accelerator. Accordingly, for purposes of analysis in this EIS, the No Action Alternative assumes the continued operation of Watts Bar 1 and Sequoyah 1 and 2 for the generation of electricity and the deferral of construction activities necessary for completion of Bellefonte 1 and 2 as nuclear units. Consequently, this No Action alternative entails the production of tritium in an accelerator. A summary of the environmental impacts associated with the production of tritium in an accelerator is contained in Section 5.2.11 of the CLWR EIS. That summary is based on the APT EIS. A comparison between the environmental impacts of the CLWR EIS reactor alternatives and those for accelerator production is presented in **Table 3-14**. Since the APT EIS was developed in parallel with the CLWR EIS, the impacts in Table 3-14 represent the conclusions of the APT Draft EIS. These impacts are not expected to change in the APT Final EIS.

3.2.5 Reactor Options

3.2.5.1 Watts Bar Nuclear Plant Unit 1

Watts Bar 1 is located on a 716-hectare (1,770-acre) site in Rhea County, Tennessee, on the Tennessee River at Tennessee River Mile 528, approximately 80 kilometers (50 miles) northeast of Chattanooga, Tennessee (TVA 1976, TVA 1995c). A second, partially completed unit, Watts Bar 2, also is located at this site. Watts Bar 2 was considered and dismissed as an alternative for tritium production in the CLWR EIS, as described in Section 3.2.2. The main land-use activities of the surrounding area are described in Section 4.2.1.1. The general arrangement of the Watts Bar Nuclear Plant is shown in **Figure 3–5**.

Watts Bar 1 began commercial power operation in May 1996 (NRC 1997a). The Watts Bar 1 structures include a reactor containment building, a turbine building, an auxiliary building, a service building, a water pumping station for circulating water in the condenser, a diesel generator building, a river intake pumping station, a natural-draft cooling tower, a transformer yard, a 500-kilovolt switchyard and a 161-kilovolt switchyard, a spent nuclear fuel storage facility, and sewage treatment facilities (TVA 1976). The reactor containment building houses a pressurized water reactor designed and manufactured by the Westinghouse Electric Corporation. No modifications are expected to be necessary for Watts Bar 1 to irradiate TPBARs. Design equipment and facilities are sufficient to load and unload the TPBAR assemblies. During normal operation with tritium production, the plant could employ a few more workers (less than 10) in addition to the 809 presently employed (TVA 1998a). The spent nuclear fuel storage capacity is not sufficient for 40 years of operation with or without TPBARs. This EIS evaluates the impacts of a generic dry cask spent nuclear fuel storage facility in Section 5.2.6.

The general design specifications of the unit are provided in **Table 3–3.**

Table 3–3 General Design Specifications of Watts Bar Nuclear Plant Unit 1

Criteria	*Quantity*
Core thermal power level (megawatts-thermal)	3,411
Plant capacity factor	0.80
Total steam flow rate (pounds per hour)	1.51×10^{7}
Electrical generation (net) (megawatts-electric)	1,160
Normal operating cycle (months)	18
Size of full core fuel load	193 fuel assemblies (89.5 metric tons of uranium)

Sources: TVA 1976, TVA 1995d.

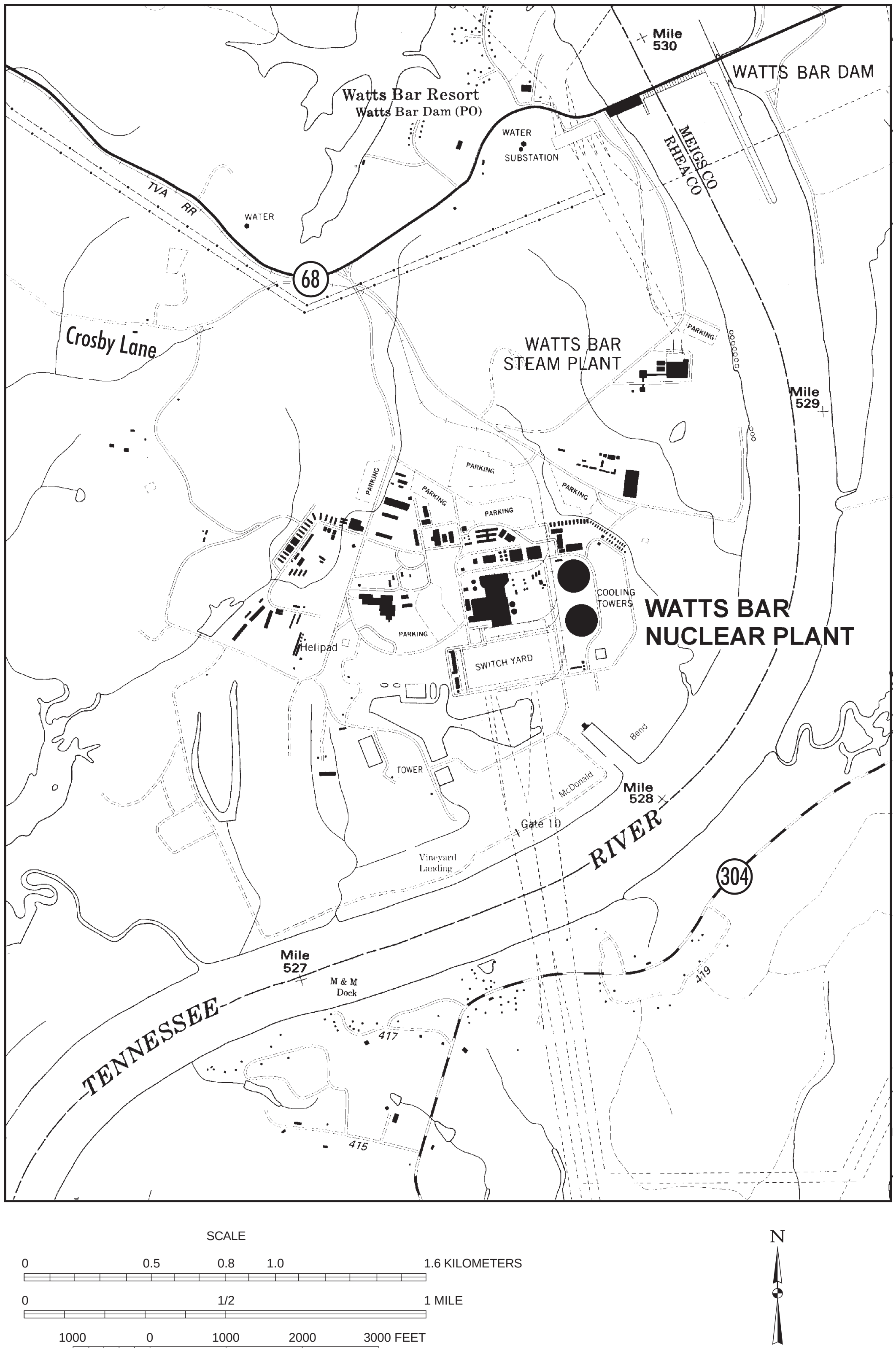

Figure 3–5 Watts Bar Nuclear Plant

In a tritium-producing mode of operation, up to 3,400 TPBARs could be placed in the core, occupying the same fuel assembly locations as the burnable absorber rods now in use. The TPBARs would be irradiated on an 18-month refueling-cycle schedule. During operation, heat released from the fissioning fuel is transported by the reactor cooling water to the steam generators. The overall thermal efficiency of the plant is about 34 percent (TVA 1995c). After passing through the turbine, the steam is condensed by moving through a condenser cooled with recirculated water. This recirculated condenser water is then cooled by passing it through a natural-draft (without fans), evaporative cooling tower. Although the cooling system is of the so-called "closed type," makeup water from the Tennessee River is needed to replace water losses due to evaporation, drift, and blowdown. Blowdown is a process to remove excess dissolved solids.

At full power, the temperature of the water flowing through the condenser is raised by approximately 20°C (36°F) (TVA 1995c). To replace water lost through evaporation, minor leaks, and blowdown (mainly associated with cooling tower operation), approximately 156,332 liters per minute (41,300 gallons per minute) (TVA 1976) is withdrawn from the Tennessee River. Blowdown from the natural-draft cooling tower is discharged into the Tennessee River at a normal rate of 106,593 liters per minute (28,160 gallons per minute) (TVA 1976). A diffuser system disperses the blowdown into the river water, thus limiting the rise in temperature to less than 3°C (5°F) (TVA 1976). This water is discharged under a National Pollutant Discharge Elimination System (NPDES) Permit (TN DEC 1993b).

The operation of Watts Bar 1 produces radioactive fission products and activates corrosion products in the reactor coolant system. Small amounts of these radioactive products enter the cooling system water. Radionuclides are removed from the cooling water through a chemical water treatment system. The gases and liquids are processed, stored, and monitored within the facility to minimize the radioactive nuclides that could be released to the atmosphere and into the Tennessee River. Radioactive waste is generated in this treatment system. The Watts Bar 1 liquid contaminant releases to the environment during normal operations are identified in **Table 3–4.**

Table 3–4 Annual Liquid Releases to the Environment from Operation of Watts Bar 1

Materials	*Quantity*
Chemicals (kilograms)	1,098,040 [a]
Tritium (Curies)	639 [b]
Other Radionuclides (Curies)	1.32 [b]

[a] TVA 1995a.
[b] TVA 1998e.

Radioactive gaseous emission releases are controlled by using a ventilation system consisting of gas decay tanks, filter components, and related piping, ductwork, valves, and fans. The main sources of gaseous radioactive emissions are generated in conjunction with degassing of the primary coolant during letdown depressurization of the reactor cooling water into the various process equipment and tanks associated with the makeup water and purification systems. Gases from the reactor are trapped in holding tanks to allow short-lived radioactive gases to decay before they are released to the shield building vent at a controlled rate through high efficiency particulate air filters and charcoal absorbers. Another source of radioactive gaseous emissions is the purging of the reactor containment building, which is also routed through high efficiency particulate air filters and charcoal absorbers prior to release.

Nonradiological criteria and hazardous air pollutant emissions are based on the operation of equipment at Watts Bar 1 at full power. Air pollutant sources include five diesel generators, one diesel generator used for security power, one diesel pump for firefighting, two auxiliary boilers fired with No. 2 fuel oil (0.5 percent sulfur), two natural-draft cooling towers, the lube oil system, two fixed-roof tanks for storing No. 2 fuel oil, the paint shop, and the sandblast shop. Emission factors for both nonradiological criteria and hazardous air pollutants are based on the U.S. Environmental Protection Agency's (EPA) *Supplement B to Compilation of Air Pollutant Emission Factors, AP-42* (EPA 1996b).

The gaseous waste releases from Watts Bar 1 during normal operations are summarized in **Table 3–5.**

Table 3–5 Summary of Annual Watts Bar 1 Gaseous Emissions

Constituents	*Quantity*
Particulate matter (kilograms)	20,366 [a]
Carbon monoxide (kilograms)	21,802 [a]
Sulfur dioxide (kilograms)	77,634 [a]
Nitrogen dioxide (kilograms)	84,584 [a]
Volatile organic compounds (kilograms)	41,602 [a]
Hazardous air pollutants (kilograms)	126 [a]
Tritium (Curies)	5.6 [b]
Other radionuclides (Curies)	283 [b]

[a] TVA 1998a.
[b] TVA 1998e.

Several hazardous substances and chemicals are used on a regular basis in the operation of Watts Bar 1. This results in the generation of hazardous waste that is controlled, stored, and managed in accordance with the Resource Conservation and Recovery Act (40 CFR 260). This waste is disposed of off site at Resource Conservation and Recovery Act-permitted treatment and disposal facilities. Solid waste such as noncontaminated clothing, rags, office paper, boxes, and noncontaminated filters is also generated on a regular basis and is disposed of as solid waste.

The waste and spent fuel generation volumes for Watts Bar 1 during normal operation are summarized in **Table 3–6.**

Table 3–6 Summary of Annual Watts Bar 1 Waste and Spent Fuel Generation Rates

Waste Type	*Volume or Mass*
Hazardous waste (cubic meters)	1.025
Nonhazardous solid waste (kilograms)	853,438
Low-level radioactive waste (cubic meters)	40
Mixed low-level radioactive waste (cubic meters)	< 1
Spent fuel assemblies (per 18-month operating cycle)	80

Sources: TVA 1976, TVA 1995a, TVA 1995c.

The reactor is shut down for refueling and maintenance as part of a normal fuel cycle of 18 months. During this shutdown period, the irradiated TPBARs/spent fuel assemblies would be removed from the reactor and placed in the spent fuel pool for cooling. After approximately one to two months, the TPBARs would be removed from the fuel assemblies, loaded into transportation casks, and sent to the proposed Tritium Extraction Facility at the Savannah River Site for tritium extraction and purification.

3.2.5.2 Sequoyah Nuclear Plant Units 1 and 2

Sequoyah 1 and 2 are operating, pressurized CLWR nuclear power plants. The units are located on a 212-hectare (525-acre) site in Hamilton County, Tennessee, on the Tennessee River at Tennessee River Mile 484.5, approximately 12 kilometers (7.5 miles) northeast of the nearest city limit of Chattanooga, Tennessee (TVA 1974a, TVA 1996b). The main land use activities of the surrounding area are described in Section 4.2.2.1. The general arrangement of the Sequoyah Nuclear Plant is shown in **Figure 3–6**.

Sequoyah 1 began commercial operation in July 1981, and Sequoyah 2 began commercial operation in June 1982 (TVA 1996b). The nuclear steam supply systems, designed and manufactured by the Westinghouse Electric Corporation, include the reactor vessel, steam generators, and associated piping and pumps. These are housed in two reactor containment buildings. The balance of the nuclear power plant includes: a turbine building, an auxiliary building, a service and office building, a control building, a condenser circulating water pumping station, a diesel generator building, a river intake pumping station, two natural-draft cooling towers, a transformer yard, a 500-kilovolt switchyard and a 161-kilovolt switchyard, spent nuclear fuel storage facilities, and sewage treatment facilities (TVA 1974a). No modifications are expected to be needed for Sequoyah 1 and 2 to irradiate TPBARs. Equipment and facilities are sufficient to load and unload the TPBAR assemblies. Tritium production could require the addition of a few more employees (fewer than 10 per unit) to the 1,120 employees currently employed at the two-unit site (TVA 1998a). The general design specifications of the plant are provided in **Table 3–7**. The spent nuclear fuel storage capacity is not sufficient for 40 years of operation with or without TPBARs. This EIS evaluates the impacts of a generic dry cask spent fuel storage facility in Section 5.2.6.

Table 3–7 General Design Specifications of Sequoyah 1 or Sequoyah 2

Criteria	***Quantity***
Core thermal power level (megawatts-thermal)	3,411
Plant capacity factor	0.80
Total steam flow rate (pounds per hour)	1.492×10^{7}
Net electrical generation (net) (megawatts-electric)	1,183
Normal operating cycle (months)	18
Size of full core fuel load	193 Fuel Assemblies (89.5 metric tons of uranium)

Source: TVA 1974a, TVA 1996b.

In a tritium-producing mode of operation, approximately 3,400 TPBARs could be placed in the reactor core(s) of Sequoyah 1 and/or 2 in the same fuel assembly guide tube locations that now accommodate standard burnable absorber rods. The TPBARs would be irradiated on an 18-month refueling cycle.

During current operations at Sequoyah 1 or Sequoyah 2, heat released from the fissioning fuel is transported by the reactor cooling water to the steam generators. After passing through the turbines, the steam is condensed by moving it through a condenser. The overall thermal efficiency of each unit is about 35 percent (TVA 1996b). The condenser is in turn cooled by a direct open cooling system (or mode) using diffusers supplemented by a helper or closed system (or mode) that uses natural-draft, evaporative cooling towers (TVA 1996b). However, the cooling towers have only been used for approximately 2 percent of the plant's operating time (TVA 1998a) to meet thermal discharge limits. The direct open cooling system uses a diffuser system which discharges cooling water to the Tennessee River from diffuser pipes. One diffuser pipe is

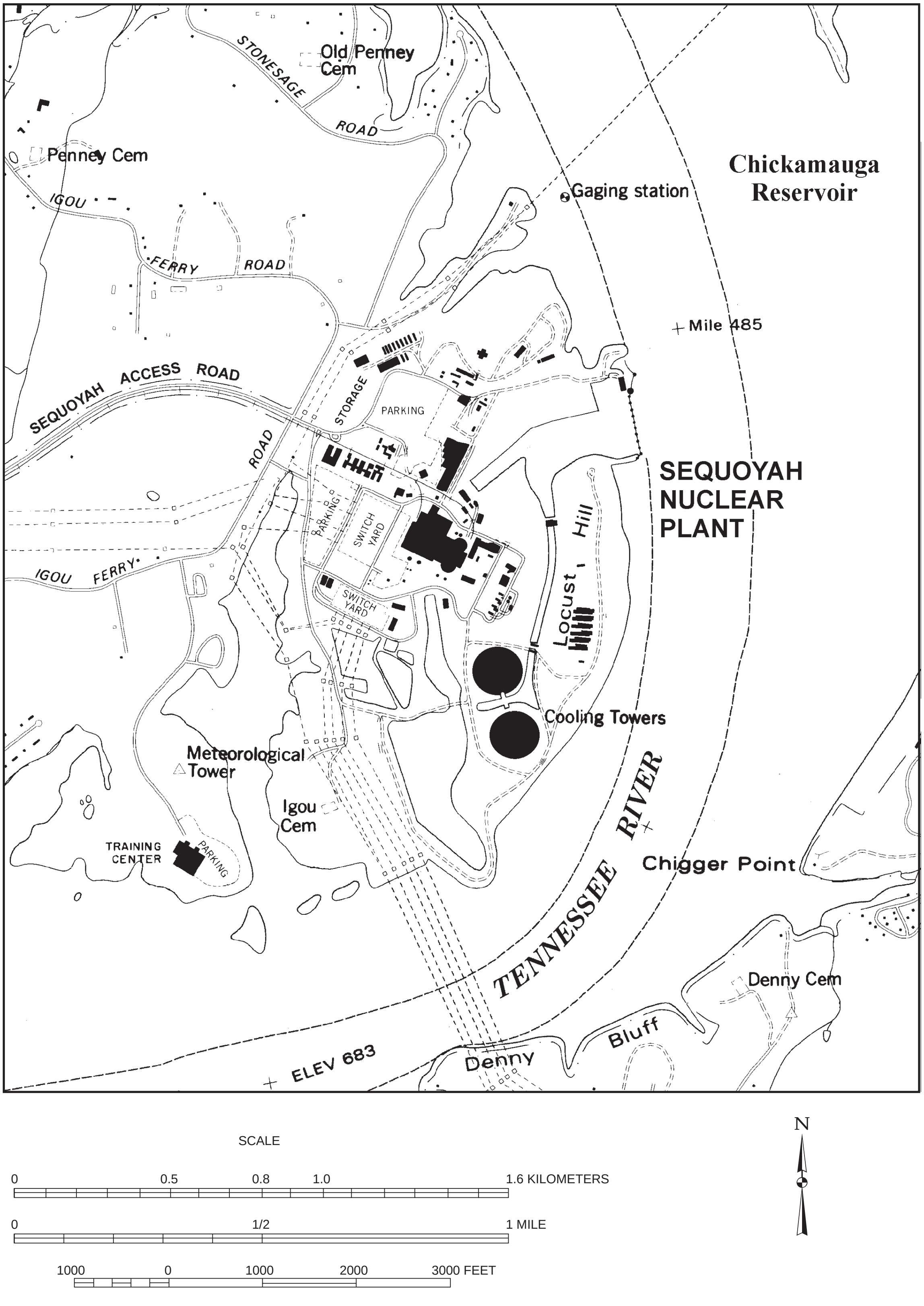

Figure 3–6 Sequoyah Nuclear Plant

4.9 meters (16 feet) in diameter and extends 107 meters (350 feet), while the other diffuser pipe is 5.2 meters (17 feet) in diameter and extends 213 meters (700 feet). These two pipes are perforated with about twelve thousand 5-centimeter (2-inch) ports through which water is discharged into the river for maximum thermal mixing. This reduces the average river water temperature rise to less than 5.6°C (10°F) (TVA 1996c).

Cooling towers can be used in the helper mode, in which they discharge water through the diffuser pipes into the river, or in the closed mode. When the supplemental cooling tower system is used in the closed mode of operation, makeup water from the Tennessee River is needed to replace water losses from evaporation, drift, and blowdown. When the cooling towers are used in the closed mode, cooling is accomplished in the same manner as described for Watts Bar 1 in Section 3.2.5.1.

When the reactor is at full power, the temperature of the water flowing through each condenser is raised by approximately 17°C (30°F) (TVA 1996b). The open cooling mode using the diffuser pipes withdraws and returns 4,250,000 liters per minute (1,222,000 gallons per minute) with two units operating (TVA 1974a). In the cooling tower closed- cycle cooling mode, water lost through evaporation, small leaks, drift, and blowdown is made up by withdrawing approximately 249,745 liters per minute (65,978 gallons per minute) (TVA 1974a) from the Tennessee River. Blowdown from a natural-draft cooling tower is discharged into the Tennessee River at a normal rate of 120,000 liters per minute (31,700 gallons per minute) (TVA 1974a). Diffusers are used to mix the blowdown with river water, thus limiting the temperature rise after mixing to less than 5.6°C (10°F) (TVA 1996c). This water is discharged under a NPDES Permit (TN DEC 1993a). Tritium production would not affect the thermal discharge characteristics of the plant.

Operation of the plant produces radioactive fission products and activates corrosion products in the reactor coolant system. Small amounts of these radioactive products enter the plant cooling water. Radionuclides are removed from the cooling water through a chemical water treatment system. The gases and liquids are processed and monitored within the facility to minimize the radioactive nuclides released to the atmosphere and into the Tennessee River. Radioactive waste is produced in this treatment system. The total Sequoyah 1 or Sequoyah 2 liquid contaminant release to the environment during normal operation is identified in **Table 3–8**.

Table 3–8 Annual Liquid Releases to the Environment from Operating Sequoyah 1 or Sequoyah 2

Materials	***Quantity***
Chemicals (kilograms)	294,012 [a]
Tritium (Curies)	714 [b]
Other Radionuclides (Curies)	1.15 [b]

[a] TVA 1996b.
[b] TVA 1998e, TVA 1999.

Gaseous wastes are managed in the same manner as described for Watts Bar 1 in Section 3.2.5.1. Gaseous emissions from the plant are summarized in **Table 3–9**.

Table 3–9 Summary of Annual Sequoyah 1 or Sequoyah 2 Gaseous Emissions

Constituent	Quantity
Particulate matter (kilograms)	26,225 [a]
Carbon monoxide (kilograms)	22,194 [a]
Sulfur dioxide (kilograms)	11,335 [a]
Nitrogen dioxide (kilograms)	86,928 [a]
Volatile organic compounds (kilograms)	2,377 [a]
Hazardous air pollutants (kilograms)	171 [a]
Tritium (Curies)	25 [b]
Other radionuclides (Curies)	120 [b]

[a] TVA 1998a.
[b] TVA 1998e, TVA 1999.

Several hazardous substances and chemicals are used regularly during plant operation. This results in the generation of hazardous waste, which is controlled, stored, and managed in accordance with Resource Conservation and Recovery Act guidelines. This waste is disposed of off site at Resource Conservation and Recovery Act-permitted treatment and disposal facilities. Solid waste such as noncontaminated clothing, rags, waste paper, boxes, and uncontaminated filters is also generated regularly and disposed of as solid waste. The waste generation volumes for Sequoyah 1 or Sequoyah 2 during normal operation are summarized in **Table 3–10**.

Table 3–10 Summary of Annual Sequoyah 1 or Sequoyah 2 Waste and Spent Fuel Generation Rates

Waste Type	Volume or Mass
Hazardous waste (cubic meters)	1.196
Nonhazardous solid waste (kilograms)	1,301,966
Low-level radioactive waste (cubic meters)	383
Mixed low-level radioactive waste (cubic meters)	less than 1
Spent fuel assemblies (per 18-month operating cycle)	80

Sources: TVA 1974a, TVA 1996b.

The reactors are shut down for refueling and maintenance as part of a normal fuel cycle of 18 months. During this shutdown period, the irradiated TPBARs/spent fuel assemblies would be removed from the reactors and placed in the spent fuel pool for cooling. After approximately one to two months, these TPBARs would be removed from the fuel assemblies, loaded into transportation casks, and sent to the proposed Tritium Extraction Facility at the Savannah River Site for tritium extraction and purification.

3.2.5.3 Bellefonte Nuclear Plant Units 1 and 2

Bellefonte 1 and 2 are partially completed pressurized water reactors. They are situated on approximately 607 hectares (1,500 acres) (TVA 1997f) on a peninsula at Tennessee River Mile 392, on the west shore of Guntersville Reservoir, about 11.3 kilometers (7 miles) northeast of Scottsboro, Alabama (TVA 1991). The main land uses of the surrounding area are forestry and agriculture; however, urban-industrial development has grown over the past several years around the plant along the Guntersville Reservoir. The affected environment at the Bellefonte Nuclear Plant site is described in Section 4.2.3. The general arrangement of the Bellefonte Nuclear Plant is shown in **Figure 3–7**.

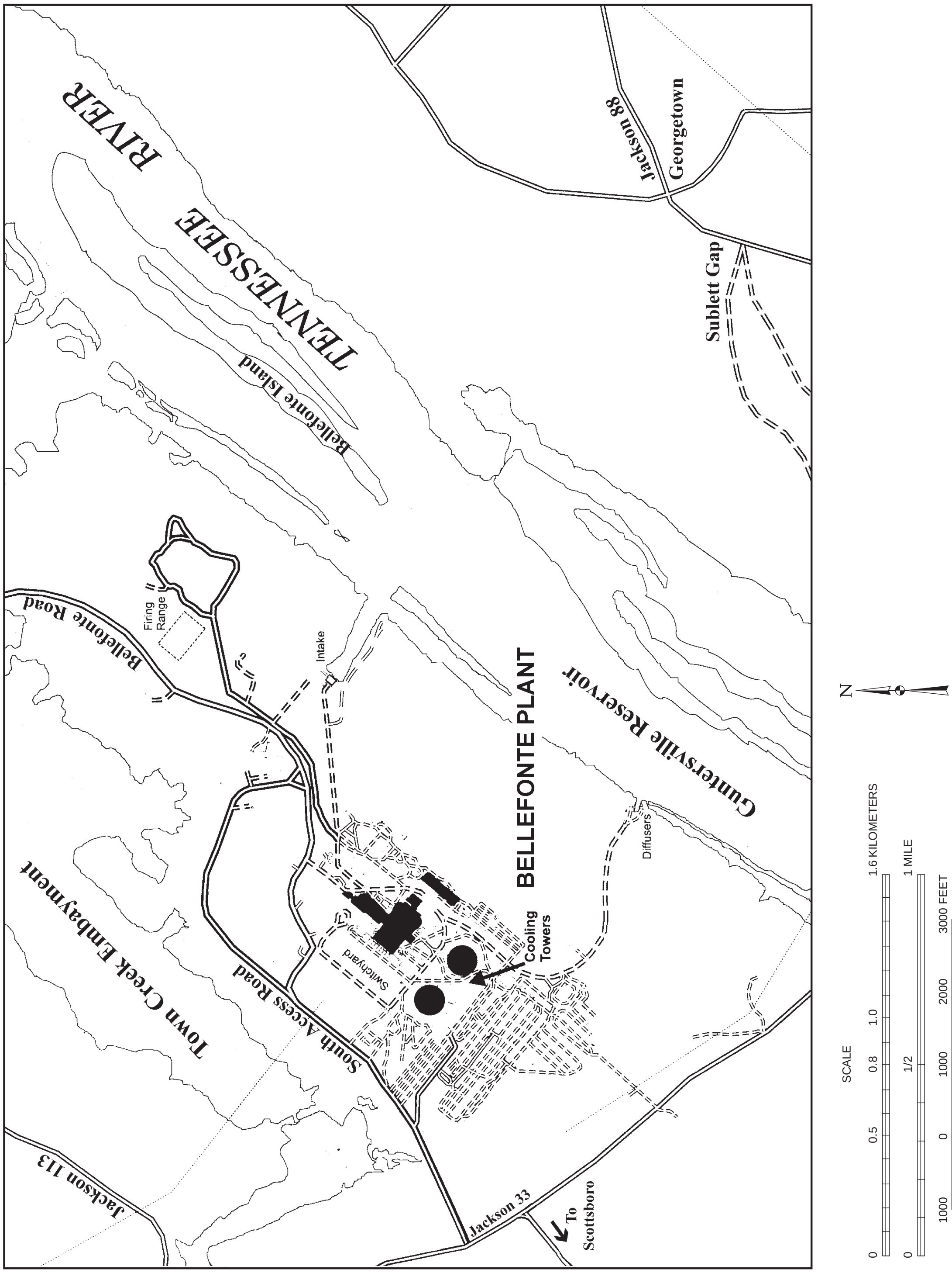

Figure 3–7 Bellefonte Nuclear Plant

The U.S. Atomic Energy Commission (now the NRC) issued the construction permit for the Bellefonte Nuclear Plant in December 1974 (NRC 1990), and construction started in February 1975. On July 29, 1988, TVA notified the NRC that Bellefonte was being deferred as a result of a lower load forecast for the near future (TVA 1988). After three years of extensive study, TVA notified the NRC on March 23, 1993, of its plans to complete Bellefonte 1 and 2 (TVA 1994a). In December 1994, TVA announced that Bellefonte would not be completed as a nuclear plant without a partner and put further activities on hold until a comprehensive evaluation of TVA's power needs was completed. On April 29, 1996, TVA issued a Notice of Intent to prepare an EIS for the proposed conversion of the Bellefonte Nuclear Plant to a fossil fuel facility. The *Final Environmental Impact Statement for the Bellefonte Conversion Project*, which analyzed alternatives for such a conversion, was issued in October 1997 (TVA 1997f). A Record of Decision for that EIS will not be made until it is determined whether Bellefonte 1 or both Bellefonte 1 and 2 will be used for tritium production.

The plant structures presently consist of two reactor containment buildings; a control building; a turbine building; an auxiliary building; a service building; a condenser circulating water pumping station; two diesel generator buildings; a river intake pumping station; two natural-draft cooling towers; a transformer yard; a 500-kilovolt switchyard and a 161-kilovolt switchyard; a spent nuclear fuel storage pool; and sewage treatment facilities (TVA 1991). Additionally, there are office buildings to house engineering and other department personnel. Entrance roads, parking lots, railroad spurs, and a helicopter landing pad are in place and are capable of supporting a construction project.

No modifications to the original design should be necessary to complete Bellefonte 1 or Bellefonte 2 for operation, with or without TPBARs.

The plant systems and structures are maintained through active layup and preservation. Program activities include the following:

- Each unit's main turbine generators are rotated every other week.
- The diesel fire pumps are maintained in an operational status and are run monthly.
- The shell and tube sides of the main condensers (heat exchangers) are kept dry, and the tube side is maintained with a flow of warm, dehumidified air.
- The reactor coolant system is kept dry using a flow of warm, dehumidified air.

A workforce of approximately 80 personnel supports layup and preservation of the plant. Of that number, 38 are involved in operations and maintenance (TVA 1998e).

To complete Bellefonte 1 or both Bellefonte 1 and 2, additional engineering and construction activities would be required (TVA 1998a). These activities are summarized in the following paragraphs.

Engineering

Engineering for the original Bellefonte Nuclear Plant design is substantially complete. The additional engineering effort consists of completing analysis and design modifications that were not completed prior to deferral to update the design-basis documentation to current industry standards, as well as supporting construction, startup, and licensing of the plant. More specifically, the remaining engineering effort for Bellefonte 1 and 2 includes, but is not limited to, the following:

- Issuing detailed design modifications for certain mechanical and electrical systems to meet current requirements

- Updating the main control room drawings into computer-aided design electronic format
- Reviewing the control room design and upgrading the simulator and plant computers
- Reanalyzing piping and pipe supports
- Resolving industry issues (e.g., fire protection, electrical equipment qualification, station blackout, site security, communications, motor-operated valves) that were either not completed prior to deferral in 1988 or have arisen since deferral
- Developing fuel assembly and fuel cycle designs to facilitate the production of tritium
- Supporting submittals of the Final Safety Analysis Report and completing previous NRC position papers
- Supporting field change requests by the constructor

Construction

Construction activities required to complete Bellefonte 1 and 2 include, but are not limited to, the following:

- Completing the application of protective coatings to structures, piping, and components and the installation of piping insulation
- Installing the Bellefonte 2 reactor coolant pump internals and motors [Some (less than 10 percent) of Bellefonte 1 reactor coolant instrumentation and pipe supports would have to be installed.]
- Installing limited major piping and components in the balance of the plant for Bellefonte 2
- Installing the steam piping for Bellefonte 2
- Installing and energizing a limited amount of the electric power equipment within the plant [The 161-kilovolt and 500-kilovolt offsite transmission lines are terminated in the switchyard, which is complete and energized.]
- Completing the Bellefonte 2 main control room [Substantial work would be required because the Bellefonte 1 main control room, although not complete, is functional and manned to monitor the ongoing preservation activities. The recommendations of the Control Room Design review would be factored into efforts to complete construction of both control rooms.]
- Preparing the intake structure for operation by desilting the intake water pump
- Constructing some new support buildings and installing additional equipment

In addition to the engineering and construction activities, completion and operation of Bellefonte 1 or both Bellefonte 1 and 2 would require NRC licensing, startup testing, and operations staffing and training.

Estimates of the resources required to complete Bellefonte 1 and both Bellefonte 1 and 2 are provided in **Table 3–11**. Bellefonte 2 would require fewer resources than Bellefonte 1 because some facilities constructed for Bellefonte 1 are in common with Bellefonte 2.

Table 3–11 Summary of Resources Required to Complete Construction of Bellefonte 1 or Bellefonte 1 and 2

Resources	*Bellefonte 1*	*Bellefonte 1 and 2*
Employment, peak year	4,500	4,500
Length of time (years)	5	6.5
Electricity (megawatt-hours)	575,000	1,075,000
Water (cubic meters)	280,000	440,000
Concrete (cubic meters)	2,190	3,981
Steel (metric tons)	353	451
Fuel (liters)	9.7×10^{6}	1.4×10^{7}
Industrial gases (cubic meters)	500	1,800

Source: TVA 1995b.

For tritium production, approximately 3,400 TPBARs could be placed in the reactor core(s) of Bellefonte 1 or both Bellefonte 1 and 2, occupying the same fuel assembly guide tube locations that would otherwise have held standard burnable absorber rods.

During normal operation, one unit would employ approximately 800; both units would employ 1,000 (TVA 1998a). Less than 10 additional employees per unit would be needed for normal operations with tritium production. If either or both units were completed, each reactor containment building would house a pressurized water reactor designed and manufactured by Framatome Technologies, Inc. The general design specifications of the plant are provided in **Table 3–12**.

Table 3–12 General Design Specifications of Bellefonte 1 or Bellefonte 2

Criteria	*Quantity*
Core thermal power level (megawatts-thermal)	3,600
Plant capacity factor	0.80
Total steam flow (pounds per hour)	1.609×10^{7}
Electrical generation (megawatts-electric)	1,212
Normal operating cycle (months)	18
Size of full core fuel load	205 fuel assemblies (93.5 metric tons of uranium)

Source: TVA 1991.

During operation, heat released from the fissioning fuel would be transported by the reactor cooling water to the steam generators. After passing through the turbines, the steam would be condensed by moving it through a condenser cooled by recirculated water. The overall thermal efficiency of an operation unit is expected to be about 34 percent (TVA 1991). This water would in turn be cooled by passing through a natural-draft evaporative cooling tower. Although the cooling system would be of the (so-called) closed type, makeup water from the Tennessee River (Guntersville Reservoir) would be needed to replace water losses due to evaporation, drift, and blowdown. Cooling would be accomplished in the same manner as described for Watts Bar 1 in Section 3.2.5.1.

At full power, the temperature of the water flowing through a condenser would be raised by approximately 20°C (36°F) (ADEM 1992). In the cooling tower closed-cycle cooling mode, water lost (from both units) through evaporation, small leaks, drift, and blowdown would be made up by withdrawing approximately 252,000 liters per minute (66,600 gallons per minute) from the Guntersville Reservoir (TVA 1978).

Blowdown from the natural-draft cooling towers would be discharged into the Guntersville Reservoir at a normal rate of 2.1 cubic meters per second (74 cubic feet per second) (TVA 1974b). A diffuser would be used to mix the blowdown with reservoir water and thus limit the temperature rise after mixing to less than 3°C (5°F) (TVA 1978). This water would be discharged under a NPDES Permit (ADEM 1992).

Operation of the plant would produce radioactive fission products and activate corrosion products in the reactor coolant system. Small amounts of these radioactive products would enter the cooling water of the plant. Radionuclides would be removed from the cooling water through a chemical water treatment system. The gases and liquids would be processed and monitored within the facility to minimize the radioactive nuclides released to the atmosphere and into the Guntersville Reservoir. Radioactive waste would be generated in this treatment system.

The gaseous emissions would be managed in the same manner as described for Watts Bar 1 in Section 3.2.5.1. The projected nonradiological gaseous releases at Bellefonte 1 and 2, with the units at full power, would be similar to those for Watts Bar 1 and Sequoyah 1 and 2.

Several hazardous substances and chemicals would be used regularly in the operation of the plant. This is expected to result in the generation of hazardous waste that will be controlled, stored, and managed in accordance with the Resource Conservation and Recovery Act and disposed of off site at Resource Conservation and Recovery Act-permitted treatment and disposal facilities. Solid waste such as noncontaminated clothing, rags, waste paper, boxes, and uncontaminated filters should also be generated regularly and disposed of as solid waste.

The reactors would be shut down for refueling and maintenance after operating for approximately 18 months. During this shutdown period, the irradiated TPBARs would be removed from the reactor and placed in the spent fuel pool for cooling. After one to two months, the TPBARs separated from the hold-down assemblies would be loaded into transportation casks and sent to the proposed Tritium Extraction Facility at the Savannah River Site for tritium extraction and purification.

3.2.6 Comparison of Alternatives

To aid the reader in understanding the differences among the various alternatives, this section presents a comparison of the environmental impacts associated with tritium production at each of the reactor plants. The comparisons concentrate on those resources that would most likely be impacted.

The information in this section is based on the environmental consequences described in Chapter 5 of this EIS. For the five TVA reactors being considered for tritium production (Watts Bar 1, Sequoyah 1, Sequoyah 2, Bellefonte 1, and Bellefonte 2), impacts are presented for the bounding case (i.e., the maximum number of TPBARs that could be irradiated in a reactor). For those cases in which impacts would be significantly different for a lesser number of TPBARs, an explanation is provided. The impacts of using more than one CLWR for tritium production can be determined by adding the impacts of each individual CLWR together. The impacts of not producing tritium at any of these five reactors (the No Action Alternative) are presented first as a baseline against which to compare the impacts of producing tritium. A summary of the environmental consequences is presented in **Table 3–13** at the end of this chapter. In addition, **Table 3–14** contains a comparison of the environmental impacts between tritium production in a CLWR and the accelerator at the Savannah River Site.

3.2.6.1 No Action Alternative Impacts

Construction

Watts Bar 1 and Sequoyah 1 and 2. Under the No Action Alternative, Watts Bar 1 and Sequoyah 1 and 2 would continue to produce electricity, and no construction impacts would occur.

Bellefonte 1 and 2. Under the No Action Alternative, Bellefonte 1 and 2 would remain in deferred status, and no construction impacts would occur. TVA could also convert Bellefonte 1 and 2 to a fossil fuel plant, as described in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997f) (see Section 1.5.2.4). Such conversion would be independent of this EIS and would not occur until a decision is made regarding the role of Bellefonte 1 and 2 in tritium production.

Operation

Watts Bar 1 and Sequoyah 1 and 2. Under the No Action Alternative, Watts Bar 1 and Sequoyah 1 and 2 would continue to produce electricity for the foreseeable future, and there would be no changes in the type and magnitude of environmental impacts that currently occur. In producing electricity, these reactor plants would continue to comply with all Federal, state, and local requirements. Impacts associated with the continued operation of Watts Bar 1 and Sequoyah 1 and 2 are described in the following paragraphs.

Under the No Action Alternative, water requirements at all three plants would continue to be met by existing water resources with no additional impacts, and water quality would not change, but would remain within regulatory limits. Air quality would also remain within regulatory limits. Worker employment should remain steady at each of the sites, with no major changes to the regional economic areas as a result of plant operation. Worker exposure to radiation should remain well under the regulatory limit of 5 rem per year, with the average worker dose at approximately 90 to 100 millirems per year. Radiation exposure of the public from normal operations would also remain well within regulatory limits (3 rem per year) for each of the reactor sites. At Watts Bar 1, the total dose to the population within 80 kilometers (50 miles) would be approximately 0.55 person-rem (see Chapter 10, *Glossary*, for definition) per year. Statistically, this equates to one fatal cancer approximately every 3,570 years from operation of Watts Bar 1. At Sequoyah 1 or Sequoyah 2, the total dose to the population within 80 kilometers (50 miles) would be approximately 1.6 person-rem per year. Statistically, this equates to one fatal cancer approximately every 1,250 years from the operation of Sequoyah 1 or 2. Risks of accidents would remain unchanged.

Under the No Action Alternative, all categories of wastes would continue to be generated at each of the reactor plants, and they would be managed in accordance with regulations. Low-level radioactive wastes would continue to be generated at a rate of approximately 40 (Watts Bar 1) to 383 (Sequoyah 1 or Sequoyah 2) cubic meters per year and would be disposed of at the Barnwell disposal facility. For each of the reactors, spent fuel would also continue to be generated at a rate of approximately 80 fuel assemblies per year. Spent fuel would continue to be managed at each of the reactor plants in compliance with all regulatory requirements.

Bellefonte 1 and 2. Under the No Action Alternative, Bellefonte 1 and 2 would remain uncompleted nuclear reactors, and the impacts on the environment would not change.

3.2.6.2 Impacts Associated with Tritium Production

Construction

Watts Bar 1 and Sequoyah 1 and 2. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, an ISFSI eventually could be required for Watts Bar 1, Sequoyah 1, or

Sequoyah 2 to support tritium production. This could be the only construction necessary for tritium production. If such a facility were to be constructed, it would consist of three reinforced concrete slabs covering approximately 3.5 acres. Approximately 60-80 horizontal storage modules, each made of reinforced concrete, could be housed on the slabs. These horizontal storage modules would have a hollow internal cavity to accommodate a stainless steel cylindrical cask that would contain the spent nuclear fuel. Constructing such a facility would disturb approximately 5 acres and require approximately 50 construction workers. Premixed concrete would be used, and impacts to air quality, water, and biotic resources are expected to be small. Appropriate NEPA documentation would be prepared prior to the construction of a dry cask spent fuel storage facility.

Bellefonte 1 and 2. All major structures (e.g., containment buildings, cooling towers, turbine buildings, support facilities) have been constructed, so construction activities would consist largely of internal modifications to the existing facilities. No additional land would be disturbed in completing construction, and there would be no impacts on visual resources, biotic resources (including threatened and endangered species), geology and soils, and archaeological and historic resources. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility would eventually be required at Bellefonte 1 and 2. The impacts of constructing such a spent fuel storage facility would be similar to those described above for Watts Bar 1, Sequoyah 1, or Sequoyah 2. Appropriate NEPA documentation would be prepared before the construction.

Completing construction of Bellefonte 1 would have the greatest impact on socioeconomics, with construction activities taking place between 1999 and 2004. During the peak year of construction (2002), approximately 4,500 direct jobs could be created. As many as 4,500 secondary jobs (indirect jobs) also could be created. The total new jobs (9,000) could cause the regional economic area unemployment rate to decrease to approximately 4 percent from the current rate of 8.2 percent. Public finance expenditures/revenues could increase by over 30 percent in Scottsboro and about 15 percent in Jackson County. Rental vacancies could decline to near zero, and demand for all types of housing could increase substantially. Rents and housing prices could increase at double-digit percentage levels.

If Bellefonte 2 were also selected for completion, construction activities for both units would be drawn out, taking place between 1999 and 2005. The peak year of construction would shift, but the total number of direct and indirect jobs would be the same. The effects, therefore, on unemployment, public finance, rents, and housing prices would be the same as for the construction completion of Bellefonte 1.

Operation

Watts Bar 1 and Sequoyah 1 and 2. In a tritium production mode, these operating reactors would continue to comply with all Federal, state, and local requirements. Tritium production would have little or no effect on land use, visual resources, water use and quality, air quality, archaeological and historic resources, biotic resources (including threatened and endangered species), and socioeconomics. It could, however, have some incremental impacts in the following areas: radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation. Tritium production could also change the accident and transportation risks associated with these reactors. Each of these areas is discussed below.

Radiation Exposure Tritium production could increase average annual worker radiation exposure by approximately 0.82–1.1 millirem per year. The resultant dose would be well within regulatory limits. Radiation exposure to the public from normal operations could also increase, but still would remain well within regulatory limits at each of the reactor sites. At either Watts Bar 1, Sequoyah 1, or Sequoyah 2, the total dose to the population within 80 kilometers (50 miles) could increase by a maximum of 1.9 person-rem per year. Statistically, this equates to one additional fatal cancer approximately every 1,000 years from the operation of Watts Bar 1, Sequoyah 1, or Sequoyah 2.

Spent Fuel Generation Given irradiation of 3,400 TPBARs (the maximum number of TPBARs without changing the reactor's fuel cycle), additional spent fuel would be generated at Watts Bar 1, Sequoyah 1, or Sequoyah 2. In the average 18-month fuel cycle, spent fuel generation could increase from approximately 80 spent fuel assemblies up to a maximum of 140, a 71 percent increase in spent fuel generation over the No Action Alternative. Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility eventually would be needed. Storing the additional spent fuel should have minor impacts. Radiation exposures would remain below regulatory limits for both workers and the public, and less than 4 cubic feet of low-level radioactive waste would be generated annually. The impacts of accidents associated with dry cask spent fuel storage would be small. As previously mentioned, appropriate NEPA documentation would be prepared before the construction of a dry cask spent fuel storage facility at Watts Bar 1, Sequoyah 1, or Sequoyah 2. If fewer than approximately 2,000 TPBARs were irradiated, there would be no change in the amount of spent fuel produced by the reactors.

Low-Level Radioactive Waste Generation Compared to the No Action Alternative, tritium production at Watts Bar 1, Sequoyah 1, or Sequoyah 2 would generate approximately 0.43 additional cubic meters per year of low-level radioactive waste. This would be a 0.1 (Sequoyah 1 or Sequoyah 2) to 1.0 (Watts Bar 1) percent increase in low-level radioactive waste generation over the No Action Alternative. Such an increase would amount to less than 1 percent of the low-level radioactive waste disposed of at the Barnwell disposal facility. The EIS also analyzes the impacts of this low-level radioactive waste disposal at the Savannah River Site. Disposing of 0.43 cubic meters per year of low-level radioactive waste would amount to less than 1 percent of the low-level radioactive waste disposed of at the Savannah River Site and less than 1 percent of the landfill's capacity.

Accident Risks Tritium production could change the potential risks associated with accidents at Watts Bar 1, Sequoyah 1, or Sequoyah 2. As described in the following text, these changes would be small. Potential impacts from accidents were determined using computer modeling. If a limiting design-basis accident occurred, tritium production at the 3,400-TPBAR level would increase the individual risk of a fatal cancer by 1.4×10^{-9} to an individual living within 80 kilometers (50 miles) of Watts Bar 1. Statistically, this equates to a risk to the individual of one fatal cancer approximately every 710 million years from tritium production. For an individual living within 80 kilometers (50 miles) of Sequoyah 1 or Sequoyah 2, there would be a 2.1×10^{-9} increased likelihood of a cancer fatality to an individual from a design-basis accident as a result of tritium production. Statistically, this equates to a risk to an individual of one additional fatal cancer approximately every 480 million years from tritium production. For a beyond design-basis accident (an accident that has a probability of occurring approximately once in a million years or less), tritium production would result in small changes in the consequences of an accident. This is due to the fact that the potential consequences of such an accident would be dominated by radionuclides other than tritium.

Transportation Tritium production at either Watts Bar 1, Sequoyah 1, or Sequoyah 2 would necessitate additional transportation to and from the reactor plants. Most of the additional transportation would involve nonradiological materials. Impacts would be limited to toxic vehicle emissions and traffic fatalities. At each of these reactors, the transportation risks would be less than one fatality per year. Radiological materials transportation impacts would include routine and accidental doses of radioactivity. The risks associated with radiological materials transportation would be less than one fatality per 100,000 years.

Bellefonte 1 and 2. Because neither Bellefonte 1 or Bellefonte 2 are currently operating, this EIS assesses the impacts of completing construction and operating these units for tritium production. Consequently, environmental impacts would occur in the following resources: visual resources, water use, biotic resources, socioeconomics, radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation. Tritium production would also change the accident and transportation risks associated with these reactors.

During operations, Bellefonte 1 and 2 would produce vapor plumes from cooling towers that would be visible up to 10 miles away. These plumes could create an aesthetic impact on the towns of Pisgah, Hollywood, and Scottsboro, Alabama.

During operation, Bellefonte 1 and 2 each would use less than 0.5 percent of the river flow from Guntersville Reservoir and would not have any adverse impacts on other users. Discharges from the plants would be treated and monitored before release and would comply with NPDES permits. Impacts on water quality would be minimal, and no standards would be exceeded. Operation of either Bellefonte 1 or both Bellefonte 1 and 2 for tritium production would have some effects on ecological resources typical to the operation of a nuclear power plant, regardless of tritium production. Impacts on ecological resources from the operation of Bellefonte 1 or both Bellefonte 1 and 2 would result from radioactive and nonradioactive emissions of air pollutants to the atmosphere; thermal, chemical, and radioactive effluent releases to surface waters; increases in human activity; and increases in noise levels. These impacts would be small, considering that the units would operate in compliance with all Federal, state, and local requirements specifically promulgated to protect environmental resources. The estimated radiological doses to terrestrial and aquatic organisms are well below levels that could have any impact on plants or terrestrial and aquatic animals at the site. Other possible environmental impacts on the aquatic ecosystem of Guntersville Reservoir due to operation of the Bellefonte units would include fish losses at the cooling water intake screens, almost total loss of unscreened entrained organisms, and effects of thermal and chemical discharges. The effects of both thermal and chemical discharges would be small, as these discharges would comply with NPDES limitations.

Socioeconomics During operations, approximately 800 direct jobs would be created at Bellefonte 1, along with approximately an equal number of indirect jobs. The total new jobs (approximately 1,600) would cause the regional economic area unemployment rate to decrease to approximately 6.2 percent. Public finance expenditures/revenues would decline from the levels achieved during construction, but would remain 10 to 15 percent higher than they would be otherwise at Scottsboro and 5 to 10 percent higher in Jackson County. Housing prices would decline and could fall below the precompletion prices, depending on how much new construction of permanent housing took place during the completion period and how many construction workers chose to remain in the area once construction was completed. If Bellefonte 2 were also completed, a total of approximately 1,000 direct jobs would be created along with approximately 1,000 indirect jobs.

Radiation Exposure Reactor operations to produce tritium would cause worker radiation exposure to increase from 0 to approximately 105 millirem per year. This resultant dose would be well within regulatory limits of 5,000 millirem per year. Radiation exposure to the maximally exposed individual from normal operations would increase from 0 to 0.28 millirem. The total dose to the population within 80 kilometers (50 miles) would increase from approximately 0 to approximately 2.3 person-rem per year for Bellefonte 1. If Bellefonte 2 also were operating, this dose would be approximately 4.6 person-rem per year. Statistically, this equates to one fatal cancer approximately every 435 years from the operation of Bellefonte 1 and 2.

Spent Fuel Generation Given production of the maximum amount of tritium in the average 18-month fuel cycle, spent fuel generation would increase from 0 up to a maximum of 141 spent fuel assemblies (i.e., 69 fuel assemblies over the normal refueling size). Because this EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility could eventually be needed to store the additional assemblies. The impacts of storing the spent fuel in a dry cask spent fuel storage facility are described above for the existing operating reactor plants. As previously mentioned, appropriate NEPA documentation would be prepared before the construction of a dry cask spent fuel storage facility.

Low-Level Radioactive Waste Generation Compared to the No Action Alternative, reactor operation to produce tritium at Bellefonte 1 or Bellefonte 2 would generate approximately 40 cubic meters (80 cubic meters for both units) of low-level radioactive waste. This quantity would be a small fraction of the landfill capacity at the Barnwell disposal facility or the Savannah River Site's low-level radioactive waste disposal facility.

Accident Risks Compared to the No Action Alternative, there is a significant change in potential risks from tritium production. Risks due to accidents would increase during the construction and operation of Bellefonte 1 and 2, and during the operation of these units for production of tritium. Similar to Watts Bar 1 and Sequoyah 1 and 2, the potential impacts from the accidents at Bellefonte 1 or Bellefonte 2 were determined using computer modeling. If a limiting design-basis accident occurred, tritium production would increase the individual risk of a fatal cancer by 8.0×10^{-10} additional fatal cancers to an individual living within 80 kilometers (50 miles) of the units. Statistically this means that, for one individual, one fatal cancer would occur approximately every 1.3 billion years from tritium production at Bellefonte. If a beyond design-basis accident occurred (an accident that has a probability of occurring approximately once in a million years or less), tritium production would increase the risk of a fatal cancer by 0.00010 additional fatal cancers to an individual living within 80 kilometers (50 miles) of the Bellefonte Nuclear Plant.

Transportation Tritium production at either Bellefonte 1 or 2 would necessitate transportation of workers, construction material, and radiological and nonradiological material to and from the reactor plants. Most of the additional transportation would involve nonradiological materials. Impacts of this transportation are limited to toxic vehicle emissions and traffic fatalities. For Bellefonte 1 or 2, the transportation risks would be significantly lower than one fatality per year. Radiological materials transportation impacts would occur as a result of routine and accidental doses. In all instances the risks associated with radiological materials transportation would be less than one fatality per 100,000 years.

3.2.7 Preferred Alternative

The Council on Environmental Quality regulations require that an agency identify its Preferred Alternative(s) in the Final EIS (40 CFR 1502.14e). The Preferred Alternative is defined as the alternative that the agency believes would fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. This EIS provides information on the environmental impacts. Cost, schedule, and technical analyses will be discussed in the Record of Decision for the EIS. DOE has identified the purchase of irradiation services from the Watts Bar and Sequoyah reactor facilities as the Preferred Alternative for the production of tritium in a CLWR. Under the Preferred Alternative, no more than 3,400 TPBARs would be irradiated in a single reactor per each refueling cycle. In implementing the Preferred Alternative, DOE and TVA would minimize, to the extent practicable, the generation of additional spent nuclear fuel.

Table 3–13 Summary of Environmental Consequences for the CLWR Reactor Alternatives

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
	No Action		
All Resource/Material Categories	No construction or operational changes. Reactor unit continues to produce electricity. No change in environmental impacts.	No construction or operational changes. Reactor units continue to produce electricity. No change in environmental impacts.	No construction or operational changes. Reactor units remain uncompleted. No change in environmental impacts.
	Annual Tritium Production		
Land Resources Land Use	*Construction:* Potential land disturbance - 5.3 acres for dry cask ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.1 acres for ISFSI if constructed.	*Construction:* Potential land disturbance - 5.47 acres for ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.2 acres for ISFSI if constructed.	*Construction:* Potential land disturbance - 4.9 acres for ISFSI if constructed and additional land for support buildings. *Operation:* Potential permanent land requirement - 3.4 acres for ISFSI if constructed and additional land for support buildings.
Visual Resources	*Construction and Operation:* No additional impact to visual resources.	*Construction and Operation:* No additional impact to visual resources.	*Construction:* No additional impact to visual resources. *Operation:* Cooling tower vapor plumes would be visible up to 10 miles away.
Noise	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels except for construction vehicle traffic. Small impacts if an ISFSI is constructed. *Operation:* Increase in noise levels from 50 dBA (decibels A-weighted) to 51 dBA at nearest receptor. Increase in traffic noise on onsite access roads from 50 dBA to 57 dBA due to commuter traffic and truck deliveries.

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
Air Quality Nonradioactive Emissions	*Construction:* No change from current air quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* No change from current air quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* Potential temporary dust emissions during construction. Small impacts if an ISFSI is constructed. *Operation:* The increase in nonradioactive air pollutant concentrations would be well within established standards.
Air Quality Radioactive Emissions	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radioactive emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 106 Curies; given 3,400 TPBARs, 346 Curies, of which 5.6 Curies would be from normal operation without tritium production. The release of other radioactive emissions would be 283 Curies.
Water Resources Surface Water	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change to current surface water requirements.	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change to current surface water requirements.	*Construction:* Potential for increased stormwater runoff. Small amount of surface water requirements. Small impacts if an ISFSI is constructed. *Operation:* Increased surface water requirements and discharge. Water usage less than 1 percent of Tennessee River flow per year. All water quality parameters within established limits.

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
Water Resources (cont'd) Radioactive Effluent	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 900 Curies; given 3,400 TPBARs, 3,060 Curies. Tritium concentration will remain well below the EPA limit of 20,000 picocuries per liter.	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 900 Curies; given 3,400 TPBARs, 3,060 Curies. Tritium concentration will remain well below the EPA limit of 20,000 picocuries per liter.	*Construction:* No radioactive effluents. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive tritium effluents would be 1,539 Curies; given 3,400 TPBARs, 3,699 Curies, of which 639 Curies would be from normal operation without tritium production. The release of other radioactive effluents would be 1.32 Curies. Tritium concentration will remain well below the EPA limit of 20,000 picocuries per liter.
Groundwater	*Construction:* No groundwater requirements or additional impacts to groundwater quality conditions. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* No groundwater requirements or additional impacts to groundwater quality conditions. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Groundwater would not be used during construction. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.
Ecological Resources	*Construction*: No additional impacts on ecological resources. Small impacts if an ISFSI is constructed. *Operation*: Small or no impacts to ecological resources from additional tritium releases.	*Construction*: No additional impacts on ecological resources. Small impacts if an ISFSI is constructed. *Operation*: Small or no impacts to ecological resources from additional tritium release.	*Construction:* Potential impacts to ecological resources due to the small amount of land disturbance. Small impacts if an ISFSI is constructed. *Operation:* Additional impacts on ecological resources, including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal plant operations.

Resource/Material Categories	*Watts Bar 1*	*Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 2*
Socioeconomics	*Construction:* No measurable impact. *Operation:* <1 percent impact on regional economy.	*Construction:* No measurable impact. *Operation:* <1 percent impact on regional economy.	*Construction:* 4,500 peak new direct jobs due to plant completion. Short-term increased costs and traffic for local jurisdictions. *Operation:* 800 to 1,000 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually), decrease in the unemployment rate (from 8.2 percent to approximately 6.2 percent), and minor impacts to school resources.
Public and Occupational Health and Safety Normal Operation	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 0.33 millirem. *Maximally Exposed Individual:* Dose increase by 0.013 millirem. *50-mile population:* Dose increase by 0.34 person-rem. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 1.1 millirem. *Maximally Exposed Individual:* Dose increase by 0.05 millirem. *50-mile population:* Dose increase by 1.2 person-rem.	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 0.24 millirem. *Maximally Exposed Individual:* Dose increase by 0.017 millirem. *50-mile population:* Dose increase by 0.57 person-rem. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 0.82 millirem. *Maximally Exposed Individual:* Dose increase by 0.057 millirem. *50-mile population:* Dose increase by 1.9 person-rem.	Annual dose for 1,000 TPBARs: *Workers:* Average dose increase by 104.33 millirem, of which 104 millirem would be from normal operations without tritium production. *Maximally Exposed Individual:* Dose increase by 0.263 millirem, of which 0.26 millirem would be from normal operations without tritium production. *50-mile population:* Dose increase by 1.6 person-rem, of which 1.4 person-rem would be from normal operations without tritium production. Annual dose for 3,400 TPBARs: *Workers:* Average dose increase by 105.1 millirem, of which 104 millirem would be from normal operations without tritium production. *Maximally Exposed Individual:* Dose increase by 0.28 millirem. *50-mile population:* Dose increase by 2.3 person-rem.

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production: For 1,000 TPBARs: *Maximally Exposed Individual:* 3.4×10^{-8} (1 fatality in 29 million years). *Average individual in population:* 4.0×10^{-10} (1 fatality in 2.5 billion years). *Exposed population*: 0.000074 (1 fatality in 13 thousand years). *Noninvolved worker:* 4.2×10^{-10} (1 fatality in 2.4 billion years).	Increased likelihood of a cancer fatality per year due to tritium production: For 1,000 TPBARs: *Maximally Exposed Individual:* 7.9×10^{-9} (1 fatality in 130 million years). *Average individual in population:* 6.1×10^{-10} (1 fatality in 1.6 billion years). *Exposed population*: 0.00015 (1 fatality in 6.6 thousand years). *Noninvolved worker:* 1.3×10^{-10} (1 fatality in 7.7 billion years).	Increased likelihood of a cancer fatality per year due to tritium production: For 1,000 TPBARs: *Maximally Exposed Individual:* 3.5×10^{-7} (1 fatality in 2.9 million years). *Average individual in population:* 2.6×10^{-10} (1 fatality in 3.8 billion years). *Exposed population*: 0.000070 (1 fatality in 14 thousand years). *Noninvolved worker:* 1.2×10^{-12} (1 fatality in 830 billion years).
	Involved worker, reactor design-basis accident: In the highly unlikely event the workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.	*Involved worker, reactor design-basis accident:* In the highly unlikely event the workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.	*Involved worker, reactor design-basis accident:* In the highly unlikely event the workers are in containment at the time of the accident they will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible. *Involved worker, nonreactor design-basis accident:* In the highly unlikely event that involved workers are in the immediate area of a rupture of the gas decay tank or associated piping, they could be injured by debris or the stream of gas from the rupture. In addition, involved workers could receive a radiation dose while evacuating the area. If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
	For 3,400 TPBARs: *Maximally Exposed Individual:* 1.1×10^{-7} (1 fatality in 9.1 million years). *Average individual in population:* 1.4×10^{-9} (1 fatality in 710 million years). *Exposed population*: 0.00026 (1 fatality in 3.8 thousand years). *Noninvolved worker:* 1.5×10^{-9} (1 fatality in 670 million years). *Involved worker: Same as above for 1,000 TPBARs.* *Involved worker: Same as above for 1,000 TPBARs.*	For 3,400 TPBARs: *Maximally Exposed Individual :* 2.7×10^{-8} (1 fatality in 37 million years). *Average individual in population:* 2.1×10^{-9} (1 fatality in 480 million years). *Exposed population*: 0.00052 (1 fatality in 1.9 thousand years). *Noninvolved worker:* 4.5×10^{-10} (1 fatality in 2.2 billion years). *Involved worker: Same as above for 1,000 TPBARs.* *Involved worker: Same as above for 1,000 TPBARs.*	For 3,400 TPBARs: *Maximally Exposed Individual:* 3.6×10^{-7} (1 fatality in 2.8 million years). *Average individual in population:* 8.0×10^{-10} (1 fatality in 1.3 billion years). *Exposed population*: 0.00022 (1 fatality in 4.6 thousand years). *Noninvolved worker:* 4.3×10^{-12} (1 fatality in 230 billion years). *Involved worker: Same as above for 1,000 TPBARs.* *Involved worker: Same as above for 1,000 TPBARs.*
Beyond Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Average individual in population:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Exposed population*: Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production.	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual :* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Average individual in population:* Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production. *Exposed population*: Due to accuracy limitations in the accident analysis computer code, the incremental risk of tritium production is not discernable from the risk of operation without tritium production.	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.3×10^{-8} (1 fatality in 30 million years). *Average individual in population:* 1.4×10^{-10} (1 fatality in 7.1 billion years). *Exposed population*: 0.00017 (1 fatality in 5.8 thousand years).

Resource/Material Categories	Watts Bar 1	Sequoyah 1 or Sequoyah 2	Bellefonte 1 or Bellefonte 2
	Noninvolved worker: Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.	*Noninvolved worker:* Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.	*Noninvolved worker:* Not applicable. Noninvolved worker has evacuated the plant before a release. Evacuation warning to noninvolved worker is at least one hour before a release. *Involved worker:* Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment. If the accident sequence is initiated by a large break loss-of-coolant accident or another high energy release mechanism, workers in containment will die due to the energy (steam) released to the containment. Evacuation from containment is not considered feasible during a high energy steam release accident scenario.
	For 3,400 TPBARs: *Maximally Exposed Individual:* 1.0×10^{-10} (1 fatality in 10 billion years). *Average individual in population:* 1.0×10^{-11} (1 fatality in 100 billion years). *Exposed population*: 0.000011 (1 fatality in 88 thousand years).	For 3,400 TPBARs: *Maximally Exposed Individual :* 1.0×10^{-10} (1 fatality in 10 billion years). *Average individual in population:* 1.1×10^{-10} (1 fatality in 9.1 billion years). *Exposed population*: 0.00014 (1 fatality in 7.1 thousand years).	For 3,400 TPBARs: *Maximally Exposed Individual:* 3.3×10^{-8} (1 fatality in 30 million years). *Average individual in population:* 1.5×10^{-10} (1 fatality in 6.6 billion years). *Exposed population*: 0.00018 (1 fatality in 5.5 thousand years).
	Noninvolved worker: Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.	*Noninvolved worker*: Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.	*Noninvolved worker:* Same as for 1,000 TPBARs. *Involved worker:* Same as for 1,000 TPBARs.

Resource/Material Categories	***Watts Bar 1***	***Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 2***
Waste Management	*Construction:* Potential nonhazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 0.43 cubic meters per year. Other waste types would be unaffected by tritium production.	*Construction:* Potential nonhazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 0.43 cubic meters per unit per year. Other waste types would be unaffected by tritium production.	*Construction:* Minor amounts of nonhazardous construction material waste generated during the completion of the plant. Potential nonhazardous waste if an ISFSI is constructed. *Operation:* Low-level radioactive waste increase by approximately 41 cubic meters per unit per year, of which 40 cubic meters would be from normal operations without tritium production.
Spent Nuclear Fuel Management	*Operation:* No increase if less than 2,000 TPBARs are irradiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 56 fuel assemblies per fuel cycle.	*Operation:* No increase if less than 2,000 TPBARs are irradiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 60 fuel assemblies per fuel cycle.	*Operation:* The amount of spent fuel would increase from 0 to approximately 72 spent fuel assemblies for less than 2,000 TPBARs. For 3,400 TPBARs, the amount of spent fuel generation could increase from 0 to a maximum of 141 spent fuel assemblies per fuel cycle, of which 72 would be from normal operation without tritium production.
Transportation	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years. Traffic volumes on local roads could increase during construction and operations.
Fuel Fabrication	Not applicable for the reactor site.	Not applicable for the reactor site.	Not applicable for the reactor site.
Decontamination and Decommissioning	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required. For a generic discussion on impacts from decontamination and decommissioning, see Section 5.2.5.

Resource/Material Categories	*Watts Bar 1*	*Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 2*
License Renewal	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would not be required.

MEI = Maximally Exposed Offsite Individual.
ISFSI = Independent Spent Fuel Storage Installation.

Table 3–14 Summary Comparison of Environmental Impacts Between CLWR Reactor Alternatives and the APT

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)[a]*
Land Resources			
Land Use	*Construction:* Potential land requirement—5.3 acres (Watts Bar) or 5.47 acres (Sequoyah) of previously disturbed industrial land for a dry cask ISFSI if constructed. *Operation:* Potential permanent land requirement - 3.1 to 3.2 acres, respectively, of previously disturbed industrial land for an ISFSI if constructed.	*Construction:* Potential land requirement—4.9 acres of previously disturbed industrial land for an ISFSI, if constructed, and additional small amounts of land for support buildings. *Operation:* Potential permanent land requirement - 3.4 acres of previously disturbed industrial land for an ISFSI, if constructed, and additional small amounts of land for support buildings.	*Construction and Operation:* 250 acres of land converted to industrial use. Additional lands for new roads, bridge upgrades, rail lines, and construction landfill. Additional 12 acres required for modular design, if selected. Additional land required for electric power generating facility, if constructed (e.g., 110 acres for a natural gas-fired facility and 290 acres for a coal-fired facility).
Visual Resources	*Construction and Operation:* No additional impact to visual resources.	*Construction:* No additional impact to visual resources. *Operation:* Vapor plumes under certain meteorological conditions would be visible up to 10 miles away.	*Construction:* No additional impact to visual resources. *Operation:* Vapor plumes under certain meteorological conditions would be visible.
Noise	*Construction:* No change from current levels. Small impacts if an ISFSI is constructed. *Operation:* No change from current levels.	*Construction:* No change from current levels except for construction vehicle traffic. Small impacts if an ISFSI is constructed. *Operation:* Increase in noise emissions from the plant from 50 dBA to 51 dBA at nearest receptor. Increase in traffic noise on site access roads from 50 dBA to 57 dBA due to commuter traffic and truck deliveries.	*Construction:* No change from current levels except for construction vehicle traffic. *Operation:* Increase in noise emissions from the new APT facility, electric power generating facility (if constructed), and support facilities.
Air Quality			
Non-radiological Emissions	*Construction:* No change from current air quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change from current air quality conditions.	*Construction:* Potential temporary dust emissions during construction. Small impacts if an ISFSI is constructed. *Operation:* The increase in nonradioactive emissions would be within established standards.	*Construction:* Potential temporary dust emissions during construction. *Operation:* The increase in nonradiological emissions would be within standards. Large increase in carbon dioxide emissions from any electric power generating facility.

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Radioactive Emissions	*Construction:* No radiological emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 100 Curies; given 3,400 TPBARs, 340 Curies.	*Construction:* No radiological emissions. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 106 Curies; given 3,400 TPBARs, 346 Curies, of which 5.6 Curies would be from normal operation without tritium production. The release of other radioactive emissions would be 283 Curies.	*Construction:* No radiological emissions. *Operation:* The maximum potential increase in annual radioactive emissions of tritium would be 30,000 Curies in oxide form and 8,600 Curies in elemental form. The release of other radioactive emissions would be 2,250 Curies. Potential for an additional 2,000 Curies from electric power generating facility if power is acquired through market transaction (APT Final EIS p. C-46 & Draft EIS p. 4-80).
Water Resources Surface Water	*Construction:* No change to current surface water requirements, discharge, or water quality conditions. Small impacts if an ISFSI is constructed. *Operation:* No change to current surface water requirements, discharge, or water quality conditions.	*Construction:* Potential for increased storm water runoff. Small amount of surface water requirements. Small impacts if an ISFSI is constructed. *Operation:* Increased surface water requirements and discharge. Water usage less than 1 percent of Tennessee River flow per year. All water quality parameters within established limits.	*Construction:* Increased storm water runoff and impacts from dewatering. Surface water requirements. *Operation:* Increased surface water requirements and discharge. Potential for additional water requirements from an electric power generating facility, if constructed—4.7 billion gallons per day (coal-fired) and 1.4 billion gallons per day (natural gas-fired). All water quality parameters within established limits (APT Draft EIS p. 4-81).
Water Resources Radioactive Effluent	*Construction:* No radiological effluent. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 900 Curies; given 3,400 TPBARs, 3,060 Curies.	*Construction:* No radiological effluent. *Operation:* Given 1,000 TPBARs, the maximum potential increase in annual radioactive emissions of tritium would be 1,539 Curies; given 3,400 TPBARs 3,699 Curies, of which 639 Curies from normal operation without tritium production. The release of other radioactive effluents would be 1.32 Curies.	*Construction:* No radiological effluent. *Operation:* The maximum potential increase in annual radioactive tritium effluents would be 3,000 Curies and 0.0031 Curies from other radioactive emissions. Potential for an additional 19,000 Curies from the electric power generating facility if power is acquired through market transaction (APT Final EIS p. C-43 & Draft EIS 4-80).
Groundwater	*Construction and Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Groundwater would not be used during construction. *Operation:* No groundwater requirements or additional impacts to groundwater quality conditions.	*Construction:* Due to below-ground construction of the APT, groundwater would be withdrawn and discharged to surface water. *Operation:* Potential for a 6,000 gallons per minute withdrawal of groundwater for APT cooling water (APT Draft EIS p. 4-3).

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Ecological Resources	*Construction:* No additional impacts on ecological resources. Small impacts if an ISFSI is constructed. *Operation:* Small or no impacts to ecological resources from tritium production.	*Construction:* Potential impacts to ecological resources due to the small amount of land disturbance. Small impacts if an ISFSI is constructed. *Operation:* Impacts on ecological resources, including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal plant operations.	*Construction:* Potential impacts to ecological resources due to land disturbance. *Operation:* Impacts on ecological resources, including fish impingement and entrainment of aquatic biota during normal plant operation. Small impacts to ecological resources from tritium and other radioactive releases during normal operations. Potential additional impacts on ecological resources from electric power generating plant, if constructed.
Socioeconomics	*Construction:* No measurable impact. *Operation:* less than 1 percent impact on regional economy.	*Construction:* 4,500 peak new direct jobs due to plant completion. Short-term increased costs and traffic for local jurisdictions. *Operation:* 800 to 1,000 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually), decrease in the unemployment rate (from 8.2 percent in 1997 to approximately 6.2 percent), and minor impacts to school resources.	*Construction:* 1,400 peak new direct jobs. Short-term increased costs and traffic for local jurisdictions. Additional 1,100 peak jobs associated with new electric power generating facility, if constructed (APT Draft EIS p. 4-80). *Operation:* 500 workers per day. Increase in payment-in-lieu of taxes to state and local jurisdictions, decrease in the unemployment rate, and minor impacts to school resources. Additional 200 jobs associated with new electric power generating facility, if constructed (APT Draft EIS p. 4-80).

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Public and Occupational Health and Safety Normal Operation	Annual dose for 1,000 TPBARs: *Workers*: Total dose - 112.35 person-rem (Watts Bar) and 132.35 person-rem (Sequoyah). *Maximally Exposed Individual*: Dose increase by 0.013 millirem (Watts Bar) and 0.017 millirem (Sequoyah). *50-mile population*: Dose increase by 0.34 person-rem (Watts Bar) and 0.60 person-rem (Sequoyah). Annual dose for 3,400 TPBARs: *Workers*: Total dose 113.2 person-rem (Watts Bar) and 133.2 person-rem (Sequoyah). *Maximally Exposed Individual*: Dose increase by 0.05 millirem (Watts Bar) and 0.057 millirem (Sequoyah). *50-mile population*: Dose increase by 1.2 person-rem (Watts Bar) and 1.9 person-rem (Sequoyah).	Annual dose for 1,000 TPBARs: *Workers*: Total dose—112.35 person-rem per unit; 112 person-rem per unit from normal operations without tritium production. *Maximally Exposed Individual*: Dose increase by 0.263 millirem per unit, of which 0.26 millirem per unit would be from normal operation without tritium production. *50-mile population*: Dose increase by 1.6 person-rem per unit, of which 1.4 person-rem per unit would be from normal operation without tritium production. Annual dose for 3,400 TPBARs: *Workers*: Total dose—113.2 person-rem; 112 person-rem from per unit normal operations without tritium production. *Maximally Exposed Individual*: Dose increase by 0.28 millirem per unit, of which 0.26 millirem per unit would be from normal operation without tritium production. *50-mile population*: Dose increase by 2.3 person-rem per unit, of which 1.4 person-rem per unit would be from normal operation without tritium production.	Annual dose *Workers*: Total dose - 72 person-rem (APT Draft EIS p. 4-39). *Maximally Exposed Individual*: Dose increase by 0.053 millirem (APT Final EIS p. C-52). *50-mile population*: Dose increase by 3.1 person-rem (APT Final EIS p. C-52).

Resource/Material Categories	***Watts Bar 1 or Sequoyah 1 or Sequoyah 2***	***Bellefonte 1 or Bellefonte 1 and Bellefonte 2***	***CLWR No Action (APT at the Savannah River Site)***[a]
Design-Basis Accident Risks	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.4×10^{-8} (1 fatality in 29 million years - Watts Bar) and 7.9×10^{-9} (1 fatality in 130 million years - Sequoyah). *Average individual in population:* 4.0×10^{-10} (1 fatality in 2.5 billion years - Watts Bar) and 6.1×10^{-10} (1 fatality in 1.6 billion years - Sequoyah). *Exposed population:* 0.000074 (1 fatality in 13 thousand years - Watts Bar) and 0.00015 (1 fatality in 6.6 thousand years). *Noninvolved worker:* 4.2×10^{-10} (1 fatality in 2.4 billion years - Watts Bar) and 1.3×10^{-10} (1 fatality in 7.7 billion years - Sequoyah). For 3,400 TPBARs: *Maximally Exposed Individual:* 1.1×10^{-7} (1 fatality in 9.1 million years - Watts Bar) and 2.7×10^{-8} (1 fatality in 37 million years - Sequoyah). *Average individual in population:* 1.4×10^{-9} (1 fatality in 710 million years - Watts Bar) and 2.1×10^{-9} (1 fatality in 480 million years - Sequoyah). *Exposed population:* 0.00026 (1 fatality in 3.8 thousand years - Watts Bar) and 0.00052 (1 fatality in 1.9 thousand years). *Noninvolved worker:* 1.5×10^{-9} (1 fatality in 670 million years - Watts Bar) and 4.5×10^{-10} (1 fatality in 2.2 billion years - Sequoyah).	Increased likelihood of a cancer fatality per year due to tritium production. For 1,000 TPBARs: *Maximally Exposed Individual:* 3.5×10^{-7} (1 fatality in 2.9 million years). *Average individual in population:* 2.6×10^{-10} (1 fatality in 3.8 billion years). *Exposed population:* 0.000070 (1 fatality in 14 thousand years). *Noninvolved worker:* 1.2×10^{-12} (1 fatality in 830 billion years). For 3,400 TPBARs: *Maximally Exposed Individual:* 3.6×10^{-7} (1 fatality in 2.8 million years). *Average individual in population:* 8.0×10^{-10} (1 fatality in 1.3 billion years). *Exposed population:* 0.00022 (1 fatality in 4.6 thousand years). *Noninvolved worker:* 4.3×10^{-12} (1 fatality in 230 billion years).	Increased likelihood of a cancer fatality per year due to tritium production. Design-basis seismic event: 2.6 fatalities every 2,000 years.

Resource/Material Categories	*Watts Bar 1 or Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 1 and Bellefonte 2*	*CLWR No Action (APT at the Savannah River Site)*[a]
Waste Management	*Construction:* Potential nonhazardous waste if an ISFSI is constructed. *Operation*: Low-level radioactive waste increase by approximately 0.43 cubic meters per unit per year. Other waste types would be unaffected by tritium production.	*Construction:* Minor amounts of nonhazardous construction material waste generated during the completion of the plant. Potential for additional nonhazardous waste material generated if an ISFSI is constructed. *Operation*: Low-level radioactive waste increase by approximately 41 cubic meters per unit per year, of which 40 cubic meters would be from normal operation without tritium production. Other waste types would also be generated due to tritium production.	*Construction:* 30,000 cubic meters of construction material generated and deposited in onsite landfill. Potential for additional nonhazardous waste material generated if new electric power generating facility is constructed. *Operation:* Low-level radioactive waste increase by approximately 1,400 cubic meters per year. Potential for additional 10,000 units of nuclear solid waste if power is acquired through market transaction (APT Draft EIS p. 4-80). Other waste types would also be generated due to tritium production and electric power generation (APT Draft EIS p. 4-26).
Spent Nuclear Fuel Management	*Operation:* No increase if less than 2,000 TPBARs are radiated. If 3,400 TPBARs are irradiated, the amount of spent fuel generated would increase by a maximum of 60 (Sequoyah), and 56 (Watts Bar) fuel assemblies per fuel cycle.	*Operation:* The amount of spent fuel would increase from 0 to approximately 72 spent fuel assemblies for less than 2,000 TPBARs. For 3,400 TPBARs, the amount of spent fuel generation could increase from zero to a maximum of 141 spent fuel assemblies per fuel cycle, of which 72 would be from normal operation without tritium production.	*Operation:* Spent nuclear fuel would be generated under the market transaction/existing capacity alternative for electric power generation.
Transportation	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years.	The risk associated with radiological materials transportation would be less than one fatality per 100,000 years. Traffic volumes on local roads could increase during construction and operations.	Transportation within the Savannah River Site only.
Fuel Fabrication	Not applicable for reactor site.	Not applicable for reactor site.	Not applicable for APT facility. Yes for electric-generating facility.
Decontamination and Decommissioning	Decontamination and decommissioning would be required but not because of tritium production.	Decontamination and decommissioning would be required. For a generic discussion on impacts from decontamination and decommissioning, see Section 5.2.5.	Decontamination and decommissioning would be required.
License Renewal	Licensing renewal would be required. For a generic discussion on impacts from licensing renewal, see Section 5.2.4.	Licensing renewal would not be required.	Licensing renewal is not applicable.

[a] Based on tritium production of 3 kilograms of tritium per year.

4. AFFECTED ENVIRONMENT

Chapter 4 describes the affected environment associated with the production of tritium in commercial light water reactors. The chapter begins with a brief introduction, followed by descriptions of the affected environment at each of the alternative reactor sites being considered for tritium production.

4.1 INTRODUCTION

In accordance with Council on Environmental Quality regulations, the affected environment is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment," (40 CFR 1508.14).

The descriptions of the affected environment provide bases for understanding the direct, indirect, and cumulative effects of the alternatives. The localities and characteristics of each potentially affected environmental resource are described for each site. The scope of the discussions varies with each resource to ensure that all relevant issues are included. The level of detail in the description of each resource also varies with the expectation of a potential impact to the resource. Resources expected to be impacted by the proposed action are discussed in more detail than those resources that are not likely to be affected. For instance, the descriptions of land resources, geology and soils, and archaeological and historic resources that are not expected to be impacted because of limited, if any, construction activities are less detailed. On the other hand, ambient conditions are described in greater detail for air and water resources that could be affected by the plant's intake and discharges at each site. This information serves as a basis for analyzing key air and water quality parameters to obtain results that can be compared with regulatory standards.

Socioeconomic conditions are described for the counties and communities that could be affected by regional population changes associated with the proposed program. The affected environment discussions include projections of regional growth and related socioeconomic indicators. Each region is large enough to encompass any growth related to direct project employment, as well as any secondary jobs that may be created by the program. As for other environmental resources, the level of detail is commensurate with the expected socioeconomic impacts from the proposed action. For the currently operating units, only the socioeconomic impacts associated with incremental, tritium-related changes to the plants are considered. This environmental impact statement (EIS) provides less detail concerning current conditions for the operating units, Watts Bar Nuclear Plant Unit 1 (Watts Bar 1) and Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2). However, more detail is provided for the partially constructed Bellefonte Nuclear Plant Units 1 and 2 (Bellefonte 1 and 2).

In addition to the natural and human environmental resources discussed above, the affected environment sections include a number of issues related to the ongoing activities at each site. These issues involve effluents from facility operations; waste and spent nuclear fuel management; and radiological and hazardous impacts during normal operation and from potential accidents.

4.2 AFFECTED ENVIRONMENT

4.2.1 Watts Bar Nuclear Plant Unit 1

As discussed in Section 3.2.5, one of the reactor options under consideration is the irradiation of tritium-producing burnable absorber rods (TPBARs) at Watts Bar 1. This option is based on the assumption that Watts Bar 1 would operate at its licensed full power output for the generation of electricity, with no reduced operability attributable to the production of tritium. The tritium production activity would be considered a secondary mission of the unit.

Preliminary construction of Watts Bar 1 started in spring 1973 (TVA 1995a). The major construction elements were largely completed by 1985. From 1985 to 1992, Watts Bar 1 underwent extensive reviews and modifications. Construction work was put on hold in December 1990. Work was resumed in November 1991 and, after extensive site review, the U.S. Nuclear Regulatory Commission (NRC) gave the site permission to resume full construction activities in May 1992. Watts Bar 1 was granted a full power operating license on February 7, 1996, and began commercial operation in May 1996. In October 1997, four lead test assemblies (fuel assemblies containing TPBARs) were inserted in the Watts Bar 1 reactor core in a demonstration to provide confidence to regulators and confirm that tritium production in a commercial light water reactor (CLWR) is both technically reasonable and safe. The status of this demonstration is described in Section 1.5.1.2.

Watts Bar 1 is described briefly in Section 3.2.5.1. Detailed descriptions of the site, buildings, structures, systems, and operations are provided in the licensing and environmental documents for the plant, which are listed below.

- TVA (Tennessee Valley Authority), *Watts Bar Nuclear Plant, Final Safety Analysis Report, through Amendment 91*, (TVA 1995c).

- NRC (U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Regulation), *Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2, Tennessee Valley Authority* (NRC 1995b).

- NRC (U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation), *Final Environmental Statement Related to Operation of Watts Bar Nuclear Plant Unit Nos. 1 and 2, Tennessee Valley Authority* (NRC 1978).

The regional and local climatology and meteorology of the Watts Bar 1 site was described in the *Final Environmental Statement Related to Operation of Watts Bar Nuclear Plant Units 1 and 2* (NRC 1978) and was re-evaluated in 1995 (NRC 1995b) with consideration of additional data accumulated in the intervening years. It was determined that the records used for the 1978 Final Environmental Statement provide an adequate representation of regional climatic conditions. This information was updated with the inclusion of more recent climatological and meteorological data for Chattanooga, Tennessee.

The following sections describe the affected environment at the Watts Bar 1 site for land resources, air quality, noise, water resources, geology and soils, ecology, cultural resources, and socioeconomics. In addition, the radiation and hazardous chemical environment, the waste management conditions, and the spent nuclear fuel considerations at Watts Bar 1 are described.

4.2.1.1 Land Resources

Land Use

Watts Bar 1 is on the Watts Bar Reservation in Rhea County, Tennessee, approximately 80 kilometers (50 miles) northeast of Chattanooga, Tennessee, and 50 kilometers (31 miles) north-northeast of the Sequoyah Nuclear Plant site (TVA 1995c). The location of the site is shown in **Figure 4–1**. The Watts Bar Reservation on which Watts Bar 1 is located is a 716-hectare (1,770-acre) area on the west bank of the Chickamauga Reservoir. Watts Bar 1 is on the Tennessee River at River Mile 528 (River Mile refers to the distance along the Tennessee River measured from its mouth). The site layout is shown in **Figure 4–2.** The Watts Bar Nuclear Plant site already is dedicated to power generation.

The region of influence for land use includes lands within 3.2 kilometers (2 miles) of the Watts Bar Reservation. Land uses in the vicinity of Watts Bar 1 are classified as industrial, agricultural, forest, and recreational. The reservation that encloses the Watts Bar 1 site is maintained by TVA for the U.S. Government. In addition to Watts Bar 1, the reservation contains the Watts Bar Steam Plant, which has not operated since 1983 and has been deleted from the air emission permit for the area; the Watts Bar Dam and Hydroelectric Plant; the TVA Central Maintenance Facility; and the Watts Bar Resort Area (TVA 1995c).

Industry

The only significant industrial facility in the vicinity of Watts Bar, although it is not operating at the present time, is the Watts Bar Steam Plant, a 240-megawatt coal-fired power plant that was shut down and placed in standby mode by TVA in 1983.

Agriculture

The total area of Rhea County and nearby Meigs County is approximately 1,290 square kilometers (498 square miles), of which about 34 percent, or 440 square kilometers (170 square miles), is unforested and used for agriculture (GISP 1998a, GISP 1998c).

Forest

Forests in the two-county area amount to 84,800 hectares (209,500 acres). They tend to be scattered along narrow ridges. Approximately 14 percent of forested land consists of loblolly-shortleaf pine. Hardwood forests of the oak-hickory type cover 62 percent of the forested land. The remainder supports mixtures of oak and pine (DOA 1998a, DOA 1998d).

Recreation

The Watts Bar Reservation and the adjacent Watts Bar Resort are major recreation attractions in the immediate vicinity of the plant. In general, the Watts Bar and Chickamauga Reservoirs attract a high level of water-based recreation. The peak usage time is April 15 through October 15 (TVA 1971). Demand for recreation results in a large influx of daytime and overnight users.

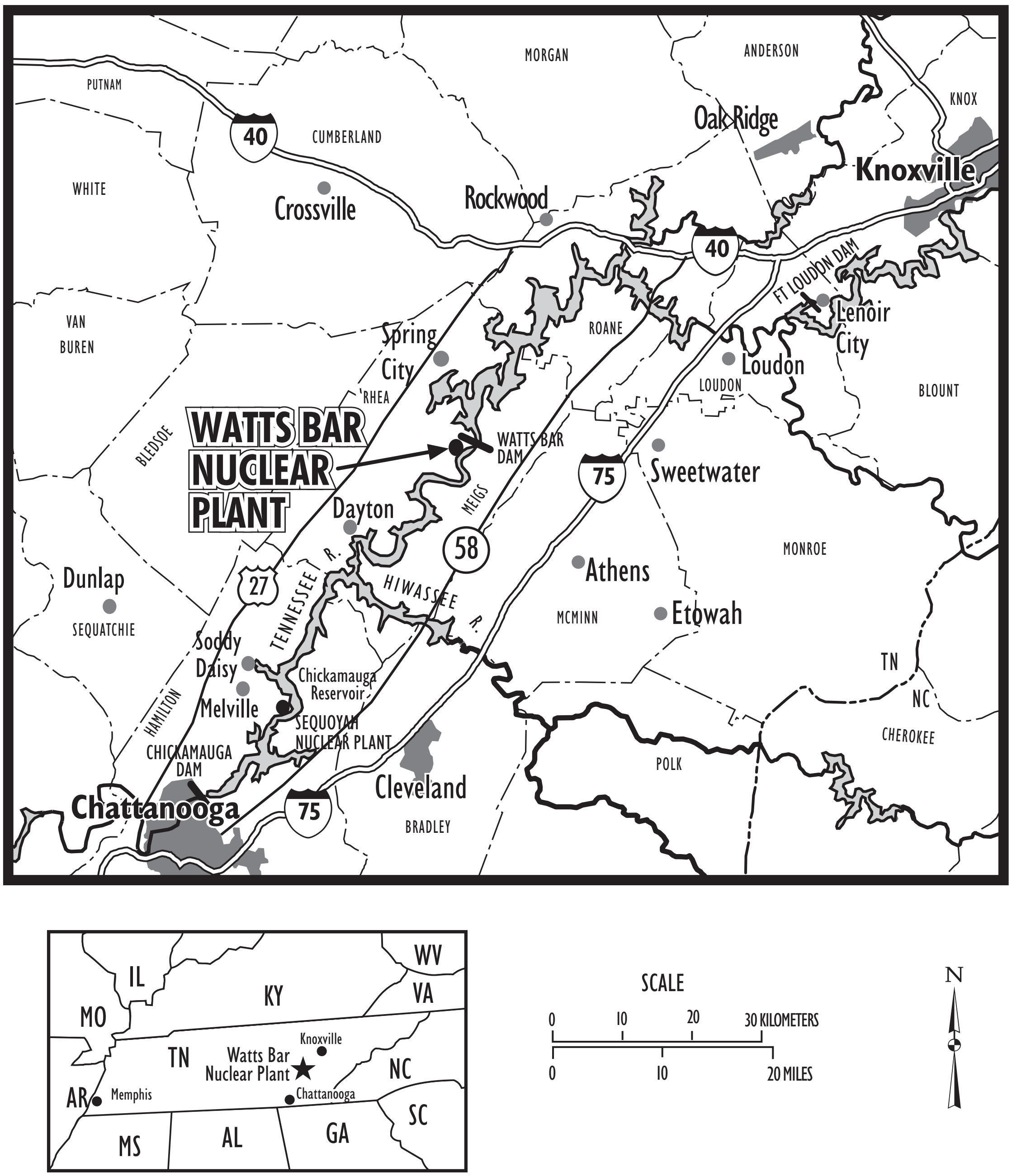

Figure 4–1 Location of the Watts Bar Nuclear Plant Site

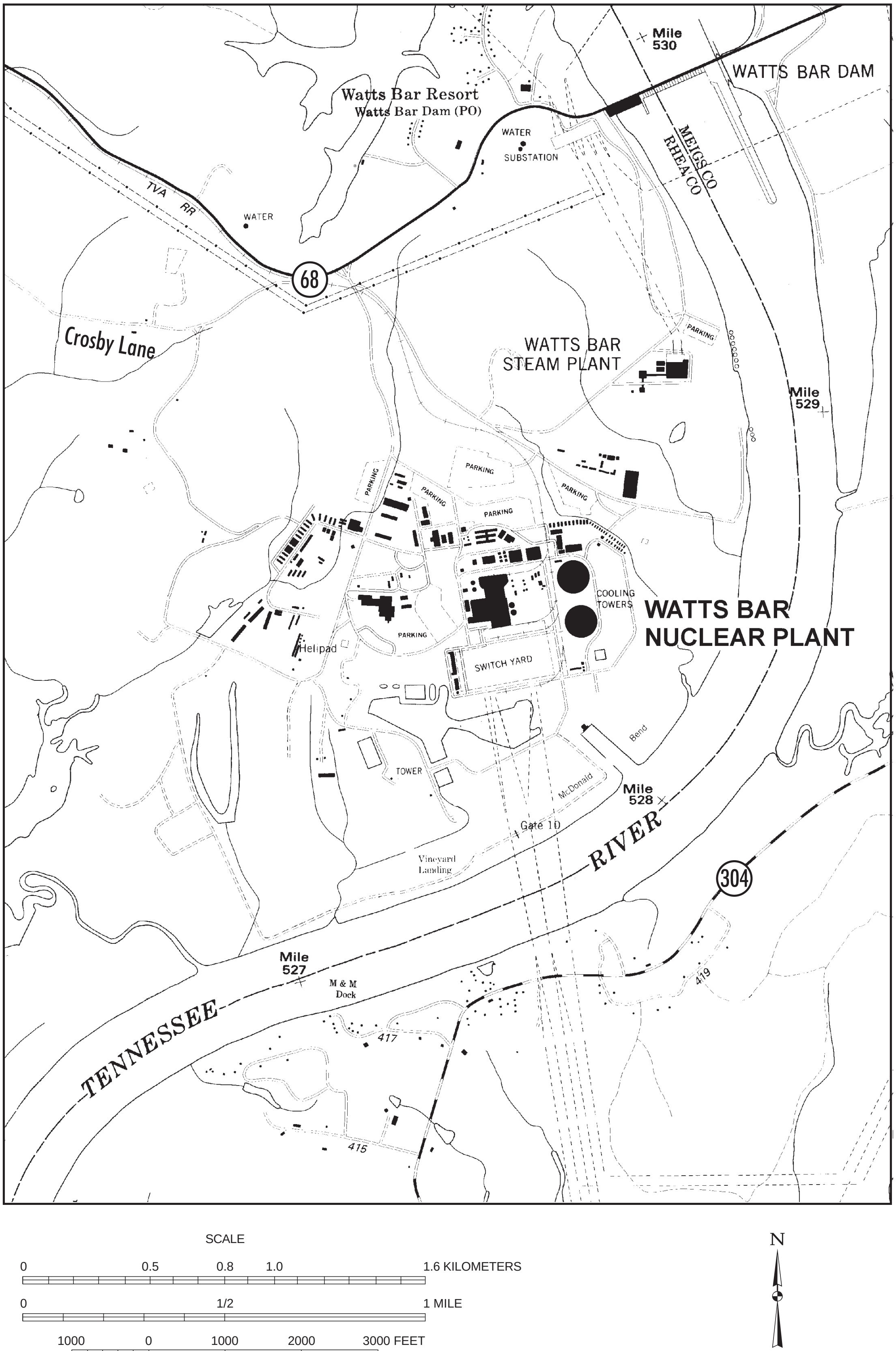

Figure 4–2 Watts Bar Nuclear Plant Site

Nature Reserves

The Hiwassee Waterfowl Refuge, Ocoee Wildlife Management Area, and the Yellow Creek Wildlife Management Area are located within 64 kilometers (40 miles) of the Watts Bar Reservation. There are three state forests and one national forest within 48 kilometers (30 miles) of the site: Falls Creek Falls State Park and Forest, Bledsoe State Forest, Mount Roosevelt State Forest, and Cherokee National Forest.

Visual Resources

The region of influence for visual resources includes those lands from which the site is visible. The major visual elements of the plant already exist, including the cooling towers, containment structures, turbine building, and transmission lines. Views of Watts Bar 1 from passing river traffic on the Tennessee River are partially screened by the wooded area east of the plant. Distant glimpses of the plant site can be seen from the coves and hollows along the river, as well as from various area roads such as State Route 68 (TVA 1995c).

Based on the Bureau of Land Management Visual Resource Management method, the existing landscape at the site would be classified as Class 3 or 4. Class 3 includes areas where there has been a moderate change in the landscape and these changes may attract attention, but do not dominate the view of the casual observer. Class 4 includes areas where major modifications to the character of the landscape have occurred. These changes may be both dominant features of the view and the major focus of viewer attention (DOI 1986a).

During operation of Watts Bar 1, the vapor plume associated with the cooling towers can be visible up to 16 kilometers (10 miles) away. The plume length and frequency of occurrence varies with atmospheric conditions, being most visible during cooler months and after the passage of weather fronts. Plumes would be less visible during the summer months, when hazy conditions persist and morning fog is more common. Vapor plumes are visible at times from nearby residential areas, State Route 68, and other nearby roads (TVA 1972).

4.2.1.2 Noise

The most common measure of environmental noise impact is the day-night average sound level. The day-night average sound level is a 24-hour sound level with a 10-decibels A-weighted (dBA) penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during nighttime hours. The U.S. Environmental Protection Agency (EPA) has developed noise level guidelines for different land-use classifications based on day-night average and equivalent sound levels. The U.S. Department of Housing and Urban Development has established noise impact guidelines for residential areas based on day-night average sound levels. Some states and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land-use category. The State of Tennessee has not developed a noise regulation that specifies the numerical community noise levels that are acceptable.

For the purpose of this document, a day-night average sound level of 65 dBA is the level below which noise levels would be considered acceptable for residential land and outdoor recreational uses. Estimated sound levels at the three residences nearest the site boundary at distances between 900 meters (3,000 feet) and 1,800 meters (6,000 feet) from the transformers and cooling towers, including the noise from the plant and background noise, are between day-night average sound levels of 53 and 63 dBA. Intermittent sound levels at these locations range from 84 to 103 dBA as a result of operating air-blast circuit breakers and steam venting (NRC 1995b). Generally the noise levels at these residences are below a day-night average sound level of 65 dBA and are considered acceptable. Watts Bar 1 is a licensed, operating nuclear power reactor. Testing of the emergency warning siren system occurs on a regular basis and results in outdoor noise levels of about 60 dBA in areas within a radius of about 16 kilometers (10 miles) of the site. TVA typically tests siren systems on a given day of the month at noon.

4.2.1.3 Air Quality

Watts Bar 1 is located in the Eastern Tennessee/Southwestern Virginia Interstate Air Quality Control Region. Baseline air quality data for the Watts Bar Nuclear Plant has been collected since 1969, prior to the start of construction of Watts Bar 1. Ambient concentrations of criteria pollutants, determined by measuring air quality in the vicinity of Watts Bar 1, are shown in **Table 4–1** with the applicable National Ambient Air Quality Standards and Tennessee State Ambient Air Quality Standards.

Table 4–1 Comparison of Baseline Watts Bar 1 Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines

Criteria Pollutant	*Averaging Time*	*Most Stringent Regulation or Guideline[a] ($\mu g/m^3$)*	*Baseline Concentration ($\mu g/m^3$)[b]*
Carbon monoxide	8-hour 1-hour	10,000[c] 40,000[c]	1,250 1,250
Lead	Calendar quarter	1.5 [c]	0.03
Nitrogen dioxide	Annual	100 [c]	26.3
Ozone	8-hour (4th highest, averaged over 3 years)	157 [c,d]	e
Particulate matter[d]	PM_{10} Annual 24-hour (interim) 24-hour 99th percentile (3-year average) $PM_{2.5}$ Annual (3-year average) 24-hour (98th percentile average over 3-years)	 50 [c] 150 [c] 150 [c] 15[c] 65[c]	 20.3 39 e f f
Sulfur dioxide	Annual 24-hour 3-hour	80 [c] 365 [c] 1,300 [c]	10.5 65.5 204
Other Regulated Pollutants			
Gaseous fluoride (as hydrogen fluoride)	30-day 7-day 24-hour 12-hour	1.2[g] 1.6[g] 2.9[g] 3.7[g]	h h h h
Total suspended particulates	24-hour	150 [g]	39 [i]

$\mu g/m^3$ = micrograms per cubic meter.
PM_n = particulate matter sized less than or equal to *n* micrometers.

[a] The more stringent of Federal and state standards are presented if both exist for the averaging time. Tennessee State and National Ambient Air Quality Standards are the same for the criteria pollutants. The National Ambient Air Quality Standards (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 1-hour ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is $\leq$ 1. The 1-hour ozone standard applies only to nonattainment areas. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 157 $\mu g/m^3$. The interim 24-hour PM_{10} (particulate matter sized less than or equal to 10 micrometers) standard is attained when the expected number of days with a 24-hour average concentration above the standard is $\leq$ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

[b] Based on ambient air quality monitoring data at a Loudon County location for 1996 and 1997, except for lead that is from the Rockwood monitor in Roane County (1996) and PM_{10} from Bradley County (1994 and 1995). Concentrations shown are maximums for the averaging period.

[c] Federal standard.

[d] EPA recently revised the ambient air quality standards for particulate matter and ozone. The new standards, finalized on July 18, 1997, change the ozone primary and secondary standards from a 1-hour concentration of 235 µg/m^3 (0.12 parts per million) to an 8-hour concentration of 157 µg/m^3 (0.08 parts per million). During a transition period while states are developing state implementation plan revisions for attaining and maintaining these standards, the 1-hour ozone standard would continue to apply in nonattainment areas (62 FR pages 38855-38894). For particulate matter, the current PM_{10} annual standard is retained and two $PM_{2.5}$ (particulate matter size less than or equal to 2.5 micrometers) standards are added. These standards are set at 15 µg/m^3 for the 3-year annual average arithmetic mean based on community-oriented monitors, and 65 µg/cubic meters for the 3-year average of the 98th percentile of 24-hour concentrations at population-oriented monitors. The current 24-hour PM_{10} standard is revised to be based on the 3-year average of the 99th percentile of 24-hour concentrations. The existing PM_{10} standards would continue to apply in the interim period (62 FR 38652).

[e] There is insufficient data to compare to the standard.

[f] Compliance with the new $PM_{2.5}$ standards was not evaluated since current emissions data for $PM_{2.5}$ are not available.

[g] State standard.

[h] No local monitoring data is available for gaseous fluoride.

[I] PM_{10} value is presented and would underestimate the total suspended particulates concentration. No monitoring data is available for total suspended particulates.

Source: 62 FR pages 38855-38894, 62 FR 38652, TN DEC 1994, TVA 1998a.

The area in which Watts Bar 1 is located is designated by the EPA as an attainment area with respect to the National Ambient Air Quality Standards for criteria pollutants (40 CFR 81). For locations that are in an attainment area for criteria pollutants, prevention of significant deterioration regulations limit pollutant emissions from new sources and establish allowable increments of pollutant concentrations. Class I areas include national wilderness areas, memorial parks larger than 2,020 hectares (5,000 acres), national parks larger than 2,340 hectares (6,000 acres), and any areas redesignated as Class I. The Class I areas closest to Watts Bar 1 are the Joyce Kilmer–Slickrock National Wilderness Area and the Great Smoky Mountains National Park. These Class I areas are located approximately 80 kilometers (50 miles) from Watts Bar 1 (TVA 1998e).

Sources of criteria nonradiological air pollutant emissions at Watts Bar 1 include five diesel-powered emergency generators; two diesel generators for security power and fire protection pumps; site and employee vehicles; two auxiliary boilers; two natural-draft cooling towers; a lube oil system; two fixed-roof, No. 2 fuel oil storage tanks; a paint shop; and a sandblast shop. Small quantities of toxic chemicals and metals are emitted from testing and operation of the diesel fuel-fired equipment, resulting in contributions to offsite concentrations of less than 0.0001 percent of the threshold limit value of any of these pollutants. One-tenth of the threshold limit value often is used as a guideline in identifying pollutants that may be of concern and should be evaluated in more detail. Ozone is produced by corona discharge (ionization of air) in the operation of transmission lines and substations, particularly at the higher voltages, and by operation of electrical equipment such as motors and generators. TVA minimizes corona discharges by optimizing, to the extent practicable, the design and construction of its transmission facilities (TVA 1997c).

The calculated concentrations of carbon monoxide, nitrogen dioxide, particulate matter, and sulfur dioxide resulting from operation of the auxiliary steam boilers are two or more orders of magnitude below the ambient standards shown in Table 4–1 (NRC 1995b). Compliance with the new $PM_{2.5}$ standards was not evaluated since current emissions data for $PM_{2.5}$ are not available. When the calculated concentrations from onsite sources are combined with concentrations from offsite sources, the ambient air quality standards for carbon monoxide, nitrogen oxide compounds, particulate matter, and sulfur dioxide continue to be met.

The occurrence of visible plumes has been evaluated for Watts Bar 1. Naturally occurring fog with visibility equal to or less than 0.4 kilometers (0.25 miles) occurs in the vicinity of Watts Bar 1 for about 35 days per year (TVA 1995c). Occurrences of the plume descending to the ground or causing localized surface fogging are expected to be rare. Some localized fog may occur on rare occasions on top of Walden Ridge, about 13 kilometers (8 miles) to the west-northwest (TVA 1995c).

Gaseous Radioactive Emissions

Watts Bar 1 has three primary sources of gaseous radioactive emissions:

- Discharges from the gaseous waste management system
- Discharges associated with the exhaust of noncondensable gases in the main condenser in the case of a primary to secondary leak exists
- Radioactive gaseous discharges from the building ventilation exhaust, including discharges from the reactor building, reactor auxiliary building, and fuel-handling building

The gaseous waste management system collects fission product gases (mainly noble gases) that accumulate in the primary coolant. A portion of the primary coolant continually is diverted to the primary coolant purification, volume, and chemical control system to remove contaminants and adjust the chemistry and volume. Noncondensable gases are stripped and sent to the gaseous waste management system, a series of gas storage tanks where the extended holdup time allows short half-life radioactive gases to decay, leaving only a small quantity of long half-life radionuclides to be released to the atmosphere. The annual gaseous radioactive emissions from Watts Bar 1 normal operation are shown in **Table 4–2**.

Table 4–2 Annual Radioactive Gaseous Emissions at Watts Bar 1

Emission	*Quantity*
Fission gases (Curies)	283
Tritium (Curies)	5.6

Source: TVA 1998e.

Meteorology and Climatology

The regional and local climatology and meteorology of the Watts Bar site, described in the *Final Environmental Statement Related to Operation of Watts Bar Nuclear Plant Units 1 and 2* (NRC 1978), was re-evaluated in 1995 (NRC 1995b) with consideration of additional data accumulated in the intervening years. It was determined that the records used for the 1978 Final Environmental Statement provide an adequate representation of regional climatic conditions. This information has been updated with more recent data for Chattanooga, Tennessee.

Regional Climate

The Great Tennessee Valley, located between the Cumberland Plateau to the west and the Appalachian Mountains to the east, is an area of complex local terrain. This results in localized variations in temperatures and winds.

As a whole, the area experiences a moderate climate with cool winters averaging 1° to 2°C (2° to 4°F) warmer than plateau areas to the west. In the winter, severe weather is rare. Snowfall is variable from year to year, ranging from none to heavy. Appreciable accumulations seldom last more than a few days. Occasional ice storms may be severe enough to cause some damage.

The summer temperature rises to as high as 35°C (95°F). Thunderstorms frequently reduce afternoon temperatures by 6° to 8°C (10° to 15°F). The annual average temperature determined from data recorded from 1961 to 1990 at the Chattanooga Airport is 15.2°C (59.3°F); the average daily minimum temperature in January is -2.2°C (28°F), and the average daily maximum temperature in July is 31.7°C (89.0°F) (NOAA 1997a).

Precipitation is fairly uniform throughout the year. The average annual precipitation is approximately 133.5 centimeters (52.57 inches). Severe thunderstorms may result in hail and damaging winds. Prevailing winds are from the south-southwest. The average annual wind speed is 1.82 meters per second (4.07 miles per hour) (TVA 1995c).

Severe Weather

The current estimate of tornado strike probability at the Watts Bar site is 0.00018 per year (18 chances in 100,000 in a given year) with a recurrence interval of 5,400 years (NRC 1995b). The maximum sustained windspeed reported in Chattanooga was 132 kilometers per hour (82 miles per hour).

Thunderstorms occur on approximately 50 days per year. Freezing precipitation occurs, on the average, every other year. Air stagnation within the site area is expected to occur for about 6 days annually (TVA 1995c, TVA 1998e).

Local Meteorological Conditions

Winds tend to be light. The direction of flow is up and down the Tennessee River Valley. Nighttime stable atmospheric conditions with light winds are driven by local conditions. Neutral atmospheric stability conditions are prevalent during the transition between day and night. The frequencies of calm winds during extremely unstable atmospheric conditions (stability classes A and B) are lower than expected. Although unusual, this shift in stability class is not significant because it occurs infrequently and under conditions associated with relatively good dispersion.

4.2.1.4 Water Resources

Surface Water

The Watts Bar Reservation is located at Tennessee River Mile 528 at the northern end of the Chickamauga Reservoir (TVA 1998e). Chickamauga Reservoir is TVA's sixth largest reservoir. The reservoir is 95 kilometers (59 miles) long on the Tennessee River and 51 kilometers (32 miles) long on the Hiwassee River, covering an area of 14,300 hectares (35,350 acres) with a volume of 775 million cubic meters (628,000 acre-feet). At the Watts Bar 1 site, the reservoir is about 335 meters (1,100 feet) wide, with cross-sectional depths ranging between 5.5 meters (18 feet) and 7.9 meters (26 feet).

The Tennessee River above Chattanooga is one of the most highly regulated rivers in the United States. The TVA reservoir system is operated for flood control, navigation, and power generation, with flood control a prime purpose. Particular emphasis is placed on protection of Chattanooga, 66 kilometers (41 miles) downstream from the Watts Bar Nuclear Plant.

During the steam cycle, heat from the Watts Bar 1 turbine is released when the steam passes through a condenser cooled with recirculated water from the Tennessee River. This water is cooled by passing it through a natural-draft evaporative cooling tower. Although the system is designated as a closed type, makeup water from the Tennessee River is needed to replace water losses from evaporation, drift, and blowdown.

At full power, the temperature of the water flowing through the condenser is raised by approximately 20°C (36°F). About 156,000 liters per minute (41,300 gallons per minute) of water are withdrawn from the

Tennessee River to make up for water lost in the cooling system. Blowdown from the natural-draft cooling tower is discharged into the river at a normal rate of 106,593 liters per minute (28,160 gallons per minute). "Blowdown" is a maintenance process to remove excess dissolved solids left after the water evaporates.

On the Watts Bar 1 site, two temporary chemical holding ponds are available for use to retain and treat chemicals from the turbine building. The smaller pond is lined and holds 3,800 cubic meters (1 million gallons). The larger, unlined pond has a volume of 19,000 cubic meters (5 million gallons). The ponds discharge via outfall pipe 103 to the large outdoor holding pond. This discharge is monitored in accordance with the plant's State of Tennessee 1993 National Pollutant Discharge Elimination System (NPDES) Permit (TN DEC 1993a).

Blowdown from the natural-draft cooling towers is routed to a multiport diffuser system (outfall pipe 101) in the main channel of the Tennessee River at River Mile 527.9 in accordance with the NPDES Permit. Makeup water and other water supply requirements are taken from an intake channel and pumping station at Tennessee River Mile 528. When there is low flow from the Watts Bar Dam, cooling tower blowdown is routed to a holding pond. The maximum intake pumping flow rate is approximately 4.5 cubic meters per second (160 cubic feet per second) (TVA 1997b). At this flow, the diffuser exit jet velocity would be 2 meters per second (6.6 feet per second). The discharge temperature varies depending on the cooling tower performance, which is a function of the ambient air temperature, from 5°C (41°F) in January to 33°C (91°F) in July. With a 35°C (95°F) maximum blowdown temperature, the average monthly temperature difference between the discharge and the river temperature varies from -5.8°C (-10.5°F) in winter and spring to 22.3°C (40.2°F) during summer and fall (TVA 1998e).

TVA has completed an environmental assessment of a proposed modification to Watts Bar 1 called the supplemental condenser cooling water project (TVA 1997g). As previously discussed, the Watts Bar 1 condenser circulating cooling water system uses a natural-draft cooling tower to reject waste heat from the steam cycle. The cooling capability of the tower is significantly affected by site meteorological conditions. As the ambient temperatures become higher, the tower-cooled water temperature also increases. The warmer water from the tower results in a decrease in the net megawatt-electric power output of Watts Bar 1 due to an increase in the condenser backpressure above the optimum design value. If the temperature of the water to the main condenser could be reduced, the efficiency and output of Watts Bar 1 could be improved. Therefore, TVA investigated the feasibility of supplementing cooling tower thermal performance by routing cooler water from upstream of the Watts Bar Dam to mix with and lower the temperature of the water from the tower.

The proposed project would provide between 435,313 and 511,020 liters per minute (115,000 and 135,000 gallons per minute) of water from the Watts Bar Reservoir to Watts Bar 1, depending on the pool elevation, to supplement the cooling capacity of the existing cooling tower. The proposed project would use some of the existing structures and components at the nonoperational Watts Bar Steam Plant to take advantage of the gravity flow and eliminate the need for new pumps. This project would use the existing intake structure at the Watts Bar Dam and most of the existing large-diameter pipe from the dam to the Watts Bar Steam Plant to supply supplemental cooling water to Watts Bar 1. New pipe between the Watts Bar Steam Plant and the Watts Bar 1 cooling towers would be installed. The discharge structure at the Watts Bar Steam Plant would be integrated into the project.

The environmental assessment of this proposed supplemental condenser cooling water project for Watts Bar 1 concluded that the construction and operation of this system would have no significant adverse environmental impacts with the appropriate implementation of the commitments delineated in the environmental assessment. Special emphasis was placed on the thermal discharge limits, and relevant analyses were performed to demonstrate no significant thermal impacts. TVA has completed most of the work on this project, and the supplemental condenser cooling water system is expected to be in service in April 1999.

Surface Water Quality

The Tennessee Department of Environment and Conservation classifies the streams and creeks of Tennessee based on water quality, stream uses, and resident aquatic biota. Classifications are defined in the State of Tennessee's water quality standards. Monitoring data are presented in **Table 4–3**. Surface water quality measurements made during the period of operation of Watts Bar 1, when compared with preoperational monitoring values, show that Watts Bar 1 operations have no significant effect on surface water quality (TVA 1997b).

Table 4–3 Summary of Surface Water Quality Monitoring in the Vicinity of the Watts Bar Site

Parameter	*Unit of Measure*	*Water Quality Criteria*	*Average Water Body Concentration*
Radiological			
Alpha (gross)	picocuries per liter	15[a]	0.433
Beta (gross)	picocuries per liter	50[b]	3.75
Tritium	picocuries per liter	20,000[a]	less than 300[c]
Nonradiological			
Manganese	milligrams per liter	0.05[d]	0.060
Nitrate (as N)	milligrams per liter	10.0[a]	0.253
Arsenic	milligrams per liter	0.05[e]	0.001
Barium	milligrams per liter	2.0[e]	0.142
Cadmium	milligrams per liter	0.005[e]	0.00014
Chromium	milligrams per liter	0.1[e]	0.0012
Lead	milligrams per liter	0.005[e]	0.0046
Mercury	milligrams per liter	0.002[e]	0.00021
pH (acidity/alkalinity)	pH units	6.0 - 9.0[e]	7.8

[a] National Primary Drinking Water Regulations (40 CFR 141).
[b] Proposed National Primary Drinking Water Regulation.
[c] Below lower limit of detection of 300 picocuries per liter.
[d] National Secondary Drinking Water Regulations (40 CFR 143).
[e] Tennessee General Water Quality Criteria for Domestic Water Supply (TN DEC 1995).
Source: TVA 1998e, TVA 1998b, TN DEC 1998a, TVA 1997b.

Surface Water Use and Rights

There are 20 surface water users within 80 kilometers (50 miles) downstream of the Watts Bar 1 site; 6 are water utility districts and 14 are industrial users. The continued operation of the plant is not expected to affect surface water use.

The Watts Bar 1 site can use a maximum of approximately 389,000 cubic meters (103 million gallons) of process water per day. The average quantity of water flowing by the site is 66,270,000 cubic meters (17,500 million gallons) per day. Under average flow conditions, Watts Bar 1 uses 0.6 percent of the total flow of the Tennessee River (TVA 1997b).

The major public water uses of the Chickamauga Reservoir are water supplies and recreation. There are two municipal drinking water intakes downstream from the Watts Bar site on the Chickamauga Lake. The closest downstream public water supply is Dayton, Tennessee, 39 kilometers (24.2 miles) downstream, which serves 6,900 people.

In Tennessee, the state's water rights laws are codified in the Water Quality Control Act. In effect, the water rights are similar to riparian rights in that the designated usage of a water body cannot be impaired. In order to construct intake structures for the purpose of withdrawing water from available supplies, U.S. Army Corps of Engineers and TVA permits are required.

Liquid Chemical and Radioactive Effluents

The radionuclide contaminants in the primary coolant are the source of liquid radioactive waste at Watts Bar 1. Liquid radioactive wastes vary considerably in composition. They may include nonradioactive contaminants and chemical constituents depending on the history and collection point of the liquid. Each source of liquid waste receives an individual degree and type of treatment before storage for reuse or discharge to the environment under the Watts Bar 1 NPDES Permit. To increase the efficiency of waste processing, wastes of similar characteristics are grouped together before treatment. The Watts Bar 1 liquid effluents to the environment during normal operation are shown in **Table 4–4**.

Table 4–4 Annual Chemical and Radioactive Liquid Effluents Released to the Environment from Operation of Watts Bar 1

Materials	*Quantity*
Chemicals (kilograms)	1,098,040 [a]
Tritium (Curies) Other Radionuclides (Curies)	639 [b] 1.32 [b]

[a] TVA 1996a.
[b] TVA 1998e.

Floodplains and Flood Risk

At Watts Bar 1, the 100-year floodplain for the Tennessee River varies from elevation 212.3 meters (696.6 feet) above mean sea level at River Mile 527 to elevation 212.6 meters (697.6 feet) at River Mile 529. The TVA Flood Risk Profile elevation on the Tennessee River varies from elevation 213.5 meters (700.5 feet) at River Mile 527 to elevation 213.8 meters (701.5 feet) at River Mile 529. The Flood Risk Profile is used to control flood damageable development for TVA projects. At this location, the Flood Risk Profile elevation is based on the 500-year flood elevation (TVA 1998e).

The safety-related facilities, systems, and equipment are housed in structures that provide protection from flooding for all flood conditions up to plant grade at 222 meters (728 feet). Rainfall floods exceeding this elevation would require plant shutdown. The situation producing the maximum plant site flood level was determined to be one of two events: (1) a sequence of March storms producing maximum precipitation on the watershed above Chattanooga, or (2) a sequence of March storms centered and producing maximum precipitation in the basin to the west of the Appalachian Divide and above Chattanooga. Seismic and flood events could cause dam failure surges above plant grade elevation 222 meters (728 feet). Flood waves from landslides into upstream reservoirs required no special analysis (TVA 1995c).

Groundwater

Groundwater at Watts Bar 1 is derived principally from infiltration of local precipitation and from lateral underflow from the area north of the plant site. All groundwater flow from the site is to Chickamauga Lake, either directly or via Yellow Creek. The plant site is located above the Conasauga Shale, a formation made up of about 84 percent shale and 16 percent limestone. The shales and limestones are essentially impervious to water, and the majority of the groundwater flows through the terrace deposits overlying the bedrock.

Groundwater Quality

Preoperational monitoring of groundwater was performed by analyzing data from six wells tapped into the Conasauga Shale aquifer to verify that the flow gradient was toward the Chickamauga Reservoir. The operational groundwater monitoring program uses two wells in the Conasauga Shale aquifer: one upgradient and one downgradient of the plant. Quarterly samples are taken to monitor for the consistency of groundwater constituents (NRC 1995b).

Groundwater Availability, Use, and Rights

Potable water for plant use is obtained from the Watts Bar Utility District. The utility district's water is obtained from three wells located 4 kilometers (2.5 miles) northwest of the plant (TVA 1995c). Single family wells are common in adjacent rural areas not served by the public water supply system. Industrial and drinking water supplies in the area are primarily taken from surface water sources.

Groundwater rights in the State of Tennessee are traditionally associated with the Reasonable Use Doctrine. Under this doctrine, landowners can withdraw groundwater to the extent that they exercise their rights reasonably in relation to the similar rights of others.

4.2.1.5 Geology and Soils

Geology

The Watts Bar 1 site is located in the Tennessee Section of the Valley and Ridge Province of the Appalachian Highlands (TVA 1995c). The distinguishing geological feature of the province is the series of folded and faulted mountains and valleys that overlie Paleozoic sedimentary formations totaling 12.2 kilometers (40,000 feet) in thickness. The plant is located on alluvial terrace deposits on a bend of the Tennessee River. Below these deposits lies the Middle Cambrian Conasauga, a shale formation of 84 percent shale and interbedded limestone. The shales and limestones are generally low permeability formations. The majority of the groundwater flows through the terrace deposits overlying the bedrock.

The controlling feature of the geologic structure at the site is the Kingston thrust fault that developed 250 million years ago. The fault has been inactive for many millions of years, and recurrence of movement is not expected. The fault lies to the northwest of the site area and is not involved in the foundation of any of the major plant structures (TVA 1995c).

Seismology

Watts Bar 1 was designed based on the largest historic earthquake to occur in the Southern Appalachian Tectonic Province—the 1897 Giles County, Virginia, earthquake (intensity: Modified Mercalli VIII and Richter magnitude of 6 to 7). The safe-shutdown earthquake for the plant was established at a maximum horizontal acceleration of 0.18 g (g = acceleration due to gravity) and a simultaneous maximum vertical acceleration of 0.12 g (TVA 1995c). The safe-shutdown earthquake is defined as the earthquake that produces the maximum ground vibration for which: (1) the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in the shutdown mode, and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures are designed to remain functional (10 CFR 100, Appendix A).

Soils

Extensive evaluation was made of the soils on the Watts Bar 1 site, and foundation requirements were devised for all of the plant structures related to the specific location and safety classification of each. The unconsolidated deposits overlying bedrock were primarily alluvial deposits consisting of fine grained, finely sorted soils and clays with micaceous sand and some quartz gravel. The general requirements for Safety Category I structures involve use of in-situ soil, compacted granular fill, or in-situ rock as foundation material (TVA 1995c).

4.2.1.6 Ecological Resources

Terrestrial Resources

The Watts Bar Reservation is located within the Ridge and Valley Physiographic Province. This province lies between the Blue Ridge Mountains and the Cumberland Plateau and is characterized by prominent, northwest-trending ridges and adjacent valleys. The Tennessee River flows through this province, roughly paralleling the alignment of the valleys. The Watts Bar 1 site is located in an area heavily impacted by agricultural activities. The site was further altered during its conversion to an industrial site. Terrestrial biological communities outside the immediate plant area have not been substantially impacted by the existing power plant. No areas on site are identified as critical areas for terrestrial plant and animal species protected under state or Federal laws.

Terrestrial Wildlife

The Watts Bar 1 site vicinity, as a result of exclusion control, serves the function of an informal preserve and continues to support a variety of terrestrial plant and animal communities. No further expansion of the current operations area is anticipated. Game species in the vicinity of the site include white-tailed deer, gray squirrel, raccoon, wild turkey, ruffed grouse, cottontail rabbit, and bobwhite quail. Good squirrel populations occur in large stands of hardwoods, while raccoons and rabbits are most common in the wide, rolling valleys between the ridges.

The mixture of forest and open vegetative types of terrain and the large degree of openness within the forest provide an abundance of niches favoring a diverse bird population. The diverse habitat sites surrounding the plant site also support varied and abundant populations of snakes, frogs, salamanders, and other reptiles.

Wetlands

The potential wetland areas identified in the vicinity of the Watts Bar 1 site are: (1) palustrine, bottomland hardwood deciduous, temporarily flooded wetlands and (2) fringe wetlands. They are indicated in **Figure 4–3**.

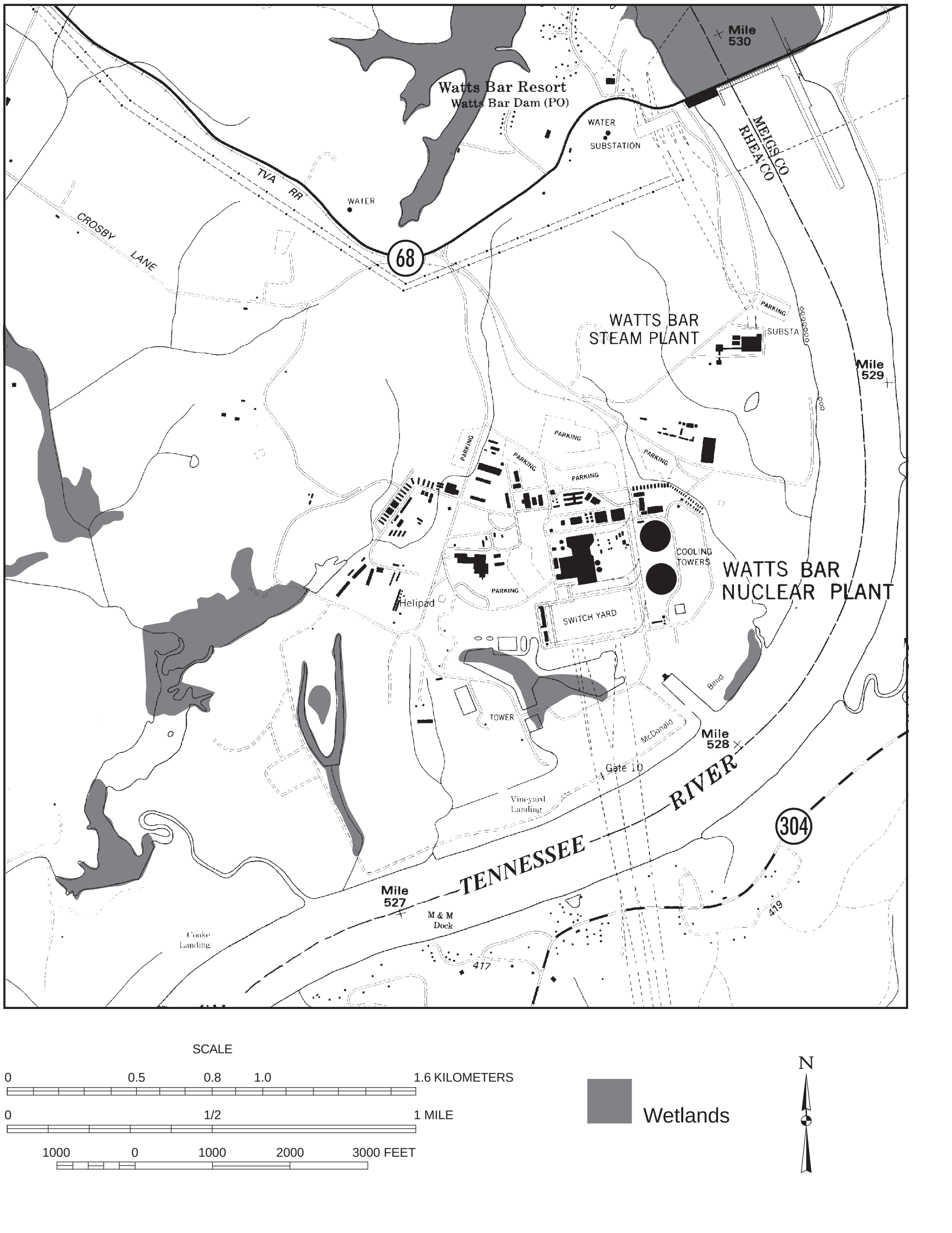

Figure 4–3 National Wetlands Inventory Map of Watts Bar Nuclear Plant Site Vicinity

Aquatic Resources

The Watts Bar 1 site (at Tennessee River Mile 528) is in the riverine portion of Chickamauga Reservoir, approximately 3.2 kilometers (2 miles) downstream of Watts Bar Dam. The quality of the water at the Watts Bar 1 intake is generally satisfactory, but negatively influenced, particularly in summer and fall, by water releases from Watts Bar Reservoir, 3.2 kilometers (2 miles) upstream. Water standing at the face (the forebay) of the Watts Bar Dam becomes stratified, particularly in warmer weather, and consequently becomes oxygen deficient. In 1996, an aerator was installed in the forebay of the Watts Bar Reservoir to reduce stratification and provide higher dissolved oxygen levels in reservoir releases.

Watts Bar 1 began commercial generation on May 27, 1996, and operated at an 84 percent capacity factor through its first cycle. Trends and similarities noted during preoperational monitoring and comparisons with operational data were used to determine potential plant-induced effects to aquatic communities and water quality.

Plankton

Evaluation of the entrainment of icthyoplankton (fish eggs and larvae) during the first year of operation of Watts Bar 1 revealed the presence of only a few varieties and at low densities (TVA 1997d). Eggs and larvae passing the Watts Bar 1 water intake are primarily spawned in the Watts Bar Reservoir and exposed to passage through the hydroelectric generation turbines at Watts Bar Dam. Very few eggs or larvae of species known to spawn in tailwaters (the downstream side of the dam) were collected, indicating that most spawning in Chickamauga Reservoir occurs downstream of the Watts Bar Nuclear Plant (TVA 1997d). The entrainment of eggs and larvae at the Watts Bar 1 water intake is characterized as extremely low (counts of 449 and 267 during the period sampled). These low levels are largely attributed to the low use of water (0.6 percent) passing the plant (TVA 1997b).

Fish Communities

Fish community sampling results after Watts Bar 1 began operation were found to be consistent with the preoperational results (TVA 1997d). The slight differences were attributed to the differences in the sample design. The 1977–1985 data were collected on a monthly basis throughout the year, and the 1990–1995 data were collected only once during the fall of each year. Important species evaluated in the comparison of preoperational and operational conditions were largemouth bass, spotted bass, redear sunfish, white bass, emerald shiner, common carp, brook silversides, log perch, bluegill, smallmouth bass, spotted sucker, and yellow bass.

Results of the first year's monitoring compared with preoperational data indicate that operation of Watts Bar 1 has not adversely impacted the tailwater fish population below Watts Bar Dam. Fish impingement on the Watts Bar 1 water intake traveling screens was virtually nonexistent.

Aquatic Macrophytes

Aquatic plants in the Watts Bar Reservoir covered 0.04 square kilometers (10 acres) during the late 1970s. Coverage increased to about 2.8 square kilometers during the 1980s, but decreased back to the 1970s levels by the early 1990s. An extended drought in the mid- to late 1980s enhanced conditions for growth of aquatic macrophytes. A return to more normal rainfall and runoff conditions resulted in a return to early 1980s densities. Eurasian watermilfoil, *Myriophyllum spicatum,* and spiny-leafed naiad, *Najas minor*, remain the dominant species. Populations of aquatic macrophyte species in the Chickamauga Reservoir fluctuated similarly over the same period, primarily in response to river flow conditions (NRC 1995b).

Mussel and Clam Communities

The Tennessee River downstream from Watts Bar Dam is inhabited by a relatively diverse native mussel community. Sampling conducted several times during the last 14 years indicates that 31 species are present; however, the 5 most abundant species account for 90 percent of the total. Many of the mussels present in this part of the Tennessee River are quite old, and most species may not have reproduced successfully in the last 30 or more years. The long-term trend is a reduction in abundance and species richness (TVA 1997b; NRC 1995b).

The 16-kilometer (9.9-mile) reach of the Tennessee River from Watts Bar Dam (Tennessee River Mile 529.9) downstream to Hunter Shoal (Tennessee River Mile 520) has been designated a mollusk sanctuary by the State of Tennessee. While commercial harvest of mussels is prohibited within the sanctuary, the age and species composition of the surviving mussel stocks in this river reach do not support any commercial harvest, even outside of the sanctuary (NRC 1995b).

In addition to the native mussels, this part of the Tennessee River is inhabited by a large population of the Asiatic clam, *Corbicula fluminea*, and an increasing population of the zebra mussel, *Dreissena polymorpha*. The Asiatic clam has been present in the Watts Bar Dam tailwater for at least 25 years, but the zebra mussel was first found there in 1993 (TVA 1997b).

Threatened and Endangered Species

Several terrestrial and aquatic species that occur in the vicinity of the Watts Bar 1 site are listed as endangered or threatened by the U.S. Fish and Wildlife Service and/or state agencies in Tennessee (**Table 4–5**). The status and biology of Federally listed species in the vicinity of the Watts Bar site were described in detail in the Biological Assessment included in the 1995 NRC Final EIS (NRC 1995b), which is incorporated here by reference. More current information on the status of the federally listed species is included, where available, in the following discussion.

Table 4–5 Listed Threatened or Endangered Species Potentially On or Near the Watts Bar Site

Common Name	*Scientific Name*	*Federal*	*State*
Mollusks			
Dromedary Pearlymussel	*Dromus dromas*	Endangered	Endangered
Pink Mucket	*Lampsilis abrupta/Lampsilis orbiculata*	Endangered	Endangered
Rough Pigtoe	*Pleurobema Plenum*	Endangered	Endangered
Fanshell	*Cyprogenia stegaria*	Endangered	Endangered
Fish			
Blue Sucker	*Cyprogenia stegaria*	Not listed	Threatened
Snail Darter	*Percina tanasi*	Threatened	Threatened
Amphibians			
Eastern Hellbender	*Cryptobranchus a. alleganiensis*	Not listed	In need of management
Birds			
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Osprey	*Pandion haliaetus*	Not listed	Threatened
Mammals			
Gray Bat	*Myotis grisescens*	Endangered	Endangered

Source: NRC 1995b, TVA 1998a, Tennessee 1994, DOI 1998a.

Plants

No Federally or state-listed plants are known to occur on or in the immediate vicinity of the Watts Bar site.

Terrestrial Animals

Bald eagles, listed as threatened, visit the Watts Bar site during the winter, where they roost on trees near the reservoirs and forage for fish. The nearest reported eagle nest is about 6.4 kilometers (4 miles) south-southwest of the plant. This nest site was first used in 1994 and has been inactive since 1996. Gray bats roost in caves throughout the year and primarily feed over water on adult insects. The nearest cave in which gray bats have been found is located about 6 kilometers (3.7 miles) downstream from the Watts Bar site. Because of frequent human visitation, this cave is not regularly occupied by bats. Gray bats have also been reported in three other caves between 15 and 30 kilometers (10 and 20 miles) from the Watts Bar site. Only one of these three caves is, at present, regularly occupied by gray bats. Gray bats may also forage over the reservoir adjacent to and downstream from the plant site.

The State of Tennessee lists the osprey as threatened. Ospreys feed primarily on fish and regularly occur along the Tennessee River adjacent to the Watts Bar site (NRC 1995b). Ospreys also have recently nested in the immediate vicinity of the Watts Bar Dam.

Aquatic Animals

Five aquatic species found in the Tennessee River near the Watts Bar site are on the Federal lists of endangered or threatened wildlife. Four of these species are endangered mussels (dromedary pearlymussel, pink mucket, rough pigtoe, and fanshell), and the other species is a threatened fish (the snail darter). Of these species, only the pink mucket and snail darter have been observed in this part of the river within the last decade. The State of Tennessee has listed the blue sucker as a threatened species and the hellbender to be "in need of management." Both of these species have been observed only on rare occasions in the Watts Bar Dam tailwater (NRC 1995b).

Three other aquatic species, all Federally listed as endangered, were found in preimpoundment surveys of nearby portions of the Tennessee River. These species are the birdwing pearlymussel, *Conradilla caelata;* white wartyback pearlymussel, *Plethobasus cicatricosus;* and the Cumberland monkeyface pearlymussel, *Quadrula intermedia.* They all inhabit gravel riffles in medium to large rivers and have not been found in the Watts Bar tailwater or in Chickamauga Reservoir for 25 years.

4.2.1.7 Archaeological and Historic Resources

For the past 1,200 years, through changing climates and environmental conditions, the Tennessee River Valley has attracted humans because of its system of water routes and its abundance of natural resources. Surveys of the Watts Bar 1 site and vicinity have identified numerous archaeological resources (Schroedl 1978, Calabrese 1976). Data recovery excavations were undertaken in 1971. Other archaeological sites exist along the reservoir shoreline downstream from the Watts Bar 1 site. However, it is important to note that no systematic archaeological survey was conducted to identify buried sites that could be present in the area of potential effect.

No sites listed in the *National Register of Historic Places* are located at or near the Watts Bar 1 site. Sites that are potentially eligible for listing in the National Register within the Watts Bar Reservation include the Watts Bar Steam Plant and the Watts Bar Dam.

Construction of Watts Bar 1 is complete, and the reactor has operated since May 1996. The operation experience to date indicates that there is no impact on archaeological or historic resources on or near the Watts Bar site.

4.2.1.8 Socioeconomics

Watts Bar 1 is located near the town of Spring City, Rhea County, in eastern Tennessee. The precise location is latitude 35°36'10" north and longitude 84°47'25" west (NRC 1998d). Spring City is about 27 kilometers (17 miles) northeast of Dayton, Tennessee, and 80 kilometers (50 miles) northeast of Chattanooga, Tennessee. Highway access to Spring City is via Route 27 and nearby Route 68. Route 27 links the town to Dayton (Rhea County seat) and Route 68, both to the south; to Chattanooga in the southwest; and to Interstate Highway 40, about 40 kilometers (25 miles) north. Route 68 links Spring City to Interstate Highway 75.

Demography

The region of influence had an estimated overall population of about 890,600 in 1990 (DOC 1992). The number of households in the region of influence was about 343,000 in 1990, while the number of families was about 254,000. **Table 4–6** shows general demographic data for Spring City, Rhea County, and the Watts Bar 1 region of influence. The Watts Bar region of influence was defined as the area within 80 kilometers (50 miles) of the Watts Bar Nuclear Plant.

Table 4–6 General Demographic Characteristics of Spring City, Rhea County, and the Watts Bar 1 Region of Influence 1990

Demographic Measure	*Spring City*	*Rhea County*	*Region of Influence*
Total population (1990)	2,199	24,344	890,617
Total population (1995/96, as noted)	2,381 (1996)	26,833 (1995)	NA
Families (1990)	614	6,976	254,319
Households (1990)	867	9,128	343,067
Male (1990)	982	11,728	428,137
Female (1990)	1,217	12,616	462,481

Sources: DOC 1992, DOC 1998c.

For Spring City, the population increased approximately 8 percent from 1990 to 1996. Rhea County had an estimated population of 26,833 in 1995, up from 24,344 in 1990 (Dayton/Rhea EDC 1998). The county is projected to continue growing to a population of 30,000 in the year 2000, and to 35,000 in 2010. **Table 4–7** shows the population distribution by ethnic group in Spring City, Rhea County, and the Watts Bar region of influence in 1990.

Figure 4–4 shows the racial and ethnic composition of the projected population residing in the affected area projected for the year 2025. Data for low-income households from the 1990 Census are presented in **Figure 4–5**. Low-income households are those with incomes of 80 percent or lower than the median income for the counties. As indicated in this figure, approximately 40 percent of the total households are low-income households (see also Appendix G).

Table 4–7 Population Distribution by Ethnic Group in Spring City, Rhea County, and the Watts Bar 1 Region of Influence (1990 U.S. Census)

Ethnic Group or Subgroup (U.S. Census Definitions)	*Spring City*		*Rhea County*		*Watts Bar 1 Region of Influence*	
	Population	*Percentage of Total Population*	*Population*	*Percentage of Total Population*	*Population*	*Percentage of Total Population*
White not of Hispanic origin	2,033	92.45	23,472	96.42	806,864	91.10
Black not of Hispanic origin	139	6.32	528	2.17	64,922	7.33
American Indian, Aleut, or Eskimo not of Hispanic origin	10	0.45	72	0.30	2,672	0.30
Asian or Pacific Islander not of Hispanic origin	8	0.36	33	0.14	5,390	0.61
Other race not of Hispanic origin	0	0.00	56	0.23	285	0.05
White of Hispanic origin	0	0.00	103	0.42	4,058	0.46
Black of Hispanic origin	0	0.00	4	0.02	146	0.02
American Indian, Aleut, or Eskimo of Hispanic origin	0	0.00	12	0.05	93	0.01
Asian or Pacific Islander of Hispanic origin	0	0.00	0	0.00	92	0.01
Other race of Hispanic origin	9	0.41	64	0.26	1,146	0.13
Hispanic total	9	0.41	183	0.75	5,535	0.62
Total population (all ethnic groups)	2,199	100.00	24,344	100.00	885,667	100.00

Sources: DOC 1992, DOC 1998c.
Note: Sum of items may not add up to population total due to rounding error.

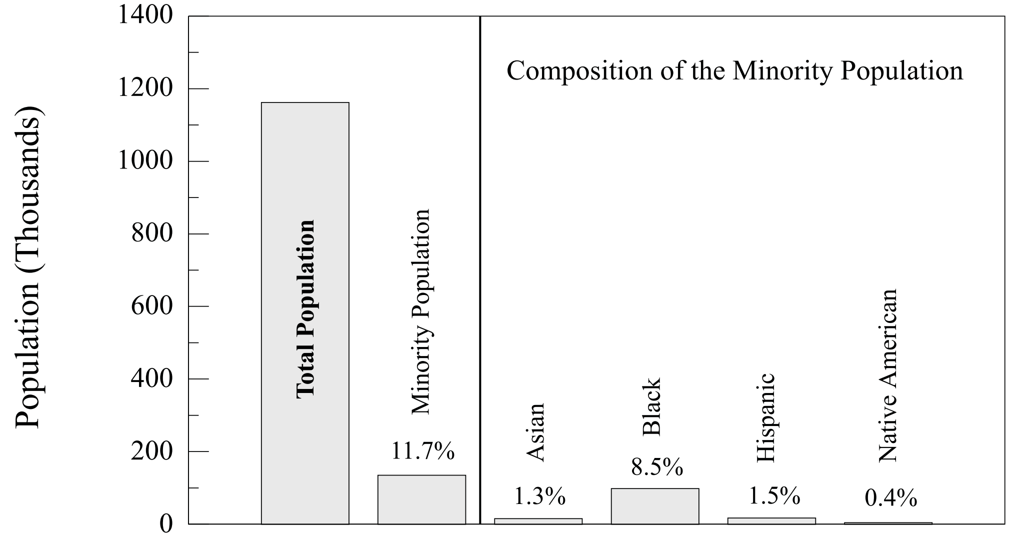

Figure 4–4 Racial and Ethnic Composition of the Minority Population Residing Within 80 Kilometers (50 Miles) of Watts Bar 1 Projected for the Year 2025

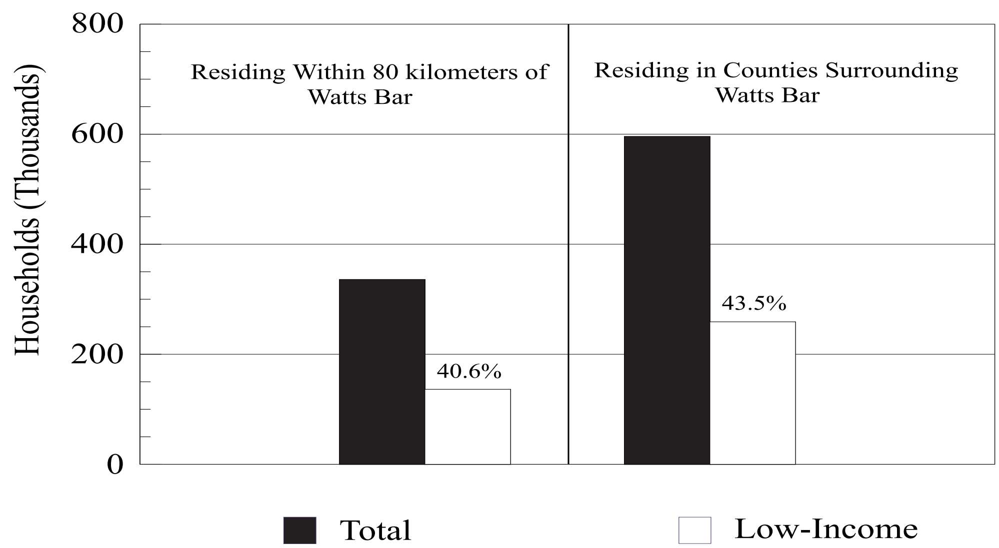

Figure 4–5 Low-Income Households Residing Within 80 Kilometers (50 Miles) of Watts Bar 1 (1990)

Income

Total personal income in Rhea County was $417 million in 1996, up from $404 million in 1995 (DOC 1998a). Comparable figures for neighboring Meigs County were $132 million in 1996 and $127 million in 1995. Per capita income in Rhea County was $15,323 in 1996, up from $15,078 in 1995. Rhea and Meigs counties were respectively ranked seventy-first and eighty-fourth in the State of Tennessee in terms of per capita income in 1996. **Table 4–8** summarizes income data for Spring City and Rhea County.

Table 4–8 Income Data Summary for Spring City and Rhea County (1989)

Income Measure	*Spring City*	*Rhea County*
Per capita income	$9,412	$9,333
Median household income	$19,757	$19,915
Median family income	$24,028	$23,789
Median housing value	$41,300	$45,100

Source: DOC 1998c.

Community Services

Education, public safety, and health care were examined to determine the level of community services for the region of influence.

Education

There are 418 schools with a capacity for 130,107 students within an 80-kilometer (50-mile) radius of the Watts Bar 1 site. The average student-to-teacher ratio is approximately 17:1.

Public Safety

City, county, and state law enforcement agencies provide police protection to residents of the region of influence. The average officer-to-population ratio is 1.3:1,000 persons. Fire protection services are provided by both paid and volunteer firefighters. The ratio of firefighters to the population is 0.6:1,000.

Health Care

The region of influence includes 34 hospitals with a total of 4,861 beds. All of the hospitals are operating below capacity.

Local Transportation

The nearest land transportation route is State Route 68, about 1.6 kilometers (1 mile) north of the site. Other surface roads in the Watts Bar 1 site vicinity are State Route 58, 4.8 kilometers (3 miles) southeast; State Route 30, 9.7 kilometers (6 miles) south; U.S. Highway 27, 11.3 kilometers (7 miles) northwest; and Interstate Highway 75, 12.9 kilometers (8 miles) southeast. A main line of the CNO&TP Railroad (Norfolk Southern Corporation) passes about 11.3 kilometers (7 miles) west of the site. A TVA railroad spur connects with the main line and serves Watts Bar 1. The spur from Spring City to the Watts Bar 1 site would require refurbishment prior to use. On the site, several hundred feet of rail that have been removed would have to be replaced if rail spent fuel shipping casks had to be accommodated (TVA 1998a). The Tennessee River is navigable past the site and is used as a major barge route (TVA 1995c). These transportation routes are shown in **Figure 4–6**.

The major surface roads mentioned above and the network of local roads connecting with them adequately serve the needs of the local communities and TVA employees at the Watts Bar 1 site.

4.2.1.9 Public and Occupational Health and Safety

Radiation Environment

Background radiation exposure to individuals in the vicinity of the Watts Bar site is presented in **Table 4–9**. The annual doses to individuals from background radiation are expected to remain constant over time. Thus, any incremental change in the total dose to the population would be a function only of a change in the size of the population.

Table 4–9 Sources of Background Radiation Exposure to Individuals in the Vicinity of the Watts Bar Site[a]

Source	***Total** Effective Dose Equivalent (millirem per year)*
Natural Background Radiation	
Cosmic and cosmogenic radiation	28
External terrestrial radiation	28
In the body	39
Radon in homes (inhaled)	200
Total	295
Other Sources of Radiation	
Release of radioactive material in natural gas, mining, ore processing, etc.	5
Diagnostic x-rays and nuclear medicine	53
Nuclear energy	0.28
Consumer and industrial products	0.03
Total	355

[a] Values are based on average national data, not measured values at the Watts Bar site.
Source: TVA 1998b.

Radionuclides released in emissions and effluents from Watts Bar 1 are a potential source of radiation exposure to individuals in the vicinity of Watts Bar 1 and are additional to the background radiation values listed. Calculations of radiation doses to individuals and the population surrounding the plant were performed by TVA using measurements from the various radiological monitoring points around the plant during operation in 1997, as well as conservative assumptions regarding both individual and population exposure time. The doses are presented in **Table 4–10**.

Radiation doses to the onsite worker include the background dose plus an additional dose from working in the facility.

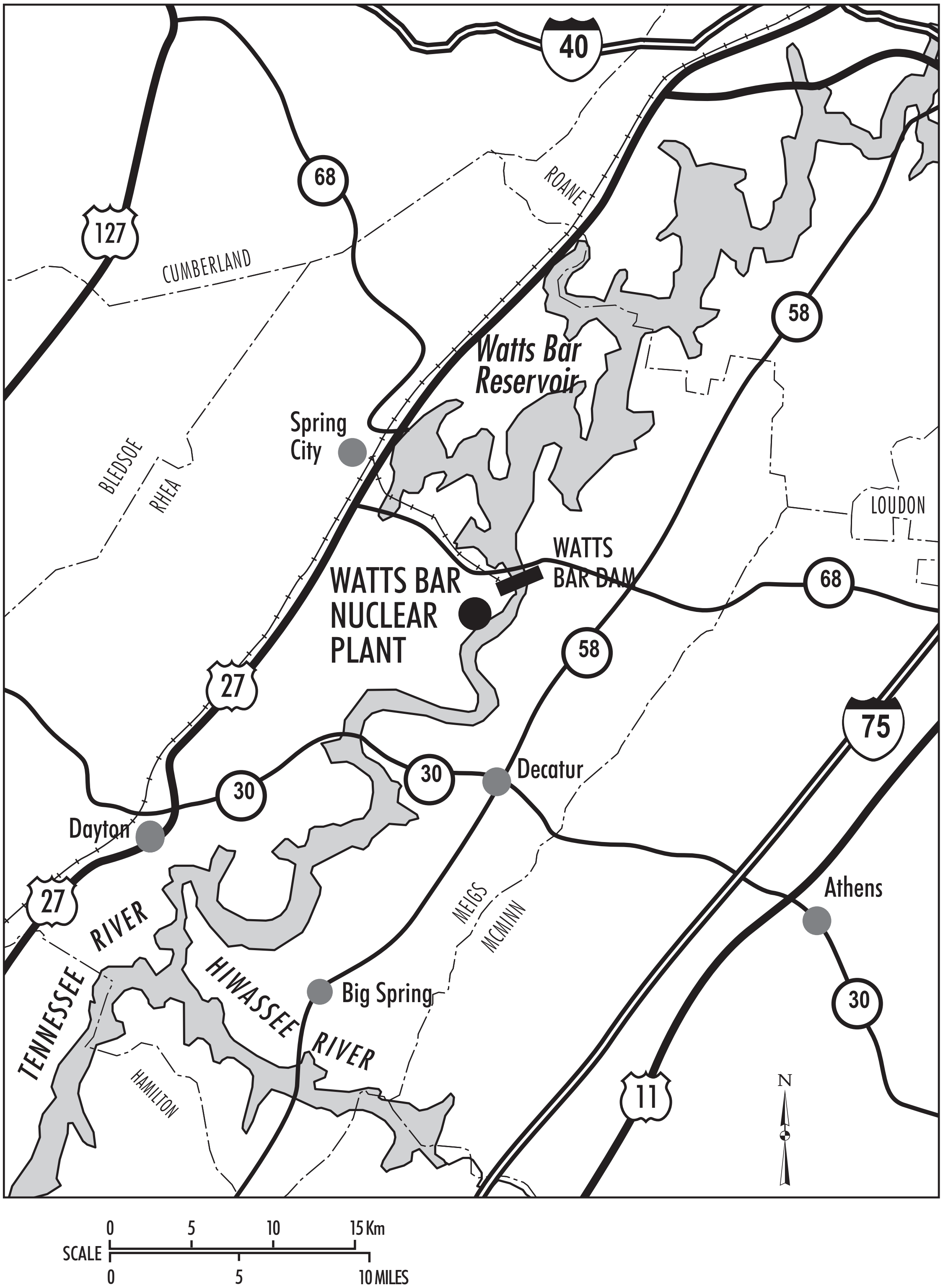

Figure 4–6 Transportation Routes in the Vicinity of the Watts Bar Nuclear Plant Site

Table 4–10 Annual Doses to the General Public During 1997 From Normal Operation at Watts Bar 1, (Total Effective Dose Equivalent)

Affected Environment	Airborne Releases		Liquid Releases		Total	
	Most Stringent Standard [a]	Based on Actual Measurements	Most Stringent Standard [a]	Calculated on the Basis of Actual Measurements	Most Stringent Standard [a]	Calculated on the Basis of Actual Measurements
Maximally exposed offsite individual (millirem)	5	0.036	3	0.25	25	0.29
Population within 80 kilometers (person-rem)[b]	None	0.068	None	0.44	None	0.51
Average dose to an individual within 80 kilometers (millirem)[c]	None	0.000063	None	0.00042	None	0.00048

[a] From 10 CFR 50, Appendix I (design objectives for equipment to control releases of radioactive materials in effluents from nuclear power reactors). The standard for the maximally exposed offsite individual (25 millirem per year for the total body from all pathways) is given in 40 CFR 190.
[b] Population used: 1,066,600.
[c] The average is obtained by dividing the population dose by the population living within an 80-kilometer (50-mile) radius of Watts Bar 1.

Source: TVA 1998e.

Direct Radiation

Radiation fields are produced in nuclear plant environments as a result of radioactivity contained within the reactor and its associated components. Doses from sources within the plant are primarily due to nitrogen-16, a radionuclide produced in the reactor core. Since the primary coolant of pressurized water reactors is contained in a heavily shielded area of the plant, dose rates in the vicinity of pressurized water reactors are generally less than 5 millirem per year.

Low-level radioactive storage containers outside the plant are estimated to contribute less than 0.01 millirem per year at the site boundary (NRC 1978).

The plant operator committed to design features and operating practices that ensure that individual occupational radiation doses are within the occupational dose limits defined in 10 CFR 20, and that individual and total plant population doses would be as low as is reasonably achievable. The combined radiation doses received by the onsite worker are shown in **Table 4–11**.

Table 4–11 Annual Worker Doses from Normal Operation of Watts Bar 1 During 1997

Affected Environment	Standard [a]	Dose [b]
Average worker (millirem)	None	104
Maximally exposed worker (millirem)	5,000	1,269
Total workers (person-rem)	None	112

[a] NRC regulatory limit from 10 CFR 20.
[b] Based on 1,073 badged workers.

Source: TVA 1998e.

Chemical Environment

Nonradioactive chemical wastes from Watts Bar 1 include boiler blowdown water treatment wastes (sludges and high saline streams whose residues are disposed of as solid wastes and biocides), boiler metal cleaning, floor and yard drains, and stormwater runoff.

Regeneration (chemical removal of radioactive waste) of ion exchange resins accounts for 596,000 kilograms per year (657 tons per year) of neutralized sulfate and sodium salts. Other water purification processes produce 196,500 kilograms per year (217 tons per year) phosphate and aluminum hydroxide residue. Processes for defouling facility piping produce 22,000 kilograms per year (24 tons per year) of organic residue byproducts and halites (oxygenated chlorine and bromine ions).

Operation of Watts Bar 1 takes into account the storage of process chemicals and disposal of waste products. Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and achieve compliance with permit requirements (such as air emissions and NPDES Permit requirements). The effectiveness of these controls is verified by monitoring information and inspecting compliance with mitigation measures.

Section 4.2.1.3, Table 4–1, and Section 4.2.1.4, Table 4–3, contain data on quantities of concentrated chemical concentrations in ambient air and surface water in the vicinity of Watts Bar 1.

Emergency Preparedness

The license issued by the NRC for the operation of Watts Bar 1 is based in part on a finding that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. This finding by the NRC is based on: (1) a review of the Federal Emergency Management Agency findings; (2) determinations that state and local emergency plans are adequate and give reasonable assurance that they can be implemented; and (3) the NRC's assessment that the applicant's onsite emergency plans are adequate and give reasonable assurance that they can be implemented.

The Watts Bar 1 emergency plan establishes that evacuation is the most effective protective action that can be taken to cope with radiological incidents. The plan provides the details of an evacuation plan. Risk counties, identified as McMinn, Meigs, and Rhea, are tasked with preparing evacuation plans for citizens within the 16-kilometer (10-mile) emergency planning zone and determining the number of people to be evacuated from the zone. Host counties, identified as Hamilton, Roane, Cumberland, and McMinn, are assigned responsibility to identify suitable shelters for evacuees. A State Emergency Operation Center would provide the focus for emergency reaction (e.g., notifications, protective action, evacuation implementation). Fixed sirens would alert residents and transients within the 16-kilometer (10-mile) emergency planning zone with backup provided, if needed, by emergency vehicle sirens and loudspeakers. The State Emergency Operation Center Director would involve the counties' Emergency Management Directors as required.

The Emergency Alert System and the National Oceanic and Atmospheric Administration Weather Radio would be used to provide emergency information and instructions.

The evacuation would be ordered and accomplished by designated sectors. The designated evacuation routes would be patrolled by traffic assistance teams.

The American Red Cross would operate mass care shelters in the host counties. Shelter information points would be established on each evacuation route to help direct evacuees to their assigned shelters.

Considerable planning is involved in evacuation planning. Training, education, and practice runs are used to further the probability of successful evacuation in the event it is ever required.

4.2.1.10 Waste Management

As with any major industrial activity, Watts Bar 1 generates waste as a consequence of its normal operation. The wastes fall into four broad categories: hazardous waste, nonhazardous solid waste, low-level radioactive waste, and sanitary liquid waste. No high-level waste, as it is defined by the Nuclear Waste Policy Act of 1992, is generated at the Watts Bar 1 site. **Table 4–12** summarizes the annual amount of waste generated at the Watts Bar 1 site in each category.

Table 4–12 Annual Waste Generation at Watts Bar 1

Category	*Volume or Mass Per Year*
Hazardous waste (cubic meters)	1.025
Non-hazardous solid waste (kilograms)	863,438
Low-level radioactive waste (cubic meters)	40
Mixed waste (cubic meters)	less than 1

Source: TVA 1998e.

Hazardous Waste

Hazardous wastes typically generated at Watts Bar 1 include paints, solvents, acids, oils, radiographic film and development chemicals, and degreasers. Neutralization is the only waste treatment performed on site. Hazardous wastes are normally stored in polyethylene containment systems during accumulation. An approved storage building is utilized to store hazardous wastes for either 90 or 180 days, depending on the plant's hazardous waste generator status (i.e., small quantity or large quantity generator) at the time. Waste is transported to an offsite hazardous waste storage facility or disposal facility prior to exceeding the 90- or 180-day storage limit.

Low-Level Radioactive Waste

During the fission process, an inventory of radioactive fission and activation products builds up within the reactor (in the fuel and the materials of construction). A small fraction of these radioactive materials escapes and contaminates the reactor coolant. These contaminants are removed from the coolant by a radioactive waste treatment system. Watts Bar 1 uses separate radioactive waste treatment systems for gaseous, liquid, and solid waste treatment. Residues from the gaseous and liquid waste treatment systems (filters, resins, dewatered solids) are combined and disposed of with the solid, low-level radioactive waste. The other important category of low-level radioactive waste is the solidified and dewatered treated product from gaseous and liquid waste treatment systems. Contaminated protective clothing, paper, rags, glassware, compactible and noncompactible trash, and reactor components and equipment comprise the majority of solid low-level radioactive waste at Watts Bar 1.

Before disposal, compactible trash, with the exception of irradiated metals, is shipped to a commercial processor where it is compacted to a lesser volume and shipped to the Barnwell, South Carolina, low-level radioactive waste disposal facility. Incineratable trash is shipped to a commercial waste incinerator in Oak Ridge, Tennessee, where the material is burned to ashes before final disposal at the Barnwell facility. Metal waste is either decontaminated and recycled or melted to form shielding blocks. TVA does not send irradiated metals for volume reduction due to their excessive dose rate. Instead, this material accumulates until a sufficient amount is on hand to ship directly to the Barnwell disposal facility. Any radioactive waste from these processes is shipped for disposal at the Barnwell disposal facility (TVA 1998a).

Mixed Waste

Mixed waste is material that is both hazardous and radioactive. Typical sources of mixed low-level radioactive waste at Watts Bar 1 are: beta-counting fluids (e.g., zylene, toluene) for use in liquid scintillation detectors, polychlorinated biphenyls susceptible to contact with radioactive contamination as a result of an accidental transformer spill or explosion, isopropyl alcohol used for cleaning radioactive surfaces, chelating agents, and various acids.

Waste Minimization Practices

The Watts Bar 1 site has an active waste minimization program that consists of the following practices:

- Useful portions of construction and demolition materials are salvaged for resale.
- Segregated storage areas are maintained for each type of recoverable material.
- Scrap treated lumber is sold or placed in dumpsters for disposal by the solid-waste disposal contractor at an offsite permitted landfill.
- Inert construction and demolition wastes are collected for disposal at the onsite permitted landfill.
- Waste paper is placed in bins or dumpsters and sold to an offsite recycle facility.
- Aluminum cans are recycled and sold.
- Nonrecoverable solid wastes are placed in dumpsters for disposal by the solid waste disposal contractor.
- Special wastes (e.g., desiccants, oily wastes, insulation) are collected and stored and then disposed of by incineration. Asbestos is sent to an approved special waste landfill for disposal.
- Used oil, fluorescent tubes, and antifreeze are collected and stored in drums and tanks and recycled.
- Medical wastes are collected and disposed of in accordance with the medical waste disposal procedure for TVA medical facilities.
- Plant sanitary wastewater is routed to the sanitary wastewater treatment plant and then treated for release in accordance with the NPDES Permit.
- Metal-cleaning wastewater (e.g., trisodium phosphate, acetic acid, etc.) is discharged into approved storage ponds for future disposal in accordance with the NPDES Permit.
- Wastewater from floor and equipment drains in nonradiation areas is routed through sumps to the turbine building sump for discharge in accordance with the NPDES Permit.
- Surplus chemicals are sold; lead acid batteries are recycled; refrigerant is recovered and recycled; and solvent recovery equipment is used for painting operations.
- Steps to use biodegradable solvents and cleaners to replace hazardous chemicals in various cleaning operations have been incorporated to the extent practical.

4.2.1.11 Spent Fuel Management

When nuclear reactor fuel has been irradiated to the point that it no longer contributes to the operation of the reactor, or when it is found to have cladding leaks that allow radioactive gaseous emissions, the fuel assembly is termed "spent nuclear fuel" and is removed from the reactor core and stored in the spent fuel storage pool or basin. The Nuclear Waste Policy Act of 1982, as amended, assigned the Secretary of Energy the responsibility for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel. When such a repository is available, spent nuclear fuel would be transported for disposal from the nuclear power reactors to the repository. Until a repository is available, spent nuclear fuel would be stored in the reactor pools or in other acceptable, NRC-licensed storage locations. Because of the uncertainty associated with opening a repository, this EIS assumes spent fuel would be stored at the reactor facility for the duration of the proposed action (i.e., 40 years).

Storage Capacity

Storage cells have been provided in the Watts Bar 1 spent fuel storage pool to hold 1,383 fuel assemblies. A reserve capacity is required for a full-core discharge (193 fuel assemblies) in the event it becomes necessary to remove fuel from the reactor vessel. The remaining storage capacity is 1,190 fuel assemblies. As of January 1998, the spent fuel inventory at Watts Bar 1 was 84 assemblies, leaving a usable storage capacity of 1,106 fuel assemblies.

Management Practice

The normal (projected equilibrium average) refueling batch size is 80 fuel assemblies, with the refueling frequency established at 18 months. The current capacity for storing spent nuclear fuel is adequate through the year 2016 (fuel cycle number 14). However, Watts Bar 1 already is licensed for a total spent nuclear fuel storage pool capacity of 1,607 fuel assemblies, an increase of 224 fuel assemblies over the present capacity. As it becomes necessary, dry storage facilities can be added to extend the plant life.

4.2.2 Sequoyah Nuclear Plant Units 1 and 2

As discussed in Section 3.2.5, one of the reactor options under consideration is the irradiation of TPBARs in Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2). This option is based on the assumption that Sequoyah 1 and 2 would operate at their licensed full power output for the generation of electricity, with no reduced operability attributable to the production of tritium. The tritium production activity would be considered a secondary mission of the units.

The TVA Board authorized the construction of the Sequoyah Nuclear Plant in August 1968. On October 15 1968, an application to construct the plant was filed with the U.S. Atomic Energy Commission. A provisional construction permit was granted on May 27, 1970. Unit 1 began commercial operation on July 1, 1981. Unit 2 began commercial operation on June 1, 1982. The units were shut down in 1985 and resumed operation in 1988. Sequoyah 1 and 2 are described briefly in Section 3.2.5.2. Detailed descriptions of the site, building structures, systems, and operations are provided in the following licensing and environmental documentation:

- TVA, *Final Environmental Statement, Sequoyah Nuclear Plant Units 1 and 2* (TVA 1974a).
- TVA, *Sequoyah Nuclear Plant Updated Final Safety Analysis Report*, *Amendment 12* (TVA 1996b).

The following sections describe the affected environment at the Sequoyah Nuclear Plant site for land resources, noise, air quality, water resources, geology and soils, biotic resources, cultural resources, and socioeconomics. In addition, radiation and hazardous chemical environments and the waste management conditions and spent nuclear fuel considerations at Sequoyah 1 and 2 are described.

4.2.2.1 Land Resources

Land Use

The Sequoyah Nuclear Plant site is on a 212-hectare (525-acre) site near the center of Hamilton County, Tennessee, on a peninsula on the western shore of Chickamauga Reservoir at River Mile 484.5, as shown in **Figure 4–7**. A map of the site is shown in **Figure 4–8**. The Sequoyah Nuclear Plant site is approximately 12 kilometers (7.5 miles) northeast of the nearest city limit of Chattanooga, Tennessee. The corridor to the southwest of the site that encompasses the city of Chattanooga is considered a growth area in Hamilton County. The remaining area surrounding the site is rather sparsely settled. Development consists of scattered dwellings and associated small-scale farming. The sectors east of the site and the Chickamauga Reservoir are expected to retain their rural character (TVA 1996b). Land uses in the vicinity of the Sequoyah Nuclear Plant are classified as industrial, agricultural, forest, and recreational.

Industry

There is no significant industrial development in the immediate vicinity of the Sequoyah Nuclear Plant site. Chattanooga, an industrial center, lies 12 kilometers (7.5 miles) southwest of the site. A center of diversified light industry, Cleveland, lies 23 kilometers (14 miles) east-southeast of the site (TVA 1996b).

Agriculture

Nearly 28 percent of the 224,000 hectares (554,500 acres) that constitute the land area of Hamilton and Bradley Counties, Tennessee, about 62,500 hectares (154,400 acres), is dedicated to farming. Crop land accounts for 33,500 hectares (82,700 acres) of the total agricultural area. (GISP 1998d, GISP 1998e)

Forest

The total area of forested land in Hamilton County, Tennessee, is 85,270 hectares (210,700 acres). This area is made up of approximately 19 percent loblolly and short-leaf pine (softwood) forests, 59 percent oak-hickory forests, and the remainder is oak-pine stands (DOA 1998a, DOA 1998d).

Recreation

Water-based recreation is supported by the Chickamauga Reservoir, particularly in late spring, summer, and early fall. There are three primary public recreation facilities, Harrison Bay and Booker T. Washington State Parks and the Chester Frost County Park, as well as numerous commercial marinas, group camps, cottage developments, and small formal and informal public access areas along the reservoir shoreline (TVA 1996b).

Nature Reserves

The Soddy Creek waterfowl management area is located 4.8 kilometers (3 miles) upstream from the Sequoyah Nuclear Plant site. The Hiwassee Island Refuge is located 24 kilometers (15 miles) upstream. The Hiwassee Island Refuge is the principal waterfowl unit on the Chickamauga Reservoir.

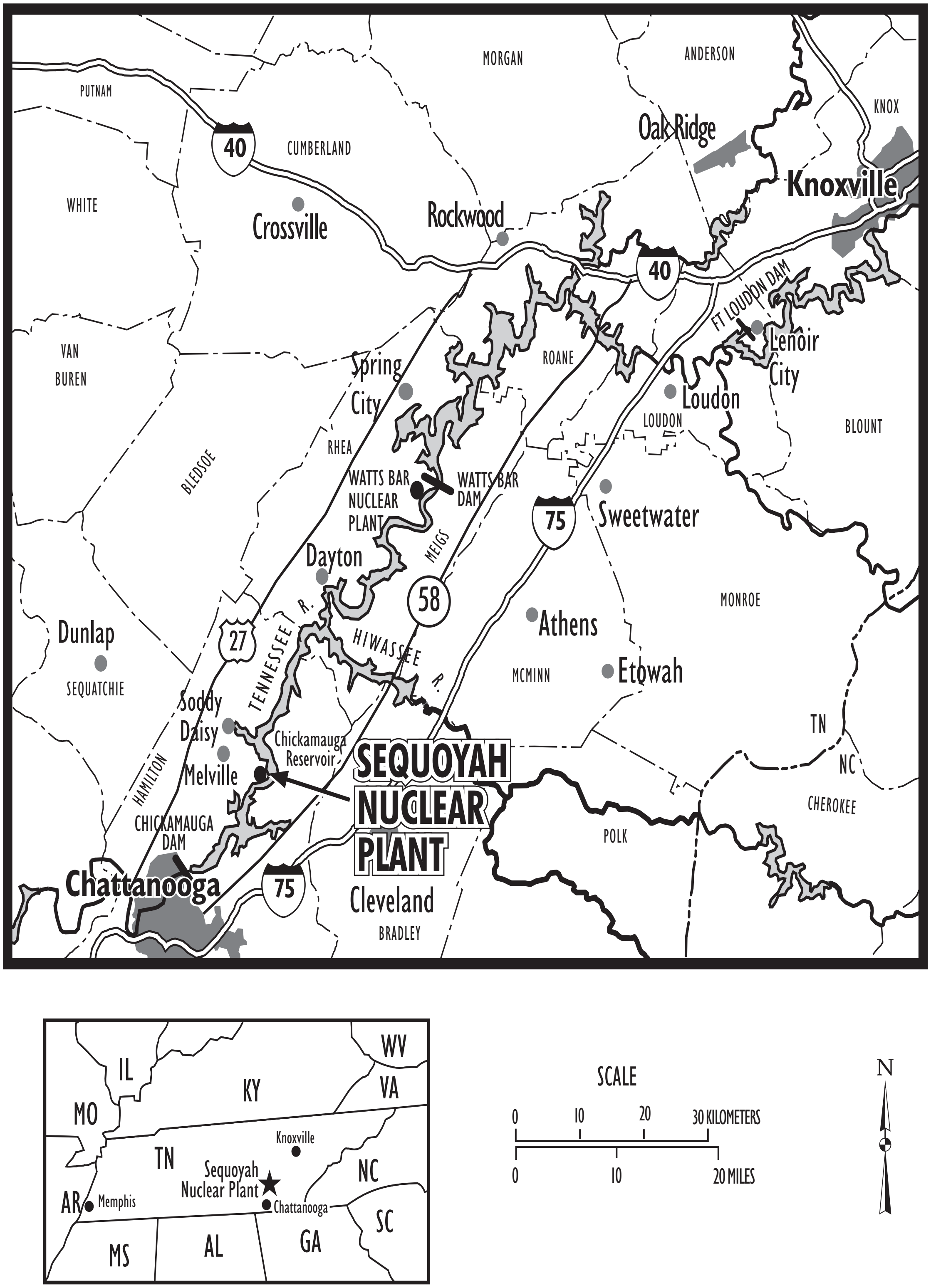

Figure 4–7 Location of the Sequoyah Nuclear Plant Site

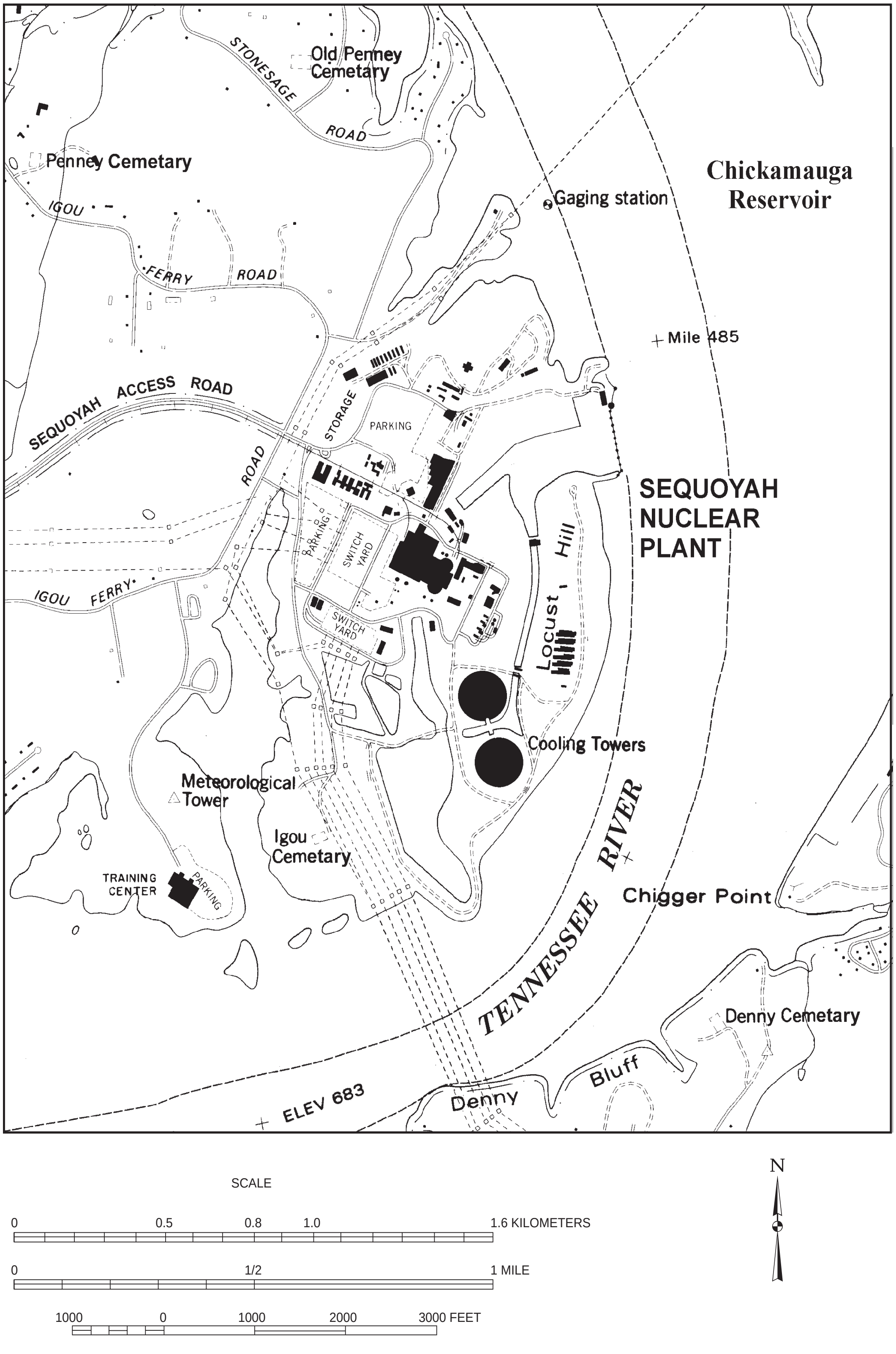

Figure 4–8 Sequoyah Nuclear Plant Site

Visual Resources

The major visual elements of the plant already exist, including the cooling towers, containment structures, turbine building, and transmission lines. Views of Sequoyah 1 and 2 from passing river traffic on the Tennessee River are partially screened by the wooded area east of the plant (TVA 1974a). The plant can be viewed from White Oak Mountain on the east side of the river. Distant glimpses of the plant site can be seen from the coves and hollows along the river and from various roads in the area, including U.S. Highway 27.

Based on the Bureau of Land Management Visual Resource Management method, the existing landscape at the Sequoyah Nuclear Plant site would be classified as Visual Resource Management Class 3 or 4. Class 3 includes areas where there has been a moderate change in the landscape and these changes may attract attention, but do not dominate the view of the casual observer. Class 4 includes areas where major modifications to the character of the landscape have occurred. These changes may be both the dominant features of the view and the major focus of viewer attention (DOI 1986a).

During operation of Sequoyah 1 and 2, the vapor plume associated with the cooling towers may be visible up to 10 miles away. Cooling towers are used approximately 2 percent of the time, usually during periods of low river flow or peak summer temperatures. The plume length and frequency of occurrence with direction varies with atmospheric conditions, being most visible during cooler months and after the passage of weather fronts. Vapor plumes are visible at times from nearby residential areas, U.S. Highway 27, Tennessee State Highway 58, and County Highway 5550 (TVA 1974a).

4.2.2.2 Noise

The most common measure of environmental noise impact is the day-night average sound level. The day-night average sound level is a 24-hour sound level with a 10-dBA penalty added to sound levels between 10:00 p.m. and 7:00 a.m to account for increased annoyance due to noise during nighttime hours. The EPA has developed noise level guidelines for different land-use classifications based on day-night average sound levels and equivalent sound levels. The U.S. Department of Housing and Urban Development has established noise impact guidelines for residential areas based on day-night average sound levels. Some states and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land-use category. The State of Tennessee has not developed a noise regulation that specifies the numerical community noise levels that are acceptable.

For the purpose of this document, noise impacts are assessed using a day-night average sound level of 65 dBA as the level below which noise levels would be considered acceptable for residential land uses and outdoor recreational uses. Generally the noise levels off site are below day-night average sound levels of 65 dBA and are considered acceptable. Testing of the emergency warning siren system occurs on a regular basis and results in outdoor noise levels of about 60 dBA in areas within a radius of about 16 kilometers (10 miles) of the site. TVA typically tests siren systems on a given day of the month at noon.

4.2.2.3 Air Quality

Sequoyah 1 and 2 are located in Hamilton County in south-central Tennessee in the Chattanooga Interstate Air Quality Control Region. Ambient concentrations of criteria pollutants determined by monitoring air quality in the vicinity of Sequoyah 1 and 2 are compared with the applicable National Ambient Air Quality Standards and Tennessee State Ambient Air Quality Standards in **Table 4–13**.

Table 4–13 Comparison of Baseline Sequoyah 1 and 2 Ambient Air Concentrations with Most Stringent Applicable Regulations and Guidelines

Criteria Pollutant	*Averaging Time*	*Most Stringent Regulation or Guideline[a] ($\mu g/m^3$)*	*Baseline Concentration [b] ($\mu g/m^3$)*
Carbon monoxide	8-hour 1-hour	10,000[c] 40,000[c]	1,250 1,250
Lead	Calendar quarter	1.5[c]	0.03
Nitrogen dioxide	Annual	100[c]	9.4
Ozone	8-hour (4th highest averaged over 3 years)	157[c,d]	e
Particulate matter [d]	PM_{10} Annual 24-hour (interim) 24-hour 99th percentile (3-year average) $PM_{2.5}$ Annual (3-year average) 24-hour (98th percentile averaged over 3-years)	 50[c] 150[c] 150[c] 15[c] 65[c]	 20.3 39 e f f
Sulfur dioxide	Annual 24-hour 3-hour	80[c] 365[c] 1,300[c]	5.24 28.8 123
Other Regulated Pollutants			
Gaseous fluoride (as hydrogen fluoride)	30-day 7-day 24-hour 12-hour	1.2[g] 1.6[g] 2.9[g] 3.7[g]	h h h h
Total suspended particulates	24-hour	150[g]	39[i]

$\mu g/m^3$ = micrograms per cubic meter

PM_n = particulate matter size less than or equal to *n* micrometers.

[a] The more stringent of the Federal and state standards is presented if both exist for the averaging time. Tennessee state and National Ambient Air Quality standards are the same for the criteria pollutants. The National Ambient Air Quality Standards (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 1-hour ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is ≤ 1. The 1-hour ozone standard applies only to nonattainment areas. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 157 $\mu g/m^3$. The interim 24-hour PM_{10} standard is attained when the expected number of days with a 24-hour average concentration above the standard is ≤ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

[b] Based on ambient air quality monitoring data at Bradley County location for 1994–1995, except for carbon monoxide from Loudon County (1996) and lead from the Rockwood monitor in Roane County (1996). Concentrations shown are maximums for the averaging period.

[c] Federal standard.

[d] EPA recently revised the air quality standards for particulate matter and ozone. The new standards, finalized on July 18, 1997, change the ozone primary and secondary standards from a 1-hour concentration of 235 $\mu g/m^3$ (0.12 parts per million) to an 8-hour concentration of 157 $\mu g/m^3$ (0.08 parts per million). During a transition period while states are developing state implementation plan revisions for attaining and maintaining these standards, the 1-hour ozone standard would continue to apply in nonattainment areas (62 FR 38855). For particulate matter, the current PM_{10} (particulate matter size less than or equal to 10 micrometers) annual standard is retained and two $PM_{2.5}$ (particulate matter size less than or equal to 2.5 micrometers) standards are added. These standards are set at 15 $\mu g/m^3$ 3-year annual average arithmetic mean based on community-oriented monitors, and 65 $\mu g/m^3$ 3-year average of the 98th percentile of 24-hour concentrations at population-oriented monitors. The current 24-hour PM_{10} standard is revised to be based on the 3-year average of the 99th percentile of 24-hour concentrations. The existing PM_{10} standards would continue to apply in the interim period (62 FR 38652).

[e] There is insufficient data to compare to the standard.

[f] Compliance with the new $PM_{2.5}$ standards is not evaluated since current emissions data for $PM_{2.5}$ are not available.

[g] State standard.

[h] No local monitoring data is available for gaseous fluoride.

[I] PM_{10} value is presented and would underestimate the total suspended particulates concentration. No monitoring data available for total suspended particulates.

Sources: TN DEC 1994, TVA 1998a.

The area in which Sequoyah 1 and 2 are located, the Chattanooga Interstate Air Quality Control Region, is designated by EPA as an attainment area with respect to the National Ambient Air Quality Standards for criteria pollutants (40 CFR 81). The Prevention of Significant Deterioration Class I areas closest to Sequoyah 1 and 2 are the Joyce Kilmer-Slickrock National Wilderness Area and Cohutta National Wilderness Area, Georgia. For locations that are in an attainment area for criteria pollutants, Prevention of Significant Deterioration regulations limit pollutant emissions from new sources and establish allowable increments of pollutant concentrations. Class I areas include national wilderness areas, memorial parks larger than 2,020 hectares (5,000 acres), and national parks larger than 2,340 hectares (6,000 acres). The Class I areas noted above are about 60 kilometers (37 miles) from Sequoyah 1 and 2 (TVA 1998d).

Sources of criteria air pollutant emissions at the Sequoyah Nuclear Plant site include diesel-powered emergency generators and fire protection pumps; site, trade, and employee vehicles; auxiliary boilers; and cooling towers. Small quantities of toxic chemicals and metals are emitted from the testing and operation of the diesel-fueled equipment, resulting in offsite concentrations of less than 0.0001 percent of the threshold limit value of any of these pollutants. One-tenth of the threshold limit value is often used as a guideline in identifying pollutants that may be of concern. Ozone is produced at the Sequoyah Nuclear Plant site by corona discharge (ionization of air) in the operation of transmission lines and substations, particularly at high voltages. Operation of electrical motors and generators also produces ozone. TVA minimizes corona discharge by optimizing, to the extent practicable, its design and construction of transmission facilities.

An analysis of the occurrence of visible plumes has been performed for Sequoyah. Naturally occurring fog with visibility equal to or less than 0.4 kilometers (0.25 miles) occurs in the vicinity of Sequoyah about 36 days per year. Occurrences of the plume descending to the ground or causing localized surface fogging or icing are infrequent (TVA 1974a).

Compliance with the new $PM_{2.5}$ standards was not evaluated since current emissions data for $PM_{2.5}$ are not available. When the calculated concentrations from onsite sources are combined with concentrations from offsite sources, the ambient air quality standards for carbon monoxide, nitrogen oxide compounds, particulate matter, and sulfur dioxide continue to be met.

Gaseous Radioactive Emission

Sequoyah 1 and 2 have three primary sources of gaseous radioactive emissions:

- Discharges from the gaseous waste management system
- Discharges associated with the exhaust of noncondensable gases in the main condenser if a primary to secondary leak exists
- Radioactive gaseous discharges from the building ventilation exhaust, including the reactor building, reactor auxiliary building, and the fuel handling building

The gaseous waste management system collects gaseous fission products (mainly noble gases) that accumulate in the primary coolant. A portion of the coolant is continually diverted to the coolant purification, volume, and chemical control system to remove contaminants and adjust the chemistry and volume. Noncondensable gases are stripped and sent to the gaseous waste management system, a series of gas storage tanks where the extended holdup time allows short half-life gases to decay, leaving only a small quantity of long half-life radionuclides to be released to the atmosphere. **Table 4–14** shows the annual gaseous radioactive emissions from Sequoyah 1 or Sequoyah 2.

Table 4–14 Annual Radioactive Gaseous Emissions from Sequoyah 1 or Sequoyah 2

Emission	*Quantity*
Fission gases (Curies)	120
Tritium (Curies)	25

Source: TVA 1998e, TVA 1999.

Meteorology and Climatology

The regional and local meteorology and climatology of the Sequoyah Nuclear Plant site described in TVA's *Final Environmental Statement, Sequoyah Nuclear Plant Units 1 and 2* (TVA 1974a) has been updated with more recent meteorological data from Chattanooga.

Regional Climate

The Sequoyah Nuclear Plant site is in the eastern Tennessee portion of the Southern Appalachian region. The predominant air masses affecting the Sequoyah Nuclear Plant site are interchangeably continental and maritime winter and spring—predominantly maritime in the summer and continental in the fall.

Data collected over a 30-year period (1961 to 1990) at the Chattanooga airport indicate the average annual temperature is 15.2°C (59.3°F); the average daily maximum temperature in July is 31.7°C (89°F); and the average daily minimum temperature in January is -2.2°C (28°F) (NOAA 1997a).

Precipitation of 0.025 centimeters (0.01 inches) or more occurs on an average of 117 days per year. The average monthly precipitation is 12.2 centimeters (4.80 inches); the maximum monthly average of 17.2 centimeters (6.76 inches) is reached in March.

Severe Weather

Wind storms with wind speeds exceeding 56 kilometers per hour (35 miles per hour), and occasionally 97 kilometers per hour (60 miles per hour), occur several times each year, particularly during winter, spring, and summer. High winds also may accompany thunderstorms that occur about 56 days per year, reaching a maximum frequency in July.

The current estimate of tornado strike probability at the Sequoyah site is 0.000044 per year (4.4 chances per 100,000 in a given year).

Local Meteorological Conditions

The terrain features of the region have some effect on the general climate. The mountain ridge and valley terrain aligned northeast-southwest over eastern Tennessee accounts for the predominant up-valley/down-valley wind flow in lower elevations of 150 to 300 meters (500 to 1,000 feet). The Cumberland Plateau terrain at elevation 460 to 550 meters (1,500 to 1,800 feet) tends to moderate many of the migratory storms that move from the west across the region.

4.2.2.4 Water Resources

Surface Water

The Sequoyah Nuclear Plant site is located at Tennessee River Mile 484.5 on the Chickamauga Reservoir about 21 kilometers (13 miles) upstream of the Chickamauga Dam. Chickamauga Reservoir is TVA's sixth largest reservoir. The reservoir is 95 kilometers (59 miles) long on the Tennessee River and 51 kilometers (32 miles) long on the Hiwassee River, with an area of 14,300 hectares (35,356 acres) and a volume of 775 million cubic meters (628,000 acre-feet). At the Sequoyah Nuclear Plant site, the Chickamauga Reservoir is about 914 meters (3,000 feet) wide, with cross-sectional depths ranging up to 15 meters (50 feet) at normal pool elevation.

During the steam cycle, heat from Sequoyah 1 and 2 turbines is released when the steam passes through a condenser cooled with water from the Tennessee River. This water may be cooled by passing it through evaporative cooling towers. The cooling towers may be operated in open mode, helper mode, or closed mode. In open mode, the towers are not used. All cooling water is discharged first to a pond, then through diffuser pipes into the Tennessee River. In helper mode, water is cooled by the cooling towers before being discharged to the pond. From the pond, water is discharged through diffuser pipes into the Tennessee River. In closed mode, cooling is accomplished in the same manner as described for Watts Bar 1 in Section 3.2.5.1. When the cooling towers are used in closed mode, makeup water from the Tennessee River is needed to replace water losses due to evaporation, drift, and blowdown. In closed mode, most of the water is recirculated back to the condenser, and only the blowdown water is discharged to the pond. From the pond, water is discharged through diffusers into the Tennessee River. The cooling towers have only been used for approximately 2 percent of the plant operating time (TVA 1998d) to meet thermal discharge limits. At full power, the temperature of the water flowing through each condenser is raised by approximately 17°C (30°F) (TVA 1996b).

The open cooling mode using the diffuser pipes withdraws and returns 4,250,000 liters per minute (1,222,000 gallons per minute) with two units operating (TVA 1974a). In the cooling tower closed cycle cooling mode, approximately 249,745 liters per minute (65,978 gallons per minute) are withdrawn from the Tennessee River to make up for water lost through evaporation, small leaks, drift, and blowdown (TVA 1974a). When used, blowdown from a natural-draft cooling tower is discharged into the Tennessee River at a normal rate of 120,000 liters per minute (31,700 gallons per minute) (TVA 1974a).

The direct open cooling system uses a diffuser system that discharges water from diffuser pipes. One diffuser pipe is 4.9 meters (16 feet) in diameter and extends 107 meters (350 feet), while the other diffuser pipe is 5.2 meters (17 feet) in diameter and extends 213 meters (700 feet). These two pipes are perforated with several thousand 5-centimeter (2-inch) ports through which water is discharged into the Tennessee River for maximum thermal mixing (TVA 1974a). Diffusers are used to mix the blowdown with river water, thus limiting the temperature rise after mixing to less than 5.6°C (10°F) (TVA 1996c). This water is discharged under an NPDES Permit (TN DEC 1993a). Tritium production would not affect the thermal discharge characteristics of the plant.

River flow in the vicinity of the Sequoyah site is governed by hydropower operations at the upstream Watts Bar Dam (Tennessee River Mile 529.9) and the downstream Chickamauga Dam (Tennessee River Mile 471). Peaking hydropower operation at these two hydroprojects can cause short periods of zero or reverse flow near the Sequoyah Nuclear Plant site.

Surface Water Quality

The Tennessee Department of Environment and Conservation classifies the streams and creeks of Tennessee based on water quality, stream uses, and resident aquatic biota. Classifications are defined in the State of Tennessee Water Quality Standards. The Chickamauga Reservoir is classified by the Tennessee Division of Water Pollution Control as suitable for the following uses: municipal water supply, industrial water supply, fish and aquatic life, recreation, irrigation, livestock and wildlife watering, and navigation (TVA 1996b). Monitoring data for surface water in the vicinity of Sequoyah 1 and 2 are presented in **Table 4–15.**

Table 4–15 Summary of Surface Water Quality Monitoring in the Vicinity of the Sequoyah Nuclear Plant Site

Parameter	*Unit of Measure*	*Water Quality Criteria*	*Average Water Body Concentration*
Radiological			
Alpha (gross)	picocuries per liter	15[a]	1.9
Beta (gross)	picocuries per liter	50[b]	2.67
Tritium	picocuries per liter	20,000[a]	<300[c]
Nonradiological			
Manganese	milligrams per liter	0.05[d]	0.000956
Nitrate (as N)	milligrams per liter	10.0[a]	0.245
Arsenic	milligrams per liter	0.05[e]	0.00233
Barium	milligrams per liter	2.0[e]	<0.1
Cadmium	milligrams per liter	0.005[e]	0.000117
Chromium	milligrams per liter	0.1[e]	0.00333
Lead	milligrams per liter	0.005[e]	0.00142
Mercury	milligrams per liter	0.002[e]	0.0002
pH (acidity/alkalinity)	pH units	6.0–9.0[e]	7.52

[a] National Primary Drinking Water Regulations (40 CFR 141).
[b] Proposed National Primary Drinking Water Regulations.
[c] Below lower limit of detection of 300 picocuries per liter.
[d] National Secondary Drinking Water Regulations (40 CFR 143).
[e] Tennessee General Water Quality Criteria for Domestic Water Supply (TN DEC 1995).
Source: TVA 1998e, TVA 1998c, TN DEC 1998a.

Surface Water Use and Rights

From its head near Knoxville, Tennessee, to the Kentucky Dam near its mouth, the Tennessee River is a series of highly controlled multiple-use reservoirs. This chain of reservoirs provides flood control, navigation, generation of electric power, sport and commercial fishing, industrial and public water supply, waste disposal, and recreation.

There are two municipal drinking water supply intakes from the Tennessee River within 80 kilometers (50 miles) downstream of the Sequoyah site: East Side Utility and Tennessee American Water. In addition, there are nine industrial water intakes within 80 kilometers (50 miles) downstream of the Sequoyah site; the closest are the Gold Point Marina, Chickamauga Dam, Chickamauga Power Service Shop, and E.I. DuPont de Nemours and Company (TVA 1996b, TVA 1999).

In Tennessee, the state's water rights are codified in the Water Quality Control Act. Water rights are similar to riparian rights in that the designated usage of a water body cannot be impaired. To construct intake structures for the purpose of withdrawing water from available supplies, U.S. Army Corps of Engineers and TVA permits are required.

Liquid Chemical and Radioactive Effluents

The radionuclide contaminants in the primary coolant are the source of liquid radioactive effluent from Sequoyah 1 and 2. Liquid effluent varies considerably in composition. It may include nonradioactive contaminants and chemical constituents depending on the history and collection point of the liquid. Each source of liquid effluent receives an individual degree and type of treatment before storage for reuse or discharge to the environment under the Sequoyah 1 and 2 NPDES Permit. To increase the efficiency of waste processing, wastes of similar characteristics are grouped together before treatment. The Sequoyah 1 or Sequoyah 2 liquid effluent to the environment during normal operation are shown in **Table 4–16**.

Table 4–16 Annual Chemical and Radioactive Liquid Effluents from Operation of Sequoyah 1 or Sequoyah 2

Materials	*Quantity*
Chemicals (kilograms)	294,012 [a]
Tritium (Curies) Other Radionuclides (Curies)	714 [b] 1.15 [b]

[a] TVA 1996b.
[b] TVA 1998e, TVA 1999.

Floodplains and Flood Risk

At the Sequoyah Nuclear Plant the 100-year floodplain for the Tennessee River would be at elevation 209.4 meters (687 feet) above mean sea level. The TVA Flood Risk Profile elevation on the Tennessee River would be elevation 210 meters (689 feet). The Flood Risk Profile is used to control flood damageable development for TVA projects and is based on the 500-year flood elevation (TVA 1998e). The safety-related facilities, systems, and equipment are housed in structures that provide protection from flooding for all flood conditions up to plant grade at the reactor building elevation of 215 meters (705 feet). Rainfall floods exceeding this elevation would require plant shutdown. The situation producing the maximum plant site flood level was determined to be one of two events: (1) a sequence of March storms producing maximum precipitation on the watershed above Chattanooga, or (2) a sequence of March storms centered and producing maximum precipitation in the basin to the west of the Appalachian Divide and above Chattanooga. Seismic and flood events could cause dam failure surges above the plant grade elevation of 219 meters (720 feet) (TVA 1996b).

Groundwater

Groundwater at the Sequoyah Nuclear Plant site is derived principally from local precipitation. The average annual precipitation is 1.47 meters (58 inches). There is no distinct aquifer in the Conasauga Shale that underlies the Sequoyah Nuclear Plant site. The groundwater occurs in small openings that rapidly decrease in size and depth along fractures and bedding planes. The shales and limestones provide relatively low permeability compared to terrace deposits and, therefore, the majority of the discharge of groundwater occurs by movement along the strike of bedrock to the northeast and southwest into the Chickamauga Reservoir.

Groundwater Quality

A total of 16 groundwater monitoring wells have been installed at the Sequoyah Nuclear Plant site. Older monitoring wells at the site are primarily bedrock monitoring wells. Monthly groundwater levels are obtained at all wells except for two: one destroyed during cooling tower construction and the other installed with an automatic sampler for routine monitoring of radiological contaminants. Two of the wells were installed near the low-level radiological waste storage area in August 1981 to obtain background groundwater radiological data (TVA 1998e).

Groundwater Availability, Use, and Rights

There are 8 public groundwater supplies and 24 industrial water supplies drawn from wells within a 32-kilometer (20-mile) radius of the Sequoyah Nuclear Plant site. Two supplies are taken from groundwater springs. There is no groundwater use at the Sequoyah Nuclear Plant site.

Groundwater rights in the State of Tennessee are traditionally associated with the Reasonable Use Doctrine. Under this doctrine, landowners can withdraw groundwater to the extent that they exercise their rights reasonably in relation to the similar rights of others.

4.2.2.5 Geology and Soils

Geology

The controlling feature of the geologic structure at the site is the Kingston thrust fault that developed some 250 million years ago. The fault has been inactive for many millions of years and recurrence of movement is not expected. The fault crosses the northwestern portion of the site area; however, it was not involved directly in the foundation for any of the major plant structures.

Seismology

The Sequoyah Nuclear Plant site lies within the borders of the Southern Appalachian Seismotectonic Province, a Zone 1 (minor damage region) on the U.S. Geologic Survey Seismic Probability Map of the United States. The seismic history of the southeastern United States since 1776 indicates that there has been no seismic activity originating in the site area. Sequoyah 1 and 2 were designed based on the largest historic earthquake to occur in the Southern Appalachian Tectonic Province, the 1897 Giles County, Virginia, earthquake (intensity: Modified Mercalli VIII and Richter magnitude of 6 to 7). The safe-shutdown earthquake for the plant was established at a maximum horizontal acceleration of 0.18 g (g = acceleration due to gravity) and a simultaneous maximum vertical acceleration of 0.12 g (TVA 1996b). The safe-shutdown earthquake is defined as the earthquake that produces the maximum ground vibration for which: (1) the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in the shutdown mode, and (3) the capability to prevent or mitigate the consequences of accidents that could result in offsite exposures comparable to the guideline exposures are designed to remain functional (10 CFR 100, Appendix A).

Soils

The Conasauga Formation provides a satisfactory and competent foundation for the plant structures. Cores from holes drilled in the plant area indicate no evidence of weathering below the upper 1.5 meters (5 feet) of the rock that would be removed under normal construction procedures. Physical testing, both static and dynamic, has shown that the unweathered rock is capable of supporting loads in excess of those that would be imposed by the plant structures. The Conasauga Formation at the site is relatively unfossiliferous and has no known areas of unique paleontological significance.

4.2.2.6 Ecological Resources

Terrestrial Resources

The Sequoyah Nuclear Plant site is located within the Ridge and Valley Physiographic Province. This province lies between the Blue Ridge Mountains and the Cumberland Plateau and is characterized by prominent, northwest-trending ridges and adjacent valleys. The Tennessee River flows through this province, roughly paralleling the alignment of the valleys. The Sequoyah Nuclear Plant site is located near the center of Hamilton County, Tennessee, approximately 12 kilometers (7.5 miles) northeast of the Chattanooga city limits. The area immediately surrounding the site is primarily open agricultural lands with scattered forests.

Terrestrial Wildlife

Hamilton and Bradley Counties, Tennessee, are in the vicinity of the Sequoyah Nuclear Plant site and provide habitat for seven upland game species: white-tailed deer, gray squirrel, raccoon, wild turkey, ruffed grouse, cottontail rabbit, and bobwhite quail. The largest deer populations are located along the western border of Hamilton County (Waldens Ridge) and in the northeastern corner of Hamilton County near the junction of the Hiwassee and Tennessee Rivers. Squirrel populations occur in large stands of hardwoods, while raccoons and rabbits are most common in the wide, rolling valleys between the ridges (TVA 1974a).

The mixture of forest and open vegetative types of terrain and the large degree of openness within the forest provide an abundance of niches favoring a diverse bird population. The diverse habitat sites surrounding the plant support varied and abundant populations of snakes, frogs, salamanders, and other reptiles (TVA 1974a).

Wetlands

The potential wetland areas identified in the vicinity of the Sequoyah Nuclear Plant site are: (1) palustrine, bottomland hardwood deciduous, temporarily flooded wetlands and (2) fringe wetlands. They are indicated in **Figure 4–9** (TVA 1974a).

Aquatic Resources

The Chickamauga Reservoir in the vicinity of the site includes areas of varying depth, blind nonflowing embayments, tributary streams, peninsulas, inundated reservoir shallows (overbank areas), and the navigation channel or old riverbed. The area is characterized by embayments and shallow overbanks that alternate between right and left banks as the channel changes course. There are extensive shallow areas in the stretch approximately 3.2 to 6.4 kilometers (2 to 4 miles) downstream from the Sequoyah Nuclear Plant site (TVA 1974a).

There are a variety of benthic substrates in the area. They range from bedrock to fine organic leaf fragments. The substrate of greatest areal extent is composed of mixed sand, clay, and silt (TVA 1974a).

Fish Communities

Preoperational monitoring for the Sequoyah Nuclear Plant site was conducted from 1971 to 1977. Operational monitoring occurred from 1980 to 1986. Species designated as important to the Chickamauga Reservoir (sauger, crappie, white bass, and channel cat fish) were monitored from 1986 to 1995.

The fish community of the Chickamauga Reservoir, as in most main stream Tennessee River impoundments, is dominated by gizzard and threadfin shad. Rough fish, especially carp, drum, and smallmouth buffalo, also contribute significantly to standing crop (biomass) estimates. Among the sport fish, largemouth and spotted

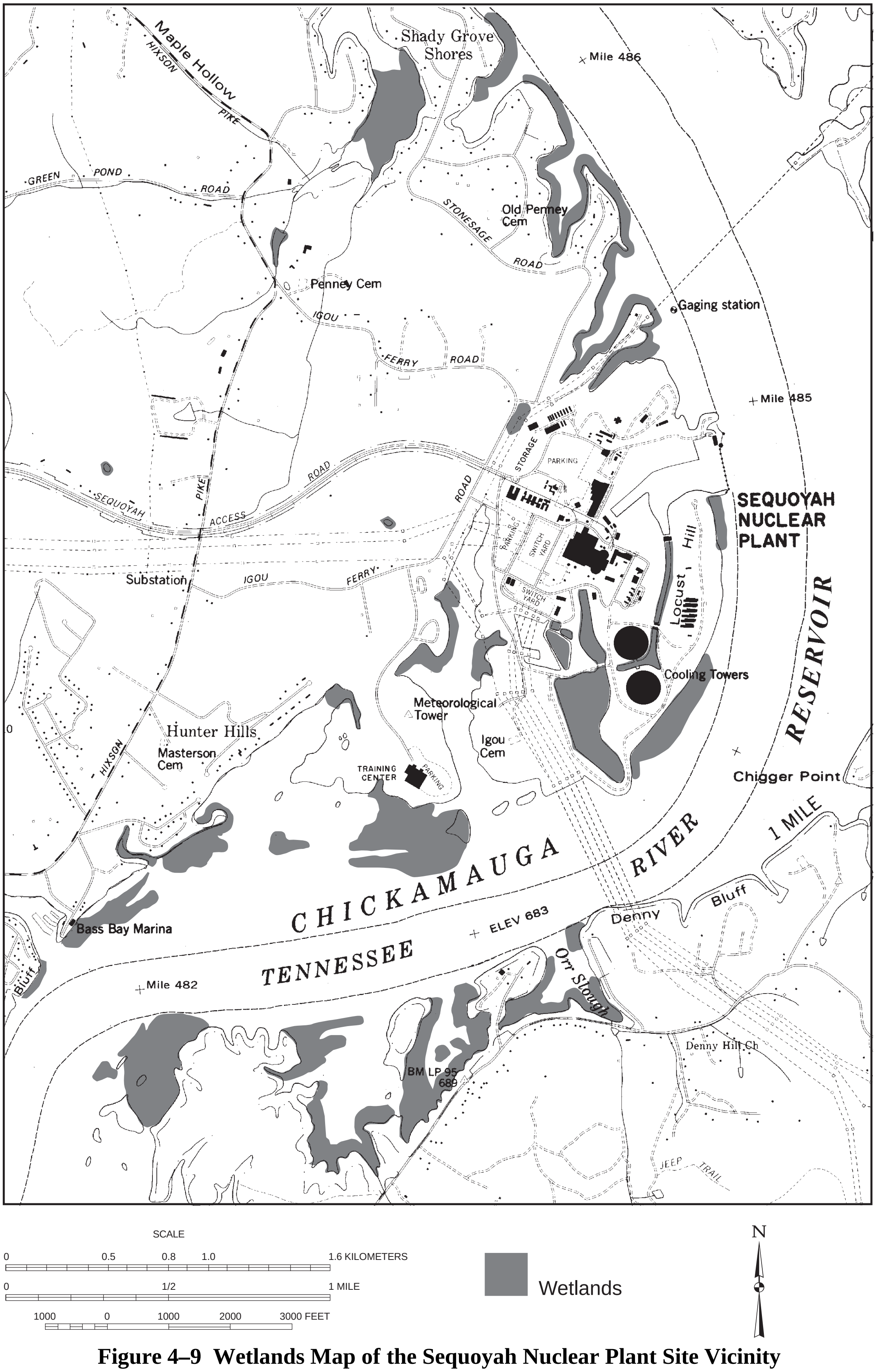

Figure 4–9 Wetlands Map of the Sequoyah Nuclear Plant Site Vicinity

bass, bluegill, redear and longear sunfish, crappie, and sauger are abundant, but smallmouth bass and walleye are rare. The Tennessee Wildlife Resources Agency reported the commercial fish harvest from Chickamauga Reservoir during 1994 to be 63,908 kilograms (140,892 pounds) of fish, primarily channel and blue catfish, buffalo, and common carp (Tennessee 1994).

Mussel and Clam Communities

Very few native mussels persist in the impounded river habitat adjacent to the Sequoyah Nuclear Plant site. Recent sampling in this part of Chickamauga Reservoir produced only a few individuals representing eight wide-ranging species. Large numbers of native mussel species occur in seminatural reaches of the Tennessee River not far downstream from Chickamauga Dam (at Tennessee River Mile 471) and in an approximate 25-kilometer (15-mile) reach downstream from Watts Bar Dam (at Tennessee River Mile 529). These areas are at least 20 kilometers (13 miles) downstream and 30 kilometers (19 miles) upstream from the Sequoyah Nuclear Plant site (Tennessee River Mile 483). There has not been any commercial harvest of native mussels from the downstream part of Chickamauga Reservoir within the last 20–25 years.

An important factor contributing to the decline in native mussel populations was the loss of habitat following impoundment of the river. Dam construction slowed the flow of the river, thereby permitting silt to settle and other bottom conditions. Mussels generally prefer gravel or a mixture of sand, mud, and gravel, but do not survive in deep silt.

While habitat for native mussels is scarce in this impounded part of the Tennessee River, suitable habitat supports large populations of the exotic Asiatic clam, *Corbicula fluminea*, and a few native snails. Also, the zebra mussel, *Dreissena polymorpha*, has been found in this area within the last few years. The Asiatic clam has been present in the Chickamauga Reservoir for at least 30 years (TVA 1998e).

Other Aquatic Life

There is an abundance of aquatic life in the Chickamauga Reservoir. The dominant spring and fall phytoplankton is typically a species of *Melosira*. The summer flora is dominated by two or three species of green algae. Blue-green algae are represented, but are not abundant. A large portion of zooplankton density is composed of rotifers. However, calenoid, copepods, and cladocerans are also plentiful.

As a rule, bottom fauna communities are not diverse and species populations are small. An exception is the Asiatic clam, *Corbicula fluminea,* which achieves densities of 2,000 per square meter (217.8 per square feet) in limited areas. Asiatic clam densities fluctuate throughout the reservoir, but densities are much less in the lacustrine portions. The most abundant insects are the burrowing mayfly, *Hexagenia bilineata*, and midges of the family *Chironomidae*.

Aquatic Macrophytes

In the reach of the Chickamauga Reservoir above the Sequoyah site (toward the Watts Bar site), some embayments support colonies of coontail, potamogetons, and cattails. A chemical control program has been used to suppress a Eurasian watermilfoil invasion. Only a few submerged or emergent macrophytes occur in the immediate area of the Sequoyah site (TVA 1974a).

Threatened and Endangered Species

The 1974 Final Environmental Statement for the Sequoyah Nuclear Plant (TVA 1974a) listed a few endangered or threatened species potentially occurring near the Sequoyah site. Based on more recent information, several terrestrial and aquatic species listed as endangered or threatened by the U.S. Fish and Wildlife Service or state agencies in Tennessee could occur in the general vicinity of the Sequoyah site (**Table 4-17**). Additional information on the status and biology of the Federally listed species in Table 4-17 (except for mountain skullcap) is contained in the biological assessment included in the 1995 NRC Watts Bar Nuclear Plant Final EIS (NRC 1995b), which is incorporated here by reference.

Table 4–17 Listed Threatened or Endangered Species Potentially On or Near the Sequoyah Nuclear Plant Site

Common Name	*Scientific Name*	*Federal*	*State*
Plants			
Large-flowered Skullcap	*Scutellaria montana*	Endangered	Endangered
Mollusks			
Orange-footed Pearlymussel	*Plethobasus cooperianus*	Endangered	Endangered
Pink Mucket	*Lampsilis abrupta/Lampsilis orbiculata*	Endangered	Endangered
Fish			
Blue Sucker	*Cyprogenia elongata*	Not Listed	Threatened
Snail Darter	*Percina tanasi*	Threatened	Threatened
Amphibians			
Eastern Hellbender	*Cryptobranchus a. alleganiensis*	Not Listed	In Need of Management
Birds			
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Osprey	*Pandion haliaetus*	Not Listed	Threatened
Peregrine Falcon	*Falco peregrinus*	Endangered	Endangered
Mammals			
Gray Bat	*Myotis grisescens*	Endangered	Endangered
Indiana Bat	*Myotis sodalis*	Endangered	Endangered

Source: NRC 1995b, TVA 1998e, Tennessee 1994, DOI 1998a.

Plants

The large-flowered skullcap (also known as the mountain skullcap) is a perennial herb in the mint family. It is restricted to three counties in southeast Tennessee and four counties in northwest Georgia. It occurs on rocky, relatively dry forested slopes and ravines and along forested streams with gravelly, fine sandy loam soils. It was first listed in 1986, when it was known to exist at a total of 10 different locations. Since then, it has been found at many more locations and is presently known to exist at 36 sites with a minimum total population of 48,000 individuals. Because some of the recovery objectives for this species have been met, the U.S. Fish and Wildlife Service recently began a review of its status (DOI 1996, DOI 1998b).

A population of large-flowered skullcap occurs on a steep bluff across the Tennessee River from the Sequoyah Nuclear Plant site, and several other skullcap populations occur within a few kilometers of the site. No suitable habitat for this species occurs on the Sequoyah Nuclear Plant site (TVA 1998e).

A population of the small whorled pogonia, *Isotria medeoloides*, Federally listed as threatened and state-listed as endangered, occurs on Walden Ridge about 24 kilometers (15 miles) southwest of the Sequoyah Nuclear

Plant site. This widespread species occurs in open, dry deciduous woods with acid soil (DOI 1992). Little suitable habitat occurs on the Sequoyah site, and the species has not been found during field surveys of the site.

Terrestrial Animals

The bald eagle is a fairly common winter resident and rare summer resident on the Chickamauga Reservoir. Its summer population has increased in the last decade and in early 1999 a pair nested in a wooded area on the Sequoyah site. Ospreys feed primarily on fish and regularly occur on the Chickamauga Reservoir. None have been known to nest in the immediate vicinity of the Sequoyah site. The peregrine falcon formerly nested on the Cumberland Escarpment in Hamilton County and very recently nested on a bridge spanning the Chickamauga Dam tailwater. Suitable nest habitat does not occur in the vicinity of the Sequoyah plant. The peregrine falcon is, however, a rare migrant in the area. Peregrine falcons feed mostly on waterfowl, shorebirds, and, in urban areas, pigeons.

No caves inhabited by gray bats are known to be near the Sequoyah Nuclear Plant site; it is likely, however, that gray bats forage over adjacent portions of the Chickamauga Reservoir. The Indiana bat has not been observed at the Chickamauga Reservoir or elsewhere in Hamilton County. It is known to hibernate in caves in other areas of east Tennessee and in northeast Alabama and periodically is seen in riparian forests along the Chickamauga Reservoir. Little suitable habitat occurs on the Sequoyah site (TVA 1998e).

Aquatic Animals

No endangered or threatened aquatic species are known or are likely to occur in the impounded part of the Chickamauga Reservoir adjacent to the Sequoyah Nuclear Plant site. Present conditions in this part of the reservoir are quite unlike the flowing water, rocky bottom habitats in which nearly all the Tennessee River's endangered and threatened species normally occur.

Four protected aquatic species listed in Table 4-17 occur in the Tennessee River not far downstream from Chickamauga Dam, 20 kilometers (13 miles) downstream from the Sequoyah site. Of these species, only the endangered pink mucket and the threatened snail darter have been encountered in the Chickamauga Dam tailwater within the last decade. The State of Tennessee has listed the blue sucker as a threatened species and the hellbender to be "in need of management." Both of these species have been observed only on rare occasions in the Chickamauga Dam tailwater.

Three other aquatic species, all Federally listed as endangered, were found in preimpoundment surveys of nearby portions of the Tennessee River. These species are the fine-rayed pigtoe, *Fusconaia cuneolus*, the tuberculed-blossom pearlymussel, *Epioblasma torulosa Dysnomia torulosa*, and the Cumberland monkeyface pearlymussel, *Quadrula intermedia*. They all inhabit gravel riffles in medium to large rivers and have not been found in the Chickamauga Reservoir or its tailwaters for 25 years.

4.2.2.7 Archaeological and Historic Resources

No archaeological survey was conducted prior to the initiation of construction activities at the Sequoyah Nuclear Plant site. An archaeological survey of the site was conducted on June 16, 1973, after construction activity was well advanced (TVA 1974a).

No properties on the National Register of Historic Places were identified by a Tennessee Historical Commission review of the Sequoyah Nuclear Plant site (TVA 1974a).

Construction of Sequoyah 1 and 2 is complete, and the reactors have operated since 1980 and 1982, respectively. The operational experience to date has not identified any impact on archaeological or historic resources on or near the Sequoyah Nuclear Plant site.

4.2.2.8 Socioeconomics

The Sequoyah Nuclear Plant is near the town of Soddy Daisy, in Hamilton County, Tennessee. Its precise location is latitude 35°13'24" north and longitude 85°5'16" west (NRC 1998d). Soddy Daisy is about 11 kilometers (7 miles) northeast of Chattanooga, Tennessee, and about 129 kilometers (80 miles) southwest of Knoxville, Tennessee. Highway access from the plant to Soddy Daisy and Chattanooga is via State Route 27. State Route 27 also links the plant to State Route 68 to the north, to Interstate Highway 40 about 73 kilometers (45 miles) to the north, and to State Routes 11, 127, 41, and Interstate Highway 75.

Demography

According to the U.S. Census, the population of Soddy Daisy was 8,240 in April 1990 (DOC 1998c). The estimated population in mid-1996 was 8,884, indicating a growth rate from 1990 to 1996 of almost 8 percent.

Hamilton County had an estimated population of 285,536 in 1990 (DOC 1998c). It also had 79,031 families and 111,380 households in that year. **Table 4–18** shows demographic data for Soddy Daisy, Hamilton County, and the Sequoyah region of influence. The Sequoyah region of influence was defined as the area within 80 kilometers (50 miles) of the Sequoyah Nuclear Plant.

Table 4–18 General Demographic Characteristics of Soddy Daisy, Hamilton County, and the Sequoyah Region of Influence (1990 U.S. Census)

Demographic Measure	*Soddy Daisy*	*Hamilton County*	*Sequoyah Region of Influence*
Total population	8,240	285,536	857,880
Families	2,468	79,031	245,206
Households	3,213	111,380	325,243
Male	3,961	134,510	413,227
Female	4,279	151,026	444,654

Sources: DOC 1992, DOC 1998c.

The Sequoyah region of influence had an estimated population of 857,880 in 1990 (DOC 1992). The number of households in the region of influence was about 325,000 in 1990; the number of families was about 245,000. **Table 4–19** shows Hispanic and non-Hispanic populations residing within 80 kilometers (50 miles) of the Sequoyah Nuclear Plant site.

Table 4–19 Population Distribution by Ethnic Group in Soddy Daisy, Hamilton County, and the Sequoyah Region of Influence (1990 U.S. Census)

Ethnic Group or Subgroup (U.S. Census Definitions)	*Soddy Daisy*		*Hamilton County*		*Sequoyah Region of Influence*	
	Population	*Percentage of Total Population*	*Population*	*Percentage of Total Population*	*Population*	*Percentage of Total Population*
White not of Hispanic origin	8,176	99.22	226,222	79.23	758,404	90.20
Black not of Hispanic origin	36	0.44	54,251	19.00	69,553	8.27
American Indian, Aleut, or Eskimo not of Hispanic origin	8	0.10	762	0.27	2,714	0.32
Asian or Pacific Islander not of Hispanic origin	0	0.00	2,339	0.82	3,601	0.43
Other race not of Hispanic origin	0	0.00	97	0.03	178	0.02
White of Hispanic origin	7	0.09	1,237	0.43	3,674	0.44
Black of Hispanic origin	0	0.00	126	0.04	199	0.02
American Indian, Aleut, or Eskimo of Hispanic origin	0	0.00	10	0.00	53	0.01
Asian or Pacific Islander of Hispanic origin	13	0.16	42	0.01	62	0.01
Other race of Hispanic origin	0	0.00	450	0.16	2,403	0.29
Hispanic total	20	0.24	1,865	0.65	6,391	0.76
Total population (all ethnic groups)	8,240	100.00	285,536	100.00	840,840	100.00

Note: Sum of items may not add up to population total due to rounding error.
Source: DOC 1992, DOC 1998c.

Figure 4–10 shows the projected racial and ethnic composition of the population residing within 80 kilometers (50 miles) of the Sequoyah Nuclear Plant site. Low-income households, as determined from 1990 Census data, are presented on **Figure 4–11**. Low-income households are those with incomes of 80 percent or lower than the median income of the counties. As indicated in that figure, approximately 43 percent of the total households are low-income households (see Appendix G).

Income

Per capita income in Soddy Daisy was $10,709 in 1989, while median household and family income were $22,115 and $27,022, respectively (DOC 1998c). Total personal income in Hamilton County was $7.4 billion in 1996, up from $7.13 billion in 1995 (DOC 1998a). Per capita income in the county was $25,401 in 1996, up from $24,316 in 1995. Hamilton County was ranked fourth in the State of Tennessee in terms of per capita income in 1996. **Table 4–20** summarizes income data for Soddy Daisy and Hamilton County.

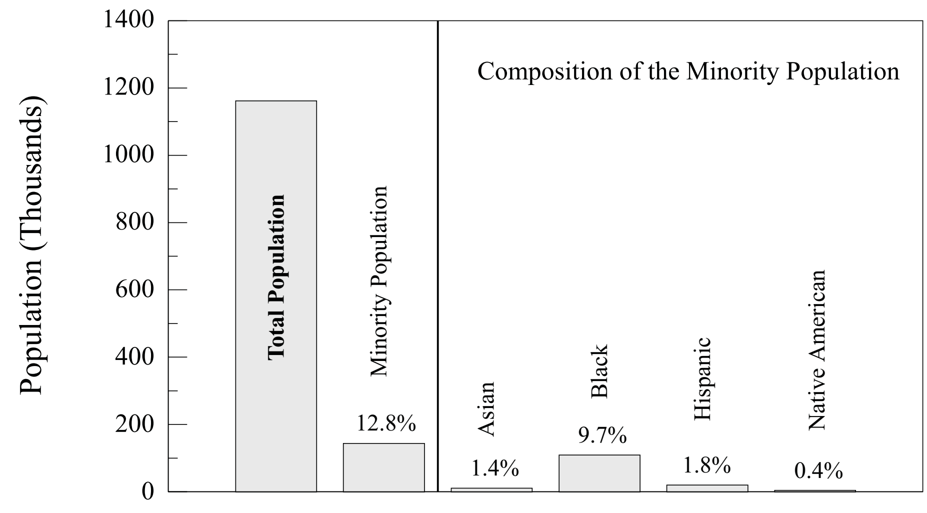

Figure 4–10 Racial and Ethnic Composition of the Minority Population Residing in Counties Within 80 Kilometers (50 Miles) of the Sequoyah Nuclear Plant Projected for the Year 2025

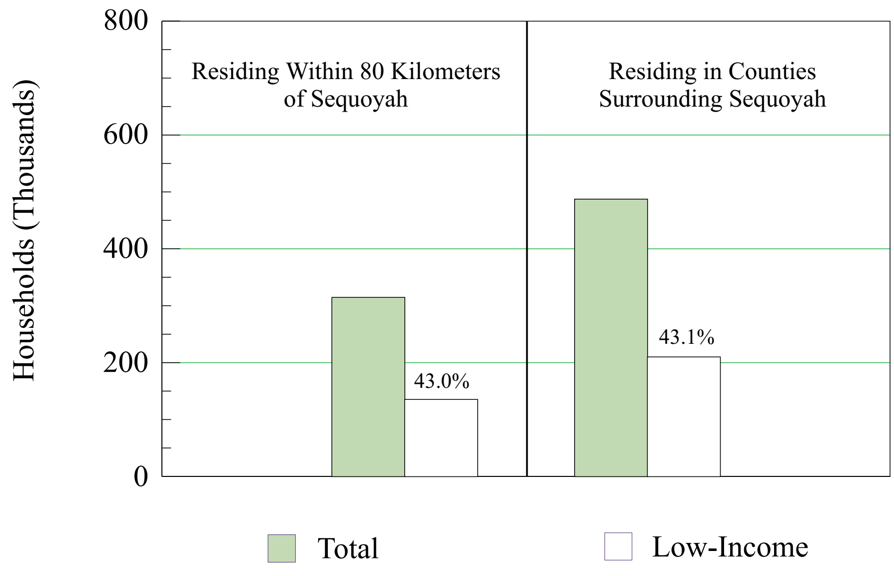

Figure 4–11 Low-Income Households Residing Within 80 Kilometers (50 Miles) of the Sequoyah Nuclear Plant (1990)

Table 4–20 Income Data Summary for Soddy Daisy and Hamilton County (1989)

Income Measure	*Soddy Daisy*	*Hamilton County*
Per capita income	$10,709	$13,619
Median household income	$22,115	$26,523
Median family income	$27,022	$32,185
Median housing value	$46,700	$61,700

Sources: DOC 1998c.

Community Services

Education, public safety, and health care were examined to determine the level of community services for the region of influence.

Education

There are 396 schools within an 80-kilometer (50-mile) radius of the Sequoyah Nuclear Plant site, with a capacity of 135,755 students. The average student-to-teacher ratio is 17:1.

Public Safety

City, county, and state law enforcement agencies provide police protection to residents of the region of influence. The average officer-to-population ratio is 1.4:1,000 persons. Fire protection services are provided by both paid and volunteer firefighters. The ratio of firefighters to the population is 0.7:1,000.

Health Care

The region of influence includes 31 hospitals with a total of 3,672 beds. All of the hospitals are operating below capacity.

Local Transportation

The nearest land transportation routes are State Route 58, about 8 kilometers (5 miles) east of the site and paralleling the east bank of the Tennessee River, and U.S. Highway 27, also 8 kilometers (5 miles) from the site on the west side of the river. State Route 60 passes the northeast quadrant of the site at a distance of about 16 kilometers (10 miles). Interstate Route 75 passes the site from northeast to southwest at a distance of about 14.5 kilometers (9 miles) en route to Chattanooga. A main line of the CNO&TP Railroad (Norfolk Southern Corporation) runs adjacent to Interstate Highway 27 west of the site. The TVA railroad spur connecting the Sequoyah Nuclear Plant site is in good condition from the plant to the CNO&TP tie-in. On the site, 61 meters (200 feet) of track have been removed from the auxiliary building railroad bay. Replacement of this track and other maintenance of the onsite track would be necessary before it could be used. The Tennessee River is navigable past the site and is used as a major barge route (TVA 1996b). These transportation routes are shown in **Figure 4–12**.

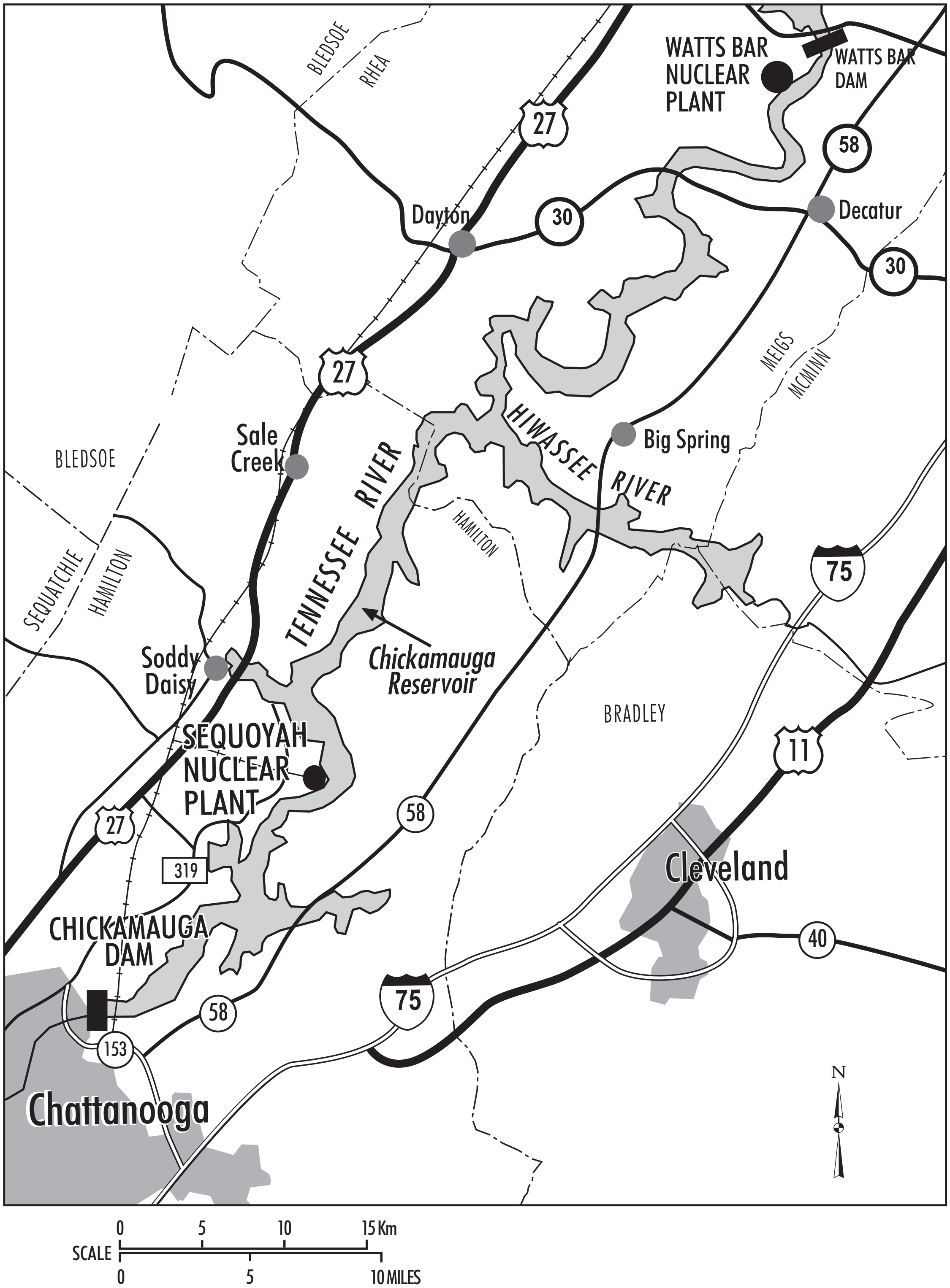

Figure 4–12 Transportation Routes in the Vicinity of the Sequoyah Nuclear Plant Site

The major surface roads mentioned above and the network of local roads connecting with them adequately serve the needs of the local communities and TVA employees at the Sequoyah Nuclear Plant site.

4.2.2.9 Public and Occupational Health and Safety

Radiation Environment

Background radiation exposure to individuals in the vicinity of the Sequoyah Nuclear Plant site is expected to be the same as for the Watts Bar site. The background radiation exposure at the Sequoyah site is presented in **Table 4–21.** The annual doses to individuals from background radiation are expected to remain constant over time. Thus, any incremental change in the total dose to the population would be a function only of a change in the size of the population.

Table 4–21 Sources of Background Radiation Exposure to Individuals in the Vicinity of the Sequoyah Nuclear Plant Site[a]

Source	***Total* Effective Dose Equivalent (millirem per year)**
Natural Background Radiation	
Cosmic and cosmogenic radiation	28
External terrestrial radiation	28
In the body	39
Radon in homes (inhaled)	200
Total	295
Other Sources of Radiation	
Release of radioactive material in natural gas, mining, ore processing, etc.	5
Diagnostic x-rays and nuclear medicine	53
Nuclear energy	0.28
Consumer and industrial products	0.03
Total	355

[a] Values are based on average national data, not measured values at the Sequoyah site.
Source: TVA 1998b.

Radionuclides released in effluents from Sequoyah 1 and 2 are a potential source of radiation exposure to individuals in the vicinity of Sequoyah 1 and 2 and are additional to the background radiation values listed. Calculations of radiation doses to individuals and the population surrounding the plant were performed by TVA using measurements from the various radiological monitoring points around the plant during operation in 1997, as well as conservative assumptions regarding individual and population exposure time. The doses are presented in **Table 4–22.**

Radiation doses to onsite workers include the same background dose received by the general public plus an additional dose from working in the facility.

Table 4–22 Annual Doses to the General Public During 1997 from Normal Operation at Sequoyah 1 or Sequoyah 2 (Total Effective Dose Equivalent)

Affected Environment	Airborne Releases		Liquid Releases		Total	
	Most Stringent Standard[a]	Calculated Based on Actual Measurements	Most Stringent Standard[a]	Calculated on the Basis of Actual Measurements	Most Stringent Standard[b]	Calculated on the Basis of Actual Measurements
Maximally exposed offsite individual (millirem)	5	0.031	3	0.022	25	0.053
Population within 80 kilometers (50 miles), (person-rem) [b]	None	0.37	None	0.79	None	1.16
Average dose to an individual within 80 kilometers (50 miles) (millirem) [c]	None	0.00039	None	0.00085	None	0.0012

[a] From 10 CFR 50, Appendix I (design objectives for equipment to control releases of radioactive materials in effluents from nuclear power reactors). The standard for the maximally exposed individual (25 millirem per year total body from all pathways) is given in 40 CFR 190.
[b] Population used: 933,852.
[c] The average is obtained by dividing the population dose by the 50-mile radius population.
Source: TVA 1998e.

Direct Radiation

Radiation fields are produced in nuclear plant environs as a result of the radioactivity contained in the reactor and its associated components. Doses from sources within the plant are largely due to nitrogen-16, a radionuclide produced from the primary coolant in the reactor core. Since the primary coolant of pressurized water reactors is contained in a heavily shielded area of the plant, dose rates from direct radiation in the vicinity of pressurized water reactors are generally less than 5 millirem per year.

The plant operator committed to design features and operating practices that ensure that individual occupational radiation doses are within the occupational dose limits defined in 10 CFR 20, and that individual and total plant operational doses would be as low as is reasonably achievable. The combined radiation doses received by the onsite worker are shown in **Table 4–23**.

Table 4–23 Annual Worker Doses from Normal Operation at Sequoyah 1 or Sequoyah 2 During 1996

Affected Environment	Standard[a]	Dose[b]
Average worker (millirem)	None	90
Maximally exposed worker (millirem)	5,000	≤ 2,000
Total workers (person-rem)	None	132

[a] NRC regulatory limit: 10 CFR 20.
[b] TVA 1996 report based on 1,470 badged workers per unit.
Source: NRC 1997b.

Chemical Environment

Nonradioactive chemical wastes from Sequoyah 1 and 2 include boiler blowdown, water treatment wastes (sludges and high saline streams whose residues are disposed of as solid wastes and biocides), boiler metal cleaning, floor and yard drains, and stormwater runoff. Processes for defouling facility piping produce about 22,000 kilograms per year (24 tons per year) of organic residue byproducts and halites (oxygenated chlorine and bromine ions) per reactor.

Operation of Sequoyah 1 and 2 takes into account the storage of process chemicals and disposal of the waste products. Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements (such as air emissions and NPDES Permit requirements). The effectiveness of these controls is verified by monitoring information about and inspecting compliance with mitigation measures.

Section 4.2.2.3, Table 4–13, and Section 4.2.2.4, Table 4–15, contain data on chemical concentrations in ambient air and surface water in the vicinity of the Sequoyah site.

Emergency Preparedness

The license issued by the NRC for the operation of Sequoyah 1 and 2 is based in part on a finding that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. This finding by the NRC is based on: (1) a review of the Federal Emergency Management Agency findings; (2) determinations that state and local emergency plans are adequate and give reasonable assurance that they can be implemented; and (3) the NRC's assessment that the applicant's onsite emergency plans are adequate and give reasonable assurance that they can be implemented.

The Sequoyah Nuclear Plant emergency plan (Annex H) establishes that evacuation is the most effective protective action that can be taken to cope with radiological incidents. The plan provides the details of the evacuation plan. Risk counties, identified as Bradley and Hamilton Counties, are tasked with preparing evacuation plans for citizens within the 16-kilometer (10-mile) emergency planning zone and determining the number of people to be evacuated from the zone. Host counties, identified as Meigs, Rhea, and Sequatchie, are assigned responsibility to identify suitable shelters for evacuees. A State Emergency Operation Center would provide the focus for emergency reaction, e.g., notifications, protective action, and evacuation implementation. Fixed sirens would alert residents and transients within the 16-kilometer (10-mile) emergency planning zone with backup provided, if needed, by emergency vehicle sirens and loudspeakers. The State Emergency Operation Center Director would involve the counties' Emergency Management Directors as required.

The Emergency Alert System and the National Oceanic and Atmospheric Administration Weather Radio would be used to provide emergency information and instructions.

The evacuation would be ordered and accomplished by designated sectors. The designated evacuation routes would be patrolled by traffic assistance teams.

The American Red Cross would operate mass care shelters. Shelter information points would be established on each evacuation route to help direct evacuees to their assigned shelters.

Considerable planning is involved in evacuation planning. Training, education, and practice runs are utilized to further the probability of successful evacuation in the event it is ever required.

4.2.2.10 Waste Management

As with any major industrial activity, Sequoyah 1 and 2 generate waste as a consequence of normal operation. Such wastes include hazardous waste, nonhazardous solid waste, low-level radioactive waste, and sanitary liquid waste. **Table 4–24** summarizes the annual amount of waste generated at the Sequoyah Nuclear Plant site in each category.

Table 4–24 Annual Waste Generation at Sequoyah 1 and 2

Waste Type	*Volume or Mass*
Hazardous waste (cubic meters)	1.196
Nonhazardous waste (kilograms)	1,301,966
Low-level radioactive waste (cubic meters)	383
Mixed waste (cubic meters)	less than 1

Source: TVA 1998e.

Hazardous Waste

Hazardous wastes typically generated at Sequoyah 1 and 2 include paints, solvents, acids, oils, radiographic film and development chemicals, and degreasers. Neutralization is the only waste treatment performed on site. Hazardous wastes are normally stored in polyethylene containment systems during accumulation. An approved storage building is used to store hazardous wastes for either 90 or 180 days, depending on the plant's hazardous waste generator status (i.e., small quantity or large quantity) at the time. Waste is transported to an offsite hazardous waste storage or disposal facility prior to exceeding the 90- or 180-day storage limit.

Low-Level Radioactive Waste

During the fission process, an inventory of radioactive fission and activation products builds up within the reactor (in the fuel and the materials of construction). A small fraction of these radioactive materials escape and contaminate the reactor coolant. The primary coolant system also receives radioactive contaminants. These contaminants are removed from the coolant by a radioactive waste treatment system. Sequoyah 1 and 2 use separate radioactive waste treatment systems for gaseous, liquid, and solid waste treatment. Residues from the gaseous and liquid waste treatment systems (filters, resins, dewatered solids) are combined and disposed of with the solid, low-level radioactive waste. Contaminated protective clothing, paper, rags, glassware, compactible and noncompactible trash, and reactor components and equipment constitute the majority of solid low-level radioactive waste at Sequoyah 1 and 2.

Before disposal, compactible trash (with the exception of irradiated metals) is shipped to a commercial processor where it is compacted to a lesser volume and shipped to the Barnwell low-level radioactive waste disposal facility in South Carolina. Trash that can be incinerated is shipped to a commercial waste incinerator in Oak Ridge, Tennessee, where the material is burned to ashes before final disposal at the Barnwell facility. Metal waste is either decontaminated and recycled or melted to form shielding blocks. Any radioactive waste from these processes is shipped to the Barnwell disposal facility (TVA 1998a). TVA does not send irradiated metals for volume reduction due to their excessive dose rate. Instead, this material accumulates until a sufficient amount is on hand to ship directly to the Barnwell disposal facility.

Mixed Waste

Mixed waste is material that is both hazardous and radioactive. No mixed waste has been generated at Sequoyah since 1990. Past sources of mixed low-level radioactive waste at TVA nuclear plants have included beta-counting fluids (e.g., zylene, toluene) for use in liquid scintillation detectors, polychlorinated biphenyls susceptible to contact with radioactive contamination as a result of an accidental transformer spill or explosion, isopropyl alcohol used for cleaning radioactive surfaces, chelating agents, and various acids.

Waste Minimization Practices

The Sequoyah Nuclear Plant site has an active waste minimization program that consists of the following practices:

- Useful portions of construction and demolition materials are salvaged for resale.
- Segregated storage areas are maintained for each type of recoverable material.
- Scrap treated lumber is sold or placed in dumpsters for disposal by the solid waste disposal contractor at an offsite permitted landfill.
- Inert construction and demolition wastes are collected for disposal at the onsite permitted landfill.
- Waste paper is placed in bins or dumpsters and sold to an offsite recycle facility.
- Aluminum cans are recycled and sold.
- Nonrecoverable solid wastes are placed in dumpsters for disposal by the solid waste disposal contractor.
- Special wastes (e.g., desiccants, oily wastes, insulation) are collected and stored and then disposed of by incineration. Asbestos is sent to an approved special waste landfill for disposal.
- Used oil, fluorescent tubes, and antifreeze are collected and stored in drums or tanks and recycled.
- Medical wastes are collected and disposed of in accordance with the medical waste disposal procedure for TVA medical facilities.
- All plant sanitary wastewater is discharged directly to the Hamilton County Public Operated Treatment Works.
- Metal-cleaning wastewater (e.g., trisodium phosphate, acetic acid) is discharged into approved storage ponds for future disposal in accordance with the NPDES Permit.
- Wastewater from floor and equipment drains in nonradiation areas is routed through sumps to the turbine building sump for discharge in accordance with the NPDES Permit.
- Surplus chemicals are sold; lead acid batteries are recycled; refrigerant is recovered and recycled; and solvent recovery equipment is used for painting operations.
- Steps to use biodegradable solvents and cleaners to replace hazardous chemicals in various cleaning operations have been incorporated to the extent practical.

4.2.2.11 Spent Fuel Management

When nuclear reactor fuel has been irradiated to the point that it no longer contributes to the operation of the reactor, the fuel assembly is termed spent nuclear fuel and is removed from the reactor core and stored in the spent fuel storage pool or basin. The Nuclear Waste Policy Act of 1982, as amended, assigned to the Secretary of Energy the responsibility for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel. When such a repository is available, spent nuclear fuel will be transported for disposal from the nation's nuclear power reactors to the repository. Until a repository is available, spent nuclear fuel must be stored in the reactor pools or in other acceptable, NRC-licensed storage locations. Because of the uncertainty associated with opening a repository, this EIS assumes spent fuel would be stored at the Sequoyah site for the duration of the proposed action (i.e., 40 years).

Storage Capacity

Storage cells have been provided in the Sequoyah 1 and 2 spent fuel storage pools to hold 2,089 fuel assemblies. A reserve capacity is required for a discharge of one complete core (193 fuel assemblies) in the event it becomes necessary to remove fuel from one of the reactor vessels. An administrative policy requires the reserve spent fuel pool to have the capacity to discharge two complete cores (386 fuel assemblies). The remaining storage capacity is 1,703 fuel assemblies. As of January 1998, the spent fuel storage inventory at Sequoyah 1 and 2 was 1,214 assemblies, leaving a usable storage capacity of 489 fuel assemblies.

Management Practice

The normal (projected equilibrium average) refueling batch size is 80 spent fuel assemblies, with the refueling frequency established at 18 months. The current capacity for storing spent nuclear fuel is adequate through the year 2001 (following Unit 1 fuel cycle Number 11). However, Sequoyah 1 and 2 already are licensed for an additional storage rack that would increase the capacity by 193 assemblies (one full core) to a total spent fuel storage pool capacity of 2,282 fuel assemblies. After Unit 2 Reload 12, scheduled for year 2003, Sequoyah 1 and 2 will no longer be able to retain a two-full-core storage reserve.

4.2.3 Bellefonte Nuclear Plant Units 1 and 2

As discussed in Section 3.2.5.3, one of the reactor options under consideration is the irradiation of TPBARs in Bellefonte 1 or both Bellefonte 1 and 2 after they have been completed and licensed for operation by the NRC. An assumption incorporated in this option is that the units would operate for the generation of electricity at their licensed full-power output with no reduced operability attributable to the production of tritium. However, the irradiation of TPBARs for tritium production would be considered the primary mission of the plant.

Bellefonte 1 and 2 were issued a construction permit by the Atomic Energy Commission in December 1974. By 1988, Unit 1 was 90 percent complete, and Unit 2 about 57 percent complete. On July 29, 1988, TVA notified the NRC that completion of construction of the Bellefonte Nuclear Plant was being deferred. A lower-than-expected load forecast for the near future was given as the reason for deferral. On March 23, 1993, TVA notified the NRC of its plans to complete Bellefonte 1 and 2. This decision was the result of an extensive, three-year study that concluded completion of the facility as a nuclear power plant was viable. In December 1994, the TVA Board announced that Bellefonte would not be completed as a nuclear plant without a partner. Construction was halted again and has remained stopped pending completion of a comprehensive evaluation of TVA's power needs (TVA 1997f).

Since December 1994, engineering and construction activities have been suspended. The plant systems and structures are maintained through an active layup and preservation program initiated in 1988. The program is described briefly in Section 3.2.5.3, including brief descriptions of the existing structures. Detailed descriptions of the site, buildings, structures, systems, and operations are provided in the following licensing and environmental documentation for the plant:

- Atomic Energy Commission, *Final Environmental Statement Related to Construction of the Bellefonte Nuclear Plant Units 1 and 2* (AEC 1974).

- Tennessee Valley Authority, *Final Environmental Impact Statement for the Bellefonte Conversion Project*, (TVA 1997f).

- Tennessee Valley Authority, *Bellefonte Nuclear Plant, Final Safety Analysis Report, through Amendment 30,* Chattanooga, Tennessee, (TVA 1991).

The following sections describe the affected environment at the Bellefonte site for land resources, noise, air quality, water resources, geology and soils, ecological resources, cultural resources, and socioeconomics. In addition, the radiation and hazardous chemical environment, waste management, and spent nuclear fuel considerations are described.

4.2.3.1 Land Resources

Land Use

Located in Jackson County, Alabama, the Bellefonte Nuclear Plant site occupies approximately 607 hectares (1,500 acres) of land on a peninsula at Tennessee River Mile 392, on the west shore of Guntersville Lake, about 11.3 kilometers (7 miles) east-northeast of Scottsboro, Alabama. This land has already been dedicated as the site for Bellefonte 1 and 2. No additional land is needed to complete construction of either unit or to accommodate tritium production. The location of the Bellefonte site is shown in **Figure 4–13.** The Bellefonte site is shown in greater detail in **Figure 4–14**.

Greater than 90 percent of the land within the three-county area surrounding the site is characterized by forest and agricultural use or is undeveloped. The remaining land is used for residential, commercial, industrial, infrastructure, social, cultural, or governmental purposes. The nearest town, Hollywood, Alabama, is approximately 4.8 kilometers (3 miles) from the site.

Completion of the units for industrial purposes (including contracted irradiation services) would conform with the proposed urban and industrial development land use for the site and its vicinity as designated by the local governmental plans, policies, and controls.

Industry

Industrial development is largely concentrated along the Scottsboro-Stevenson-Bridgeport corridor and is mainly influenced by the availability of transportation and urban services.

Agriculture

The total area of Jackson County, Alabama, is approximately 277,000 hectares (684,500 acres), of which about 30 percent or 82,800 hectares (204,600 acres) is used for agriculture (GISP 1998b).

Forest

Sixty-three percent of the area of Jackson County, Alabama, is forested, amounting to 174,200 hectares (430,500 acres). Oak-hickory hardwood forests make up 78 percent of the forested area. The balance includes loblolly and short-leaf pine and oak-pine forests (DOA 1998b, DOA 1998c).

Recreation

Hunting, fishing, and pleasure boating are among the more popular activities in the Bellefonte site area. Guntersville Lake supports a variety of water-based recreation activities. Most of this activity occurs during the spring, summer, and early fall periods of the year.

Nature Reserves

A wildlife management area includes Mud Creek and Crow Creek embayments and their shoreline lands. The Coon Gulf Habitat Protection Area on the eastern shore of Guntersville Reservoir is a state-managed reserve.

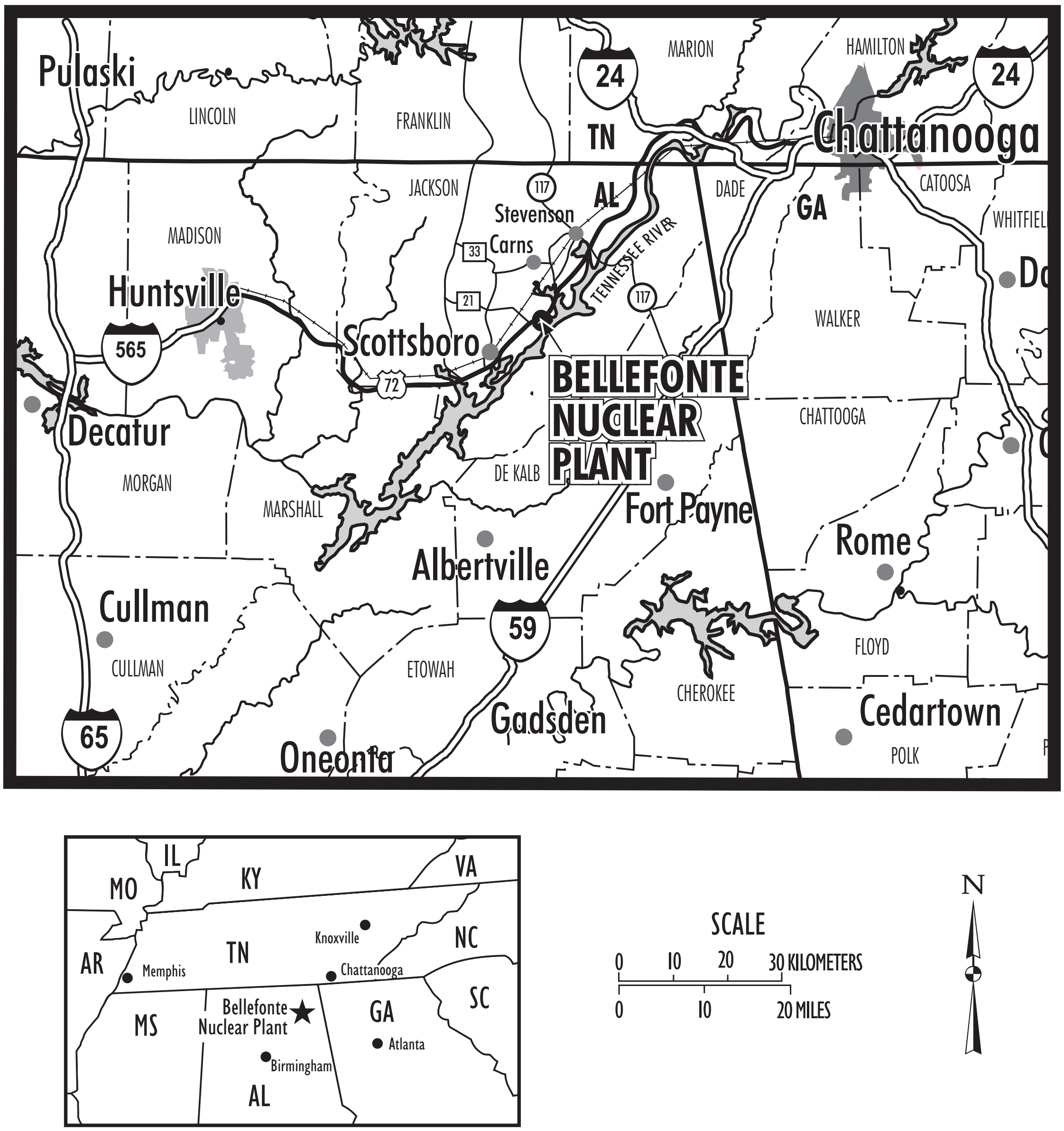

Figure 4–13 Location of the Bellefonte Nuclear Plant Site

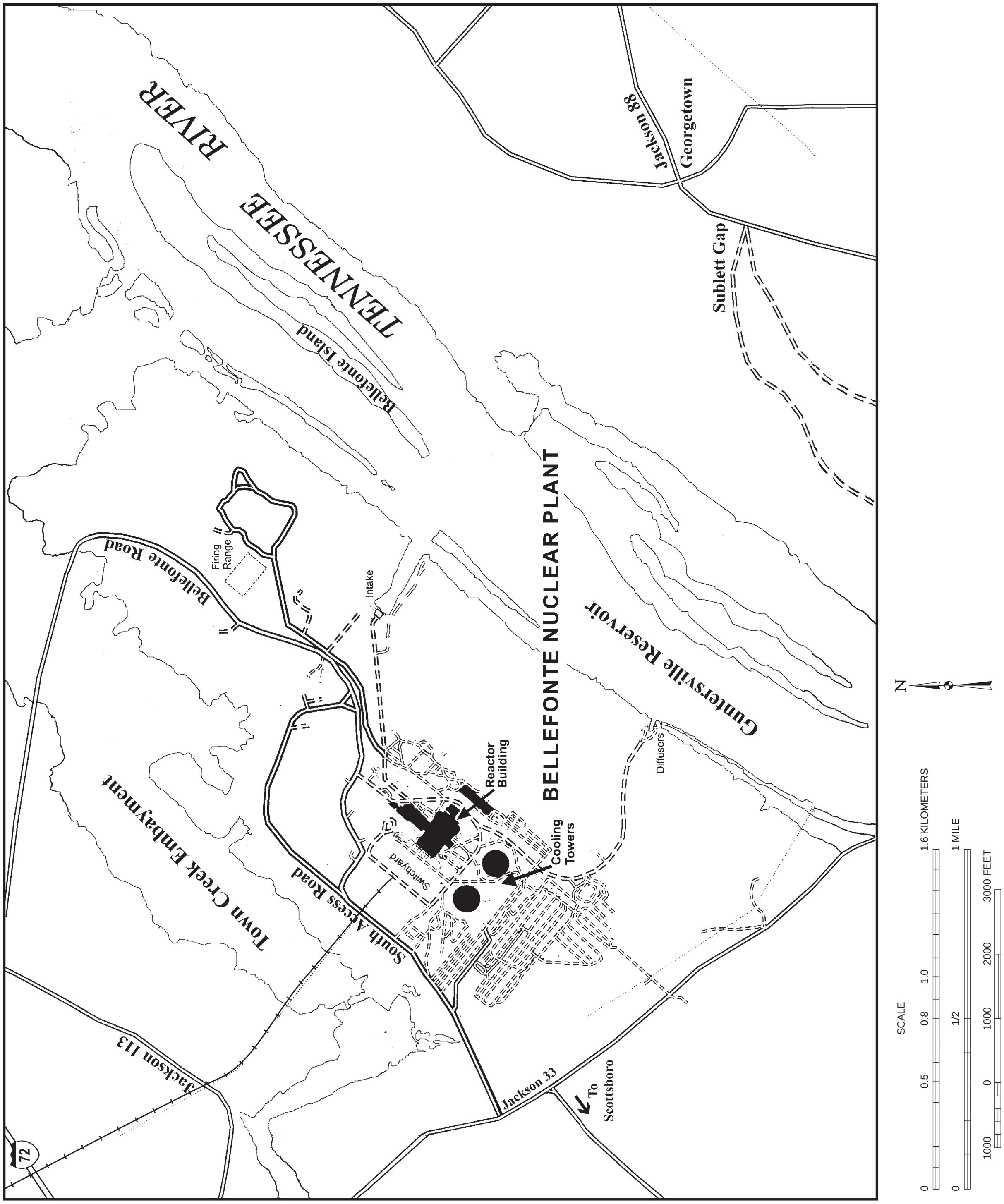

Figure 4–14 Bellefonte Nuclear Plant Site

Visual Resources

The visual landscape of the Bellefonte Nuclear Plant site is characterized by a flat valley adjacent to a reservoir and a river. The visual landscape of the site reflects that of an industrialized facility. The viewshed includes hilly land with urban-industrial nodes surrounded by low density development scattered among agricultural uses and forest lands.

The major visual elements of the plant already exist, including the cooling towers, containment structures, turbine building, and transmission lines. Views of the Bellefonte site from passing river traffic on the Tennessee River are partially screened by the ridge lines close to the shoreline. The plant is overlooked by a few residences on Sand Mountain on the east side of the river. Distant glimpses of the plant site can be had from the coves and hollows along the Sand Mountain rim, from State Roads 35 and 40 as they traverse Sand Mountain, and from Comber Bridge, which crosses Guntersville Lake (TVA 1997f). The plant can be seen from various locations along U.S. Highway 72 to the northwest and from residences on the northern shore of Town Creek Embayment.

A visual resource inventory is composed of three factors: Visual Resource Management classification, distance zones, and sensitivity levels. Distance zones for each viewpoint are determined as foreground-middleground, background, or seldom-seen. Based on the Bureau of Land Management Visual Resource Management method, the existing landscape at the site would be classified as Visual Resource Management Class 3 or 4. Class 3 includes areas where there has been a moderate change in the landscape and these changes may attract attention, but do not dominate the view of the casual observer. Class 4 includes areas where major modifications to the character of the landscape have occurred. These changes may be dominant features of the view and the major focus of viewer attention (DOI 1986a). Due to the location of the site adjacent to the Tennessee River, the area is subject to high user volumes associated with recreational uses. Because of the proximity to urban development and recreational areas, the facilities are visible from viewpoints with low to moderate sensitivity levels (DOI 1986a).

4.2.3.2 Noise

The most common measure of environmental noise impact is the day-night average sound level. The day-night average sound level is a 24-hour sound level with a 10 dBA penalty added to sound levels between 10:00 p.m. and 7:00 a.m to account for increased annoyance due to noise during nighttime hours. The EPA has developed noise level guidelines for different land-use classifications based on day-night average sound levels and equivalent sound levels. The U.S. Department of Housing and Urban Development has established noise impact guidelines for residential areas based on day-night average sound levels. Some states and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land-use category. The State of Alabama has not developed a noise regulation that specifies the numerical community noise levels that are acceptable.

For the purpose of this document, noise impacts are assessed using a day-night average sound level of 65 dBA as the level below which noise levels would be considered acceptable for residential land uses and outdoor recreational uses, and an increase of 2 dBA as an indicator of “substantial” increases in noise. This approach is based on the TVA noise analysis for the Bellefonte Conversion Project (TVA 1997f).

The day-night average sound levels at locations near the site are typical of a quiet rural community. The daytime and nighttime equivalent sound level values ranged from 41 to 51 dBA. The maximum day-night average sound level, 55 dBA, falls well within the Department of Housing and Urban Development guidelines limit. The EPA considers the typical day-night average sound level noise range for a rural location where noise sources include wind, insect activity, aircraft, and agricultural activity to be 35 to 50 dBA. Offsite noise levels below 65 dBA are considered acceptable.

4.2.3.3 Air Quality

The Bellefonte Nuclear Plant site is in the Tennessee River Valley, Alabama-Cumberland Mountains, Tennessee, Interstate Air Quality Control Region. Ambient concentrations of criteria pollutants in the vicinity of the Bellefonte Nuclear Plant that were determined by monitoring at a station on Sand Mountain are presented in **Table 4–25**. This station is about 3.8 kilometers (2.4 miles) east of the plant site. During the period from February 1, 1990, through January 31, 1991, six criteria pollutants were monitored at the station. Monitoring data for 1996 and 1997 from Scottsboro and Huntsville are used to supplement this data.

The ambient concentrations of criteria pollutants are compared with the most stringent regulation or guideline. Alabama Ambient Air Quality Standards are the same as the National Ambient Air Quality Standards for all criteria pollutants.

The area surrounding the Bellefonte Nuclear Plant site is designated by the EPA as an attainment area with respect to National Ambient Air Quality Standards for criteria pollutants (40 CFR 81). The nearest Prevention of Significant Deterioration Class I areas to the Bellefonte Nuclear Plant site are the Cohutta National Wildlife Area in north-central Georgia and the Sipsey National Wildlife Area in northeastern Alabama. Both sites are more than 100 kilometers (62 miles) from the Bellefonte Nuclear Plant site.

Sources of criteria pollutant emissions found at the Bellefonte Nuclear Plant site include the occasional operation of diesel-powered emergency generators and fire protection pumps; the backup security generator; the environmental data station generator; site, trade, and employee vehicles; and auxiliary boilers. Small quantities of toxic chemicals and metals are emitted from the testing and operation of the diesel-fueled equipment, resulting in contributions to offsite concentrations of less than 0.0001 percent of the threshold limit value of any of these pollutants.

The calculated concentrations of carbon monoxide, nitrogen dioxide, particulate matter, and sulfur dioxide from operation of the auxiliary steam boilers, diesel generators, lube oil system, and diesel fire pumps are two or more orders of magnitude below the ambient standards. Compliance with the new $PM_{2.5}$ standards was not evaluated since current emission data for $PM_{2.5}$ are not available. When the calculated concentrations from onsite sources are combined with concentrations from offsite sources, the ambient air quality standards for carbon monoxide, nitrogen oxide compounds, particulate matter, and sulfur dioxide continue to be met.

Gaseous Radioactive Emissions

Bellefonte 1 and 2 are not completed and are not operating. Therefore, there are no gaseous radioactive emissions.

Meteorology and Climatology

The regional and local climatology and meteorology of the Bellefonte Nuclear Plant site described in the Atomic Energy Commission's 1974 *Final Environmental Statement Related to Construction of Bellefonte Nuclear Plant Units 1 and 2* (AEC 1974) were re-evaluated in 1997 (TVA 1997f), with consideration of additional data accumulated in the intervening years. It was determined that the records used for the 1974 Final Environmental Statement provide an adequate representation of regional climatic conditions. This information has been updated with more recent data for Huntsville and Chattanooga.

Regional Climate

The Bellefonte site is located in an area dominated by prominent valley ridge topographical features, generally aligned from northeast to southwest. Local prevailing wind patterns of the Tennessee River Valley are down-valley (north through northeast) and up-valley (south through southwest).

Table 4–25 Comparison of Baseline Bellefonte 1 and 2 Ambient Air Concentrations With the Most Stringent Applicable Regulations and Guidelines

Criteria Pollutant	*Averaging Time*	*Most Stringent Regulation or Guideline[a] (μg/m³)*	*Baseline Concentrations μg/m³*
Carbon monoxide	8-hour 1-hour	10,000 40,000	4,104[b] 5,472[b]
Lead	Calendar quarter	1.5	0.03[c]
Nitrogen dioxide	Annual	100	24.1[b]
Ozone	8-hour (4th highest averaged over 3-years)	157[d]	e
Particulate matter	PM_{10} Annual 24-hour (interim) 24-hour (99th percentile 3-year average) $PM_{2.5}$ Annual (3-year average) 24-hour (98th percentile averaged over 3-years)	 50[d] 150[d] 150[d] 15[f] 65[f]	 24[c] 46[c] 46[c] g g
Sulfur dioxide	Annual 24-hour 3-hour	80 365 1,300	13.1[c] 73.4[h] 210[c]

μg/m³ = micrograms per cubic meter

PM_n = particulate matter size less than or equal to *n* micrometers.

[a] The Alabama Department of Environmental Management, Air Division, has incorporated all National Primary Air Quality Standards and all National Secondary Ambient Air Quality Standards by reference in Chapter 335-3-1, General Provisions, Paragraph 335-3-1-.03. Therefore, only National Ambient Air Quality Standards are provided. The standards, other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 1-hour ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is ≤ 1. The 1-hour ozone standard applies only to nonattainment areas. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 157 μg/m³. The interim 24-hour PM_{10} standard is attained when the expected number of days with a 24-hour average concentration above the standard is ≤ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

[b] Madison County - Huntsville. Carbon monoxide - 1997, nitrogen dioxide - 1993.

[c] Sand Mountain, 1990-1991.

[d] EPA recently revised the ambient air quality standards for particulate matter and ozone. The new standards, finalized on July 18, 1997, change the ozone primary and secondary standards from a 1-hour concentration of 235 μg/m³ (0.12 parts per million) to an 8-hour concentration of 157 μg/m³ (0.08 parts per million). During a transition period while states are developing state implementation plan revisions for attaining and maintaining these standards the 1-hour ozone standard would continue to apply in nonattainment areas (62 FR 38855-38894). For particulate matter, the current PM_{10} (particulate matter size less than or equal to 10 micrometers) annual standard is retained and two $PM_{2.5}$ (particulate matter size less than or equal to 2.5 micrometers) standards are added. These standards are set at 15 μg/m³ 3-year annual average arithmetic mean based on community-oriented monitors and 65 μg/m³ 3-year average of the 98th percentile of 24-hour concentrations at population-oriented monitors. The current 24-hour PM_{10} standard is revised to be based on the 3-year average of the 99th percentile of 24-hour concentrations. The existing PM_{10} standards would continue to apply in the interim period (62 FR 38652).

[e] There is insufficient data to compare to the 8-hour standard for ozone.

[f] Federal standard.

[g] Compliance with the new $PM_{2.5}$ standards was not evaluated since current emissions data for $PM_{2.5}$ are not available.

[h] Sulfur dioxide - Jackson County, 1996.

Source: TVA 1998a.

Severe Weather

The site is vulnerable to severe weather, including heavy general rainstorms; thunderstorms that can be accompanied by heavy downpours, strong winds, hail, lightning, or tornadoes; and snow and ice storms.

The probability of a tornado occurring at any point within a radius of 55 kilometers (34.2 miles) of the plant site is 1.15×10^{-4} (TVA 1997f) or once in 8,700 years. For straight winds, the fastest wind measured 10 meters (33 feet) above ground and about 145 kilometers per hour (90 miles per hour), and is expected once in a 100-year period (TVA 1997f).

Local Meteorological Conditions

Data collected over a 30-year period (1961–1990) indicate that at Huntsville the annual average temperature is 15.7°C (60.3°F); the average daily minimum temperature in January is – 1.6°C (29.2°F); and the average daily maximum temperature in July is 31.7°C (89.0°F) (TVA 1998e). The average annual precipitation is approximately 145.2 centimeters (57.18 inches). Prevailing winds are from the east-southeast. The average annual wind speed is 3.6 meters per second (8 miles per hour) (NOAA 1997b).

4.2.3.4 Water Resources

Surface Water

The Bellefonte site is located at Tennessee River Mile 391.5, about 68.8 kilometers (43 miles) upstream of the Guntersville Dam, on a peninsula formed between the Town Creek Embayment and the Guntersville Reservoir, on the western shore of Guntersville Reservoir. The surface area of the reservoir is 275 square kilometers (106 square miles).

The average daily flow volume at the Bellefonte site is 1,100 cubic meters per second (38,850 cubic feet per second). Seasonal averages derived from records for 1950 to 1987 are 895 cubic meters per second (31,600 cubic feet per second) during summer and 1,400 cubic meters per second (49,500 cubic feet per second) during winter (TVA 1997f, TVA 1998e). Hourly flows at the site may vary considerably from daily average flows, depending on turbine operations at the Nickajack and Guntersville Hydro Plants. Hourly flows may be zero or may be in an upstream direction for up to six hours per day (TVA 1998e).

Surface Water Quality

Guntersville Reservoir is classified for uses of public water supply, fish and wildlife, and swimming and other whole body water-contact sports (TVA 1997f). Monitoring data from the EPA Storage and Retrieval of Parametric Data base (STORET) for 1974 to 1990 showed that dissolved oxygen concentrations routinely drop below 5 milligrams per liter during the summer months at lower depths of the lake. No concentrations less than 4 milligrams per liter were measured. Mild dissolved oxygen stratification was found to occur occasionally in the main channel areas. Strong stratification occurred fairly frequently in the shallower overbank and embayment areas. All pH (acidity) measurements were above the minimum Alabama criterion of 6.0. In areas of high biological activity, pH values above the maximum Alabama criterion of 8.5 were observed (TVA 1997f). Surface water quality monitoring data are presented in **Table 4–26**.

Table 4–26 Summary of Surface Water Quality Monitoring in the Vicinity of the Bellefonte Nuclear Plant Site

Parameter	*Unit of Measure*	*Water Quality Criteria*	*Average Water Body Concentration*
Radiological			
Alpha (gross)	picocuries per liter	15[a]	3.25
Beta (gross)	picocuries per liter	50[b]	2.4
Tritium	picocuries per liter	20,000[a]	<300[c]
Nonradiological			
Aluminum	milligrams per liter	0.2[d]	0.43
Ammonia	milligrams per liter	30[e]	0.03
Arsenic	milligrams per liter	0.05[a]	0.0002
Barium	milligrams per liter	2.0[a]	0.05
Beryllium	milligrams per liter	0.004[a]	0.001
Boron	milligrams per liter	0.9[e]	0.15
Cadmium	milligrams per liter	0.005[a]	0.0005
Chlorides	milligrams per liter	250[d]	7.6
Chromium	milligrams per liter	0.1[a]	0.003
Copper	milligrams per liter	1.3[f]	0.011
Iron	milligrams per liter	0.3[d]	0.53
Lead	milligrams per liter	0.015[a]	0.006
Manganese	milligrams per liter	0.05[d]	Not available
Mercury	milligrams per liter	0.002[a]	0.0009
Molybdenum	milligrams per liter	0.01[e]	0.02
Nickel	milligrams per liter	0.1[a]	0.0017
pH (acidity/alkalinity)	pH units	6.5–8.5[d]	7.4
Silver	milligrams per liter	0.2[e]	0.01
Sodium	milligrams per liter	20[e]	6.83
Sulfate	milligrams per liter	250[d]	15.4
Total Dissolved Solids	milligrams per liter	500[d]	100
Zinc	milligrams per liter	3[e]	0.11

[a] Alabama Drinking Water Standards.
[b] Proposed National Primary Drinking Water Regulations.
[c] Below Lower Limit of Detection of 300 picocuries per liter.
[d] National Secondary Drinking Water Regulations (40 CFR 143).
[e] EPA health advisory.
[f] EPA primary drinking water standard goal.
Source: Alabama 1998, ADEM 1998a, ADEM 1998b, EPA 1996b, TVA 1997f.

Surface Water Use and Rights

The Bellefonte Nuclear Plant currently draws water from the Guntersville Reservoir for fire protection and some cooling needs. There are eight municipal water supplies that use water from Guntersville Reservoir downstream of the Bellefonte intake at distances of 6.3 kilometers (3.9 miles) for Fort Payne to 62.6 kilometers (38.9 miles) for Guntersville. Guntersville State Park, 47.2 kilometers (29.3 miles) downstream, uses Guntersville Reservoir water for irrigation. Water intakes near Bellefonte are shown in **Table 4-27.** The nearest intake to the Bellefonte diffuser discharge at Tennessee River Mile 390.3 is Fort Payne, 4.3 kilometers (2.7 miles) downstream (TVA 1999).

Table 4–27 Public and Industrial Surface Water Supplies From the Tennessee River Near Bellefonte

Plant Name	*Use (million liters per day)*	*Location (Tennessee River Mile and Bank)*	*Approximate Distance From Site (kilometers)*	*Type of Supply*
South Pittsburg	4.16	TRM 418.0 R	42.6	Municipal
Bridgeport	2.69	TRM 413.6 R	35.6	Municipal
TVA Widows Creek Fossil Plant	4084	TRM 407.7 R	26.1	Industrial
Mead Corporation	16.7	TRM 405.2 R	22.0	Industrial
TVA Bellefonte Nuclear Plant	unknown[a]	TRM 391.5 R	0.0	Industrial
Fort Payne	37.9	TRM 387.6 L	6.3	Municipal
Scottsboro Water System[b]	18.9	TRM 385.8 R TRM 377.4 R	9.2 22.7	Municipal
Section, Alabama Water Board	7.6	TRM 382.0 L	15.3	Municipal
Christian Youth Camp	unknown	TRM 367.9 R	38.0	Municipal
Guntersville State Park	unmetered[c]	TRM 362.2 L	47.2	Irrigation
Albertville	34.1	TRM 361.0 L Short Creek 2.0	49.1	Municipal
Guntersville	10.7	TRM 358.0 L TRM 352.6 L	53.9 62.6	Municipal
Arab	11.9	TRM 356.0 L	57.1	Municipal

L = Left bank.
R = Right bank.
[a] River water usage currently limited to fire protection needs.
[b] Also supplies water to Jackson County.
[c] Water usage is not metered.
Source: TVA 1997f.

Surface water rights concerning the Guntersville Reservoir and the Town Creek Embayment near the Bellefonte site involve nonimpairment of designated uses. In addition, constructing intake structures for withdrawing water from available supplies requires U.S. Army Corps of Engineers and TVA permits.

Liquid Chemical and Radioactive Effluents

The Bellefonte Nuclear Plant uses a small amount of chemicals for maintenance and layup. There is no liquid radioactive effluent at the partially completed plant.

Other effluent streams from the Bellefonte Nuclear Plant site leave through pathways, all of which are regulated by an NPDES Permit issued by the Alabama Department of Environmental Management. Three process discharge streams are routed to the Guntersville Reservoir. Nine stormwater discharge streams are routed to the Town Creek Embayment and the Guntersville Reservoir. Sanitary wastewater is discharged to the Hollywood Waste Water Treatment Facility, which is operated by the city of Hollywood. A small quantity of sanitary wastewater from the simulator building, training facility, and environmental data station is treated on site by sand filters and a septic system.

Floodplains and Flood Risk

The Bellefonte Nuclear Plant is situated on a peninsula formed between the Town Creek Embayment and the Guntersville Reservoir in Jackson County, Alabama.

The 100-year floodplain for the Guntersville Reservoir varies from elevation 183.0 meters (600.5 feet) above mean sea level at Tennessee River Mile 390.4 to elevation 183.2 meters (601.1 feet) at Tennessee River Mile 392.3. The TVA Flood Risk Profile elevations on the Guntersville Reservoir vary from elevation 183.4 meters (601.8 feet) at Tennessee River Mile 390.4 to elevation 183.7 meters (602.7 feet) at Tennessee River Mile 392.3. For Town Creek, the 100-year floodplain is the area lying below elevation 183.7 meters (602.7 feet). The Flood Risk Profile elevation is 183.8 meters (603.1 feet). The Flood Risk Profile is used to control flood damageable development for TVA projects. At this location, the Flood Risk Profile elevations are equal to the 500-year flood elevations. The safety-related facilities, systems, and equipment are housed in structures that provide protection from flooding for all flood conditions up to an elevation of 191.2 meters (627.3 feet) (TVA 1978).

Jackson County, Alabama, has adopted the 100-year flood as the basis for its floodplain regulations, and all development would be consistent with these regulations. There are no floodways published for this area.

Groundwater

The near-surface aquifer beneath the Bellefonte site occurs under unconfined conditions. Typical aquifer material is highly weathered sedimentary bedrock overlying slightly fractured bedrock. Groundwater movement through the Chickamauga Reservoir underlying the site is via fractures that have been subjected to solution activity.

Groundwater Quality

The groundwater quality of the near-surface aquifer beneath the site ranges from good to fair. Sampling of groundwater for prereactor ambient condition information was initiated at the site in 1973. During the period from 1977 through 1983, monthly groundwater samples were collected from six onsite bedrock wells to establish the background radionuclide levels at the site (TVA 1997f).

Groundwater sampling also has been conducted for organics and indicator parameters associated with known or potential subsurface releases at the site. Very few constituents exceeded the EPA Maximum Contaminant Levels specified in the Primary and Secondary Drinking Water Standards (TVA 1997f). Metals that appeared at levels consistently higher than the Maximum Contaminant Levels include iron, manganese, and aluminum. These may be related to the natural mineralogy of the area.

Groundwater Availability, Use, and Rights

Most of the potable water for nearby users is surface water taken from the Guntersville Reservoir near the site. There are, however, both private and public uses of groundwater in the vicinity of the site, including water supply wells for the cities of Stevenson, Scottsboro, and Hollywood, Alabama. The closest active municipal groundwater supply using the shallow (Chickamauga) aquifer is the city of Scottsboro, 11.3 kilometers (7.0 miles) from the plant site. The Bellefonte Nuclear Plant does not currently withdraw any groundwater. The aquifer is designated Class II, indicating it is currently being used for, or is a potential source of, drinking water. The city of Hollywood, 4 kilometers (2.5 miles) northwest of the site, pumps 416,000 liters per day (110,000 gallons per day) from two deep wells. These wells, along with surface water from Guntersville Reservoir, provide the water supply for the city of Hollywood and potable water for the Bellefonte site.

Groundwater rights concerning the aquifers near the site are associated with the Reasonable Use Doctrine. Under this doctrine, landowners can withdraw water to the extent that they must exercise their rights in accordance with the similar rights of others. The location of Bellefonte on a peninsula also tends to hydrologically isolate Bellefonte from the neighborhood residential wells on the other side of Town Creek.

4.2.3.5 Geology and Soils

Geology

The Bellefonte Nuclear Plant site is located in the Southern Appalachian Tectonic Province, in a 241-kilometer (150-mile) long anticlinal valley known as the Brown-Sequatchie Valley. This valley is representative of the valley and ridge topography and structure. The valley was formed by erosion of the Sequatchie anticline. When erosion breached the arch of thick sandstone and exposed the limestone and dolomite, an axial valley developed.

The controlling feature of the geologic structure is the Sequatchie thrust fault some 4 kilometers (2.5 miles) northwest of the site. The Sequatchie fault and resultant anticline developed more than 200 million years ago. The fault has been inactive for many millions of years.

Seismology

The known seismic history of the southeastern United States since 1776 indicates the site is located in an area of low seismic risk. The maximum historic intensities affecting the site were the result of earthquakes centered at distant points. Nevertheless, the Bellefonte Nuclear Plant design is based on the largest historic earthquake to occur in the Southern Appalachian Tectonic Province—the 1897 Giles County, Virginia, earthquake (intensity: Modified Mercalli VIII and Richter magnitude 6 to 7). The safe-shutdown earthquake for the plant was established at a maximum horizontal acceleration of 0.18 g (g = acceleration due to gravity) and a simultaneous maximum vertical acceleration of 0.18 g. The safe-shutdown earthquake is defined as the earthquake that produces the maximum ground vibration for which: (1) the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in the shutdown mode, and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures are designed to remain functional (10 CFR 100, Appendix A).

Soils

Extensive evaluation was made of the soil and bedrock on the Bellefonte Nuclear Plant site. All major Seismic Category I structures important to the safe operation of Bellefonte 1 and 2 are founded on competent bedrock. Physical testing has shown that the bedrock is capable of supporting loads in excess of those imposed by the plant structures.

The effects of amplications of ground motions through soil columns should be considered in the seismic design of structures not founded on rock. The potential for liquefaction beneath any new structure, pipeline, or conduit not founded on rock should be evaluated in areas that are not investigated as part of the original *Bellefonte Nuclear Plant Final Safety Analysis Report, as Amended* (TVA 1991).

4.2.3.6 Ecological Resources

Terrestrial Resources

The Bellefonte Nuclear Plant site is located within the Ridge and Valley Physiographic Province. This province lies between the Blue Ridge Mountains and the Cumberland Plateau and is characterized by prominent, northwest-trending ridges and adjacent valleys. The Tennessee River flows through this province, roughly paralleling the alignment of the valleys. The area surrounding the Bellefonte site is characterized by forests that have been continuously disturbed by timbering and agricultural practices.

The forest region that constitutes the Bellefonte Nuclear Plant site is characterized by numerous tree species (rather than domination by one or only a few species) sharing the canopy. Site vegetation has been continuously disturbed by decades of timbering and agriculture. Five categories of vegetative communities present on the site are mixed hardwoods, lawns and grassy fields, scrub-shrub thickets (including fencerows), bottomland riparian hardwoods, and pine-hardwood forests. Parking lots, roads, buildings, cooling towers, and other structures associated with the partially completed nuclear facility occupy 20 percent of the site. Mixed hardwood communities, most commonly located on the ridges and knobs, comprise 40 percent of the site. Ten percent of the site is planted in lawns and grassy fields. Fifteen percent of the site is occupied by scrub-shrub communities occurring in areas that were previously managed as open land, but which have been left undisturbed for the past 2 to 25 years. Five percent of the site is occupied by bottomland hardwood and riparian forests associated with streams and the shoreline margins of Guntersville Lake. The remainder of the site area, approximately 10 percent, is occupied by pine-hardwood forests (TVA 1997f).

Terrestrial Wildlife

Although disturbed areas in the immediate vicinity of the Bellefonte plant provide little habitat for wildlife, the remaining portions of the site are suitable for a wide variety of animals. Mixed-hardwood and pine-hardwood forests provide habitat for mammals such as white-tailed deer, gray squirrels, and flying squirrels. Common birds in these habitats include red-bellied woodpeckers, blue jays, wood thrush, Kentucky warblers, and Carolina wrens. Reptiles and amphibians commonly found in these forested habitats include ring-necked snakes, ground skinks, slimy salamanders, and Fowler's toads.

Lawns and grassy fields provide habitat for mammals such as eastern cottontail rabbits, woodchuck, hispid cotton rats, and least shrews. A variety of birds may be seen in this habitat including ground-nesting species such as meadowlarks and field sparrows. Gray rat snakes, eastern garter snakes, and American toads are a few of the reptiles and amphibians commonly found in lawns and grassy fields.

Scrub-shrub communities are one of the most abundant habitat types occurring on the site. Such communities provide important nesting and foraging areas, as well as travel corridors for birds and small mammals. Mammals present in this habitat type include southeastern shrews, eastern cottontail rabbits, and gray squirrels. Birds utilizing scrub-shrub communities include gray catbirds, rufous-sided towhees, and mockingbirds.

Bottomland hardwood and riparian forests are located along streams and the Guntersville Reservoir and support a highly diverse wildlife population. Mammals found in these forests include beaver, mink, muskrat, and gray squirrels. Great blue herons, great egrets, wood ducks, screech owls, and prothonotary warblers are a few of the many birds that may be found in bottomland hardwood and riparian forests. Several species of amphibians and reptiles are commonly found in these forests. These include rough green snakes, midland water snakes, bullfrogs, and gray treefrogs (TVA 1997f).

Wetlands

There are many wetland areas in and around the Bellefonte Nuclear Plant site, most of them located along the 20-kilometer (12.5-mile) shoreline that borders much of the site (TVA 1997f). **Figure 4–15** indicates the location of wetlands located near the plant site. Included are 9 hectares (52 acres) of islands along the old river channel. The wetlands on these islands are classified as palustrine, bottomland hardwood, deciduous, and temporarily flooded. Aquatic bed wetlands that separate the islands from the mainland are classified as lacustrine, aquatic bed, or rooted vascular submerged permanently flooded wetlands. Fringe wetlands are

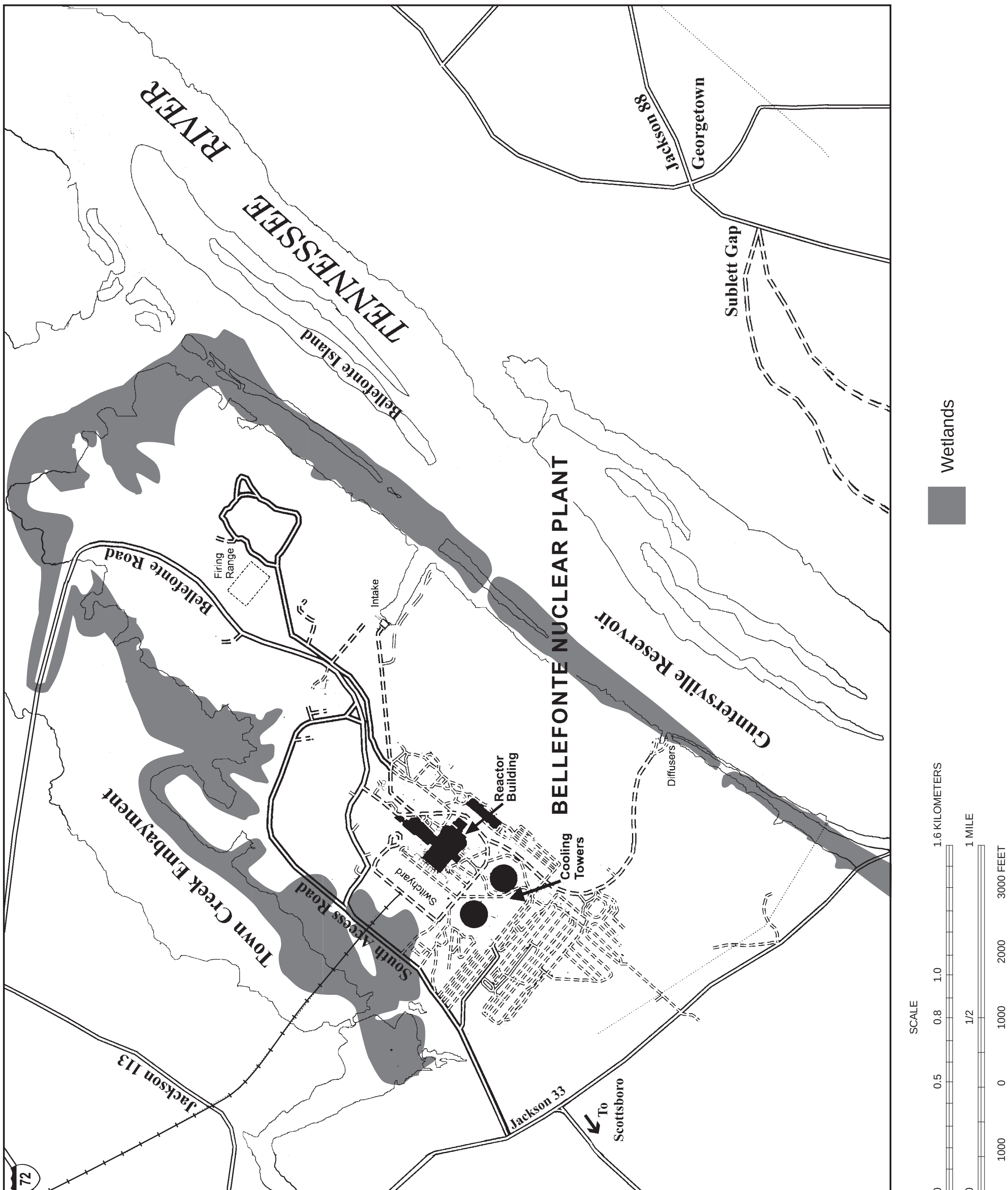

Figure 4–15 Wetlands Map of the Bellefonte Nuclear Plant Site Vicinity

characterized by the presence of emergent and scrub-shrub plant communities and forested shoreline. These are shallow overbank areas adjacent to the old river channel (TVA 1997f).

Plant species found in the fringe wetlands include:

Common cattail *(Typha latifolia)*	Black willow *(Salix nigra)*
Giant cutgrass *(Zizaniopsis miliacae)*	River birch *(Betula nigra)*
Bulrush *(Scirpus americanus)*	Sycamore *(Platanus occidentalis)*
Soft rush *(Juncus effusus)*	Willow oak *(Quercus phellos)*
Button Bush *(Cephalanthus occidentalis)*	Water oak *(Quercus nigra)*
	Red maple *(Acer rubrum)*.

Aquatic bed wetlands are formed by floating mats of Eurasian milfoil, *Myriophyllum heterophyllum*; American pondweed, *Potamogeton pectinatus*; and spiny-leafed naiad, *Najas minor*.

Wetlands have also developed in three ponds that were constructed in the 1970s during the initial phase of development of the Bellefonte project. The dikes of two ponds were breached in 1989, and 2.4 hectares (6 acres) of palustrine, emergent, persistent, intermittently flooded wetlands have developed. The third 5-hectare (12-acre) pond is used to filter stormwater runoff and is classified as palustrine, scrub-shrub, permanently flooded wetlands.

TVA fulfills its mandate to protect wetlands as directed by Executive Order 11990. Other wetlands have developed in areas where ponds were constructed for previous construction activities.

Aquatic Resources

The Bellefonte site is located on a peninsula bounded to the north by Town Creek Embayment and to the south by the Tennessee River (Guntersville Reservoir). The site, with its narrow backwater sloughs and embayments protected from the wave and current action of the main river by strip islands and bars, supports diverse aquatic flora and fauna. Beyond the strip islands and bars, the original channel of the Tennessee River also contains a diverse aquatic community that is affected by the river current. The Town Creek Embayment is more isolated from river currents than the shallow overbank aquatic habitat along the river proper.

Plankton

Assessments show phytoplankton to be quite variable among sample stations, months, and years, making the determination of spatial and temporal trends difficult. The exception is the trend for greatest phytoplankton abundance and blue-green algae dominance during parts of the year at shallow overbank habitats and at downstream sampling locations. This trend can be anticipated based on the increased hydraulic retention time during the transition from fast-flowing (lotic) to slow-flowing (lentic) conditions (TVA 1997f).

Fish Communities

Guntersville Reservoir supports an abundant and diverse fish community, including both a sport and commercial fishery. Eighty-two species of fish have been collected in TVA field investigations. Two study programs are compared: 1949 to 1984 and 1984 to 1994. Comparisons show that, of 61 species collected in both studies, only 13 species found prior to 1985 were not collected in the 1984–1994 samples. Eight new species were found after 1985. All species that are unique to either of the studies, with the exception of the introduced grass carp, are typically rare individuals.

Fish present within the Guntersville Reservoir may be placed into one of three major groups: game, rough, and forage. Game fish include bluegill, redear sunfish, warmouth, and yellow bass. Rough fish include freshwater drum, yellow bullhead, spotted gar, skipjack herring, and grass carp. Forage fish include gizzard shad and threadfin shad. Prior to 1975, forage fish were the predominant group in terms of numbers of individuals, while after 1975 game fish were the predominant group. This shift in fish numbers coincided with the onset of nonnative aquatic macrophytes in the reservoir and illustrates the impact of aquatic macrophytes on the fishery community (TVA 1997f).

The health of the fish community in the vicinity of the Bellefonte site was rated "fair" from 1993 to 1996 (Reservoir Fish Assemblage Index scores ranging from 35 to 38). This assessment included sampling the inflow region of Guntersville Reservoir (upstream from the plant site), the transition region (downstream from the plant site), and the forebay region (farfield downstream from the plant site). Aspects that appear to be limiting the fish community quality in the transition zone are the low number of sucker species, the high percentage of individuals of tolerant species, the numerical dominance by a single species, and the high percentage of omnivores in the community. Sport Fish Index scores for the upper Guntersville Reservoir reveal that this portion of the reservoir maintained a good sauger, channel catfish, and largemouth and spotted bass fishery during 1996. Smallmouth bass and crappie fisheries rated low. Commercial species taken in the reservoir include catfish, buffalo fish, and paddlefish (TVA 1997f).

Grass carp, or white amur, is a herbivorous fish native to eastern Asia. As many as 120,000 individuals were introduced into the Guntersville Reservoir from 1988 to 1990 to control aquatic vegetation; specifically, to control hydrilla and spinyleaf naiad. The decline in these aquatic macrophytes can be attributed at least in part to feeding by grass carp. Since nearly all grass carp introduced into the reservoir have been sterile, they have not reproduced. Thus, the influence of this species on the existing environment of the reservoir should decline with time.

Mussel and Clam Communities

The most permanent (long-lived) members of the benthic macroinvertebrate community are the freshwater mussels, *Unionidae*. These organisms, which require a fish host to complete their life cycle, were at one time a dominant and diverse part of the benthic community of the Tennessee River. Major declines in the numbers and diversity of these organisms have occurred during the past 30 years. A recent investigation in August 1995 identified 14 species of mussels. The greatest abundance for one of the samples (a single transect) was at Tennessee River Mile 391.1, just downstream from the Bellefonte underwater diffuser. This sample contained 65 mussels of 8 species with a population of 1.3 per square meter.

The three most abundant mussels, *Megalonaias nervosa*, *Potamilus alatus*, and *Pleurobema cordatum*, made up 84 percent of the total. While some mussels species found near Bellefonte are harvested by the commercial mussel industry (e.g., *Megalonaias nervosa*), the low average density found (0.3) indicates this area does not support a valuable commercial mussel resource (TVA 1997f).

Two introduced species, the Asiatic clam, *Corbicula fluminea*, and the zebra mussel, *Dreissena polymorpha*, are known to occur in the part of Guntersville Reservoir that is adjacent to the Bellefonte site. The Asiatic clam has been present in this part of the Tennessee River for at least 30 years, but the zebra mussel was first found here in 1995. Both species have the potential to clog power plant water systems (TVA 1997f).

Aquatic Macrophytes

The greatest abundance of aquatic macrophytes in the TVA system is in the Guntersville Reservoir (TVA 1997f). Over the past decade, coverage of aquatic macrophytes has varied from about 8,100 hectares (20,000 acres) in 1988 (about 29 percent of the water surface area) to about 2,024 hectares (5,000 acres) in 1991. The peak coverage in 1988 occurred at the end of a record drought period (1984–1988) in the Tennessee Valley. Although several native submersed species such as southern naiad, coontail, American pondweed, small pondweed, and muskgrass colonize portions of the lake, the most abundant plants are the introduced or nonnative species.

The most widespread and abundant submersed macrophyte is Eurasian watermilfoil, *Myriophyllum spicatum*. This nonnative species was introduced into the TVA system in the 1950s, and established colonies were observed on the Guntersville Reservoir in 1963. By the late 1960s there were several thousand acres of Eurasian watermilfoil growing in embayments and overbank areas of the Guntersville Reservoir. Coverage of Eurasian watermilfoil on the Guntersville Reservoir over the past decade ranged from about 1,214 hectares (3,000 acres) in 1991 to about 6,070 hectares (15,000 acres) in 1988. Abundance and coverage of Eurasian watermilfoil and other submersed macrophytes can be expected to fluctuate in response to such factors as flow and water clarity, and should be most abundant in years with the low flows and clear water commonly associated with drought conditions.

Eurasian watermilfoil typically grows at water depths of a few inches up to about 3 meters (10 feet) and can form dense colonies that can interfere with small craft navigation and recreational activities, provide habitat for mosquitoes, and clog water intakes. Eurasian watermilfoil is abundant in shallow embayments near Bellefonte and along the overbank adjacent to the river channel. However, because of the riverine nature of the Guntersville Reservoir in the vicinity of the site, the overbank habitat is not as extensive as it is in portions of the reservoir farther downstream. Extensive colonization of Town Creek Embayment by aquatic macrophytes has little potential for clogging the facility intake structure; however, they have some potential for increasing mosquitoes at the facility.

Spinyleaf naiad, *Najas minor*, and hydrilla, *Hydrilla verticillata*, are two other introduced species of submersed aquatic macrophytes that have established themselves on the Guntersville Reservoir. Like Eurasian watermilfoil, these two species also can colonize shallow water habitats and have the potential to cause similar problems. Spinyleaf naiad was introduced into the TVA system in the 1940s. During the mid- to late 1980s, spinyleaf naiad colonized as much as 607 to 810 hectares (1,500 to 2,000 acres). These levels have declined to a few hundred acres in the 1990s. Hydrilla has the potential to be an even more problematic plant than Eurasian watermilfoil because of its ability to colonize in deeper water and because it forms a continuous plant mass through the water column. Hydrilla, which was first discovered on the Guntersville Reservoir in 1982, increased to about 1,215 hectares (3,000 acres) in 1988. Although scattered hydrilla currently is present throughout the mid-portion of the reservoir, visible colonies occupy less than 4 hectares (10 acres).

The establishment and rapid spread of hydrilla were the primary reasons for the stocking of 100,000 sterile grass carp in the Guntersville Reservoir in 1990. The dramatic decline in hydrilla and spinyleaf naiad and the suppression of these species can be partially attributed to feeding by the grass carp. Like Eurasian watermilfoil, the abundance of these species can be expected to fluctuate with reservoir conditions (e.g., flow and water clarity), and also can be expected to increase as populations of the grass carp decline and feeding pressure becomes less.

Threatened and Endangered Species

Federally listed and per or state-listed threatened and endangered species occurring in the vicinity of the Bellefonte site were described in the 1974 Final Environmental Statement (TVA 1974b), and more recently in the Bellefonte Conversion Project Final EIS (TVA 1997f). At least two Federally listed animals occur regularly on the Bellefonte site, and several other Federally or state-listed species are likely to use areas of suitable habitat on or near the site occasionally (**Table 4–28**).

Table 4–28 Federally and State-Listed Threatened or Endangered Species On or Near the Bellefonte Nuclear Plant Site

Common Name	***Scientific Name***	***Federal***	***State***
Plants			
Snow-wreath	*Neviusia alabamensis*	Not listed	Endangered
Smoketree	*Cotinus obovatus*	Not listed	Species of Concern
Yellow Honeysuckle	*Lonicera flava*	Not listed	Species of Concern
Mollusk			
Orange-footed Pearlymussel	*Plethobasus cooperianus*	Endangered	Endangered
Pink Mucket	*Lampsilis abrupta (=L. orbiculata)*	Endangered	Endangered
Anthony's Riversnail	*Athearnia anthonyi*	Endangered	Endangered
Fish			
Snail Darter	*Percina tanasi*	Threatened	Threatened
Reptiles			
Box turtle	*Terrapene carolina*	Not listed	Species of Concern
Birds			
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Osprey	*Pandion haliaetus*	Not listed	Threatened
Cooper's Hawk	*Accipiter cooperii*	Not listed	Species of Concern
Willow Flycatcher	*Empidonax traillii*	Not listed	Status Undetermined
Warbling Vireo	*Vireo gilvus*	Not listed	Status Undetermined
Mammals			
Gray Bat	*Myotis grisescens*	Endangered	Endangered
Indiana Bat	*Myotis sodalis*	Endangered	Endangered
Meadow Jumping Mouse	*Zapus hudsonius*	Not listed	Species of Concern

Source: Tennessee 1994, TVA 1997f, TVA 1998a, TVA 1999.

Plants

No Federally listed threatened or endangered species are known to occur on or in close proximity to the site. However, two plants Federally listed as endangered occur in Jackson County. American hart’s-tongue fern, *Phyllitis scolopendrium var. americana*, occurs in a cave mouth about 32 kilometers (20 miles) west of the site. No suitable habitat for this species occurs on the Bellefonte Nuclear Plant site, and it has not been found in nearby caves or sinkholes. The green pitcher plant, *Sarracenia oreophila*, occurs in wet woods and streambanks on Sand Mountain. Suitable habitat is absent from the Bellefonte site, and the species has not been found on or in the immediate vicinity of the site.

The snow-wreath, listed as endangered in Alabama, and smoketree and yellow honeysuckle, both listed as of special concern in Alabama, are found across the Tennessee River from the plant site. Although habitat similar to that preferred by these species exists within the Bellefonte Nuclear Plant site boundary, these species have not been found there during extensive field surveys (TVA 1998e).

Terrestrial Animals

Two Federally listed terrestrial animals, the bald eagle and gray bat, have been seen at the Bellefonte site. The bald eagle is a fairly common winter resident and an uncommon summer resident on Guntersville Reservoir. The nearest nest sites are at the Raccoon Creek, and Crow Creek embayments, 14 kilometers (9 miles) and 16 kilometers (10 miles), respectively, upstream of the Bellefonte Nuclear Plant site. Wintering eagles on Guntersville Reservoir concentrate at a few nocturnal roost sites and disperse over much of the reservoir during the day. They regularly use the wooded shoreline of the Bellefonte site along both the main stem of the Tennessee River and the intake canal for perching and foraging. Additional information on the biology and status of bald eagles in the southeastern United States is contained in the Biological Assessment included in the 1995 NRC *Final Environmental Statement Related to the Operation of Watts Bar Nuclear Plant* (NRC 1995b).

The gray bat roosts in caves year-round and forages over water on insects. At least two caves used as summer roosting sites, Blowing Wind Cave and Nitre Cave, occur within 15 kilometers (9 miles) of the Bellefonte site. The reservoir adjacent to the Bellefonte site provides suitable foraging habitat, and gray bats frequently travel 20 or more kilometers (12 or more miles) from summer roost caves to foraging sites. It is likely, therefore, that gray bats regularly occur along the shoreline of the Bellefonte site. Best, et al., (1995) provide additional details on gray bat movements and foraging ecology at Guntersville Reservoir.

The Indiana bat roosts in hollow trees during summer months and hibernates in caves during the winter. This species typically forages in wooded areas adjacent to streams and other water courses. Because Indiana bats have been observed hibernating in caves within 15 kilometers (9 miles) of the Bellefonte site, it is likely they at least occasionally forage within forested riparian areas on the Bellefonte site during the summer.

The habitat requirements and local status of the meadow jumping mouse, osprey, Cooper's hawk, willow flycatcher, warbling vireo, and box turtle have been described by TVA. In general, suitable habitat for these species occurs at Bellefonte; however, the extent of their use (if any) of the site is not known (TVA 1997f).

Aquatic Species

In recent years, no aquatic species on the Federal or State of Alabama lists of endangered or threatened wildlife have been found in the Tennessee River in the vicinity of the Bellefonte site. Recent fish community assessments and a mussel survey in Guntersville Reservoir near the Bellefonte site do not indicate the presence of listed or candidate endangered or threatened species (TVA 1997f). A few listed aquatic species have been found in both the upstream part of Guntersville Reservoir and in Wheeler Reservoir just downstream from Guntersville Dam.

The endangered pink mucket and the threatened snail darter occur in suitable gravel and cobble habitats in several Tennessee River reaches, including both the Nickajack and Guntersville Dam tailwaters. The orange-footed pearlymussel also occurs in gravel and cobble habitats within the main stem of the Tennessee River. In recent years it has been found in the Guntersville Dam tailwater and not in the Nickajack Dam tailwater. Anthony's riversnail, the only endangered snail in this group, occurs in the lower Sequatchie River and at a few locations in the Nickajack Dam tailwater about 24 kilometers (15 miles) upstream of the Bellefonte site. It has not been found in surveys near the Bellefonte site or at any other location on Guntersville Reservoir or in the Guntersville Dam tailwater (TVA 1998a). Additional information on the biology, distribution, and recovery objectives for this species is presented in the U.S. Fish and Wildlife Service recovery plan (DOI 1997).

4.2.3.7 Archaeological and Historic Resources

An initial archaeological reconnaissance of the 607 hectares (1,500 acres) of the Bellefonte Nuclear Plant site was conducted in 1972 (TVA 1997f). This reconnaissance resulted in the verification and discovery of five sites, with three of the sites containing Archaic, Woodland, or Mississippian components. One of the sites was subjected to data recovery in 1973-1974 resulting from mitigation of adverse impacts related to the proposed construction of the Bellefonte Nuclear Plant. Another of the sites consists of a woodland component on the northeast edge of the peninsula near the confluence of Town Creek and the Tennessee River that is potentially eligible for inclusion in the National Register of Historic Places. None of the other sites are eligible for inclusion. An archival record search, an initial field check, and discussions with the Alabama Historical Commission determined that the only historical site of significance within the project locality is the original town site of Bellefonte. Bellefonte was incorporated in 1821 and served as the first county seat of Jackson County; it has been determined eligible for inclusion in the National Register of Historic Places. At the time of the survey, two antebellum structures were still standing: the Daniel Martin Inn/Tavern and a one-room cabin with a more recent lean-to addition. The major street layout of Bellefonte was still discernible, as were the limestone foundations of two antebellum brick structures and an associated cistern. Brick remnants of the former jail and the chimney and doorstep foundations of a cabin were also present. Since the 1972 survey, all structures associated with the original town site of Bellefonte were removed by subsequent landowners (TVA 1997f, TVA 1998e).

4.2.3.8 Socioeconomics

The social, economic, and community characteristics of the affected environment are described at three levels of increasing size: (1) the city of Scottsboro, (2) Jackson County, and (3) the region of influence, defined as the area within a 80-kilometer (50-mile) radius of the Bellefonte Nuclear Plant that includes the city of Scottsboro and Jackson County. Completion of Bellefonte 1 would have the greatest effect on the socioeconomic characteristics of Jackson County.

The Bellefonte Nuclear Plant site is near Hollywood, Jackson County, Alabama. Its exact location is latitude 34°42'32" north and longitude 85°55'36" west (NRC 1998d). Scottsboro, a city of approximately 14,000 persons, is about 11.3 kilometers (7 miles) from the Bellefonte Nuclear Plant and is the largest city in the county. Scottsboro is located on the banks of the Tennessee River's Guntersville Reservoir, Jackson County, Alabama. Jackson County is in the northeast corner of Alabama, adjacent to Marion County, Tennessee, to the north; DeKalb County, Alabama, to the east; Madison County, Alabama, to the west; and Marshall County, Alabama, to the south.

The affected environment section describes only those socioeconomic factors that most likely would be affected if the Bellefonte Nuclear Plant were selected for tritium production. School-related issues and tax related issues are expected to be among the important socioeconomic factors.

Regional Economic Characteristics

This section presents data on the current and recent economic conditions in Scottsboro and Jackson County, including unemployment rate, workforce occupations, per capita and household income, and main businesses.

Employment

The most recent unemployment rate for Jackson County is 8.2 percent for the period January through October, 1997 (Jackson County 1998). **Table 4–29** shows the unemployment rate for the county from 1991 to 1997. As indicated in Table 4–29, the 1997 figure is considerably lower than the annual averages from 1991 through 1996. There are no comparable figures available for the city of Scottsboro.

Table 4–29 Unemployment Percentages in Jackson County (1991–1997)

1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*
10.0	10.2	9.6	9.1	10.0	9.5	8.2

Source: Jackson County 1998.

Income

Total personal income in Jackson County increased from $876 million in 1995 to $931 million in 1996 (DOC 1998b). The per capita personal income went from $17,539 in 1995 to $18,366 in 1996. In 1996, the county ranked eighteenth in Alabama in per capita income. **Table 4–30** shows the per capita and household income figures for Scottsboro and Jackson County for 1997.

Table 4–30 Per Capita and Household Income in the City of Scottsboro and Jackson County (Estimates for 1997)

Income Measure	*City of Scottsboro*	*Jackson County*
Estimated per capita income	$15,552	$13,525
Estimated average household income	Not Available	$35,264
Estimated median household income	$27,856	$26,492

Source: Jackson County 1998.

In terms of occupations, manufacturing is the most important, accounting for about 31 percent of the workforce (5,064 workers) in Jackson County. This is followed by services, with about 27 percent of the workforce (4,377 workers), and by retail trade, with about 19 percent (3,151 workers). Less important occupations include government (almost 8 percent), finance/insurance/real estate (4.7 percent), construction (3.8 percent), and wholesale trade (2.9 percent). **Table 4–31** reflects the distribution of industrial occupations in Jackson County compared with the overall figures for Alabama and the United States (as percentages of total employment only for 1996).

Table 4–31 Industrial Occupation Distribution for Jackson County, Alabama, and the United States (1996 Main Occupations as a Percentage of Total Employment Only)

Type of Occupation	*Jackson County (Estimated for 1997)*	*Alabama (1993)*	*United States (1993)*
Manufacturing	29.7	17.4	12.6
Services	15.4	24.6	30.4
Retail trade	15.7	17.1	16.9
Government	16.6	16.8	14.2
Finance-Insurance-Real Estate	3.3	4.8	7.4
Construction	6.0	6.2	5.3
Wholesale trade	2.7	4.4	4.6
Agriculture	0.9	1.1	1.2

Source: DOC 1998b.

Businesses

The businesses of greatest economic significance in the region of influence are Akzo Nobel, CommScope, Mead Containerboard, Maples Industries, Patrick Lumber Company, Shaw Industries, U.S. Gypsum, and Wenzel Metal Spinning (Scottsboro 1998). Jackson County businesses employ a total of 16,264 workers. The average number of employees per business in the county is 10.2 (Jackson County 1998).

Population

The population of Hollywood has remained essentially flat over this decade. According to Census Bureau data, it was 916 and 914 in 1990 and 1996, respectively (DOC 1998c). The population of Scottsboro increased from 13,786 in 1990 to 14,133 in 1996 (estimated), an increase of 2.5 percent. Scottsboro ranks thirty-third in Alabama in terms of population. The nearest metropolitan city to the Bellefonte Nuclear Plant site is Huntsville, which grew from 159,880 in 1990 to 170,424 in 1996 (estimated), an increase of 6.6 percent.

According to the 1990 U.S. Census, the total population of Jackson County was 47,796 (DOC 1998c). The estimated county population in 1997 was 50,532, and the projection for 2002 is 51,132 (Jackson County 1998). The estimated number of households in the county in 1997 was 19,315; this number is projected to decrease to 19,177 by 2002.

The total population for the Bellefonte Nuclear Plant region of influence was estimated at 883,553 in 1990 (DOC 1992). For the same year, the number of households was estimated at 336,109. About 25 percent (220,967) of the region of influence's population were under 18 years of age; about 53 percent (468,407) were 18 through 54; and about 22 percent were 55 or older.

Demographic characteristics of the region of influence and Jackson County for 1990 are shown in **Table 4–32**. For the same year, **Table 4–33** shows the ethnic breakdown by race and Hispanic origin for the population of the county, the region of influence, and the United States (for comparison).

Table 4–32 General Demographic Characteristics of the Bellefonte Nuclear Plant Site Region of Influence and Jackson County (1990 Census)

Demographic Measure	*Jackson County*	*Region of Influence*
Total population	47,796	883,553
Families	14,143	252,374
Households	18,099	336,109
Male	23,146	427,549
Female	24,650	456,004

Sources: DOC 1998c.

The racial and ethnic composition of the region of influence projected for the year 2025 is shown in **Figure 4–16**. Low-income households based on 1990 Census data are presented in **Figure 4–17**. Low-income households are those with incomes of 80 percent or less than the median income of the counties. As indicated in this figure, approximately 44 percent of total households are low-income households (see Appendix G).

Table 4–33 Population Distribution by Race and Hispanic Origin in Jackson County, the Bellefonte Nuclear Plant Site Region of Influence, and the United States[a]

Ethnic Group or Subgroup (U.S. Census Definitions)	United States	Jackson County		Bellefonte Site Region of Influence	
	Percentage of Total Population	Population	Percentage of Total Population	Population	Percentage of Total Population
White not of Hispanic origin	75.60	44,531	93.17	825,149	85.11
Black not of Hispanic origin	11.80	1,957	4.09	126,093	13.01
American Indian, Aleut, or Eskimo not of Hispanic origin	0.70	1,008	2.11	4,934	0.51
Asian or Pacific Islander not of Hispanic origin	2.80	89	0.19	6,958	0.72
Other race not of Hispanic origin	Not Available	3	0.01	125	0.01
White of Hispanic origin	4.63	165	0.35	4,115	0.42
Black of Hispanic origin	0.31	11	0.02	594	0.06
American Indian, Aleut, or Eskimo of Hispanic origin	0.07	12	0.03	41	0.00
Asian or Pacific Islander of Hispanic origin	0.12	1	0.00	160	0.02
Other race of Hispanic origin	3.83	19	0.04	1,346	0.14
Hispanic total	9.10	208	0.44	6,256	0.65
Total population (all ethnic groups)	100.00	47,796	100.00	969,515	100.00

[a] Shown as a percentage of total population for comparison purposes.
Note 1: Region of Influence is defined as the area within a 50-mile radius of the Bellefonte site.
Note 2: The sum of the items may not add up to the population total due to rounding error.
Sources: DOC 1992.

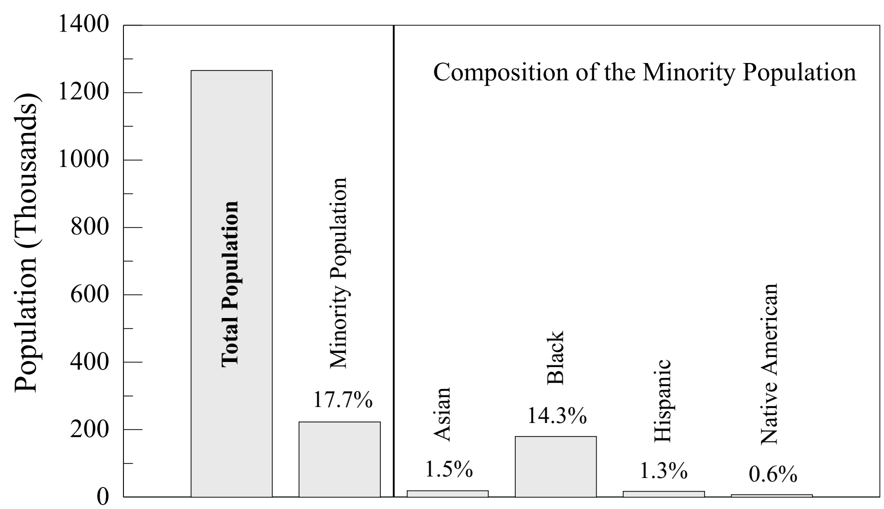

Figure 4–16 Racial and Ethnic Composition of the Minority Population Residing in Counties Within 80 Kilometers (50 Miles) of the Bellefonte Nuclear Plant Projected for the Year 2025

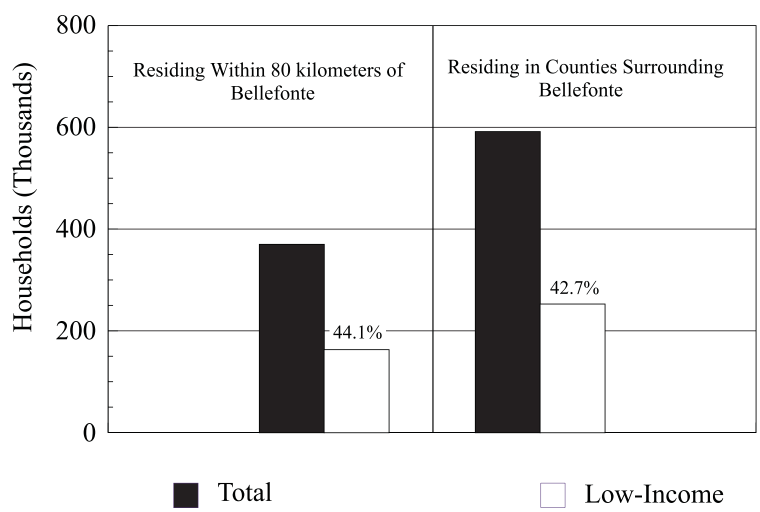

Figure 4–17 Low-Income Households Residing Within 80 Kilometers (50 Miles) of the Bellefonte Nuclear Plant (1990)

Housing

Temporary housing in Jackson County consists of 7 hotels and motels, about 10 trailer parks, and 13 apartment complexes. The hotels and motels are the Budget Inn, Comfort Inn, Days Inn, Goose Pond Colony Cottage Rentals, Hampton Inn, Scottish Inn Motel, and Scottsboro Hotel. The three largest trailer parks together have about 380 camper and mobile home lots, while the other 10 have about 30 each. Camper lots cover an area half the size of mobile homes and are ideal for workers who commute from nearby counties or neighboring states and drive back home on weekends. Thus, a trailer park designed for campers can accommodate twice as many tenants as one designed for mobile homes (Scottsboro 1998). An additional park adjacent to the Bellefonte Nuclear Plant site is planned for construction in the fall of 1998; it will feature about 125 lots, with the option for expansion to about 250. The estimated number of camper and mobile home lots in the county, which was about 590 as of May 1998, is expected to increase to about 674 in 1999. Trailer parks take about four months to build. As of spring 1998, all trailer parks in the area were at or near capacity.

Currently, most apartment complexes have low vacancy rates at or near 0 percent. Vacancy rates are subject to seasonal variation and range from 0 to 12 percent (Jackson County 1998). Monthly rents range from the low $200s to mid $300s for one-bedroom apartments, the high $200s to high $300s for two-bedroom apartments, and the high $300s to low $400s for three-bedroom apartments (Jackson County 1998). There are 12 apartment complexes in operation and one under construction in Jackson County (Scottsboro 1998). They range in size from 20 to 100 units and include one complex for the elderly and one for low-income tenants (Jackson County 1998). The estimated number of rental apartment units is 650. There were also 36 homes for rent in Jackson County as of May 1998 (Scottsboro 1998). The home rental market is considered limited by local realtors.

In terms of permanent housing, from 1980 to 1990 a total of 621 electrical utility permits were issued to new single-family homes, equal to a less than 0.5 percent increase per year (Scottsboro 1998). The number of occupied housing units in Jackson County was 18,020 in 1990, of which 13,827 (77 percent) were owner-occupied and 4,193 (23 percent) were rentals (Jackson County 1998). The average number of persons per housing unit in 1990 was 2.6, which is slightly higher than the average for Alabama (2.32) and the United States (2.29) (Jackson County 1998). There were 147 homes listed for sale in Jackson County as of April 21, 1998 (Scottsboro 1998). Of these, 82 were in Scottsboro. The average number of days to sell a home was 126 as of April 21, 1998.

The average home sale price in 1997 was $72,000. Property taxes, insurance costs, and utility rates are about 88 percent of the national average (Scottsboro 1998).

Community Services

General Education

A total of 152 students are enrolled in Hollywood Junior High School, part of the Jackson County School System (Jackson County 1998). The city of Scottsboro has four public elementary schools, one junior high school, and one high school. Total public school enrollment in Scottsboro is 2,967, of which 1,664 attend primary schools and 1,303 attend secondary schools (Scottsboro 1998). Scottsboro has one private elementary school (the North Alabama Christian School, a new private elementary school opened for the current academic year) and eight private preschool and kindergarten schools. The Scottsboro School System has 207 certified teachers and can absorb 725 additional students next year with the construction of a new high school. The old high school is being converted into an elementary school (Scottsboro 1998). The current student-to-teacher ratio for the system is 14:1. Presented as **Table 4–34** are the student enrollment breakdown by year and the number of staff for 1997–1998 in the Scottsboro School System.

Table 4–34 Scottsboro School System Breakdown by Academic Year (1991–1998)

School and Location	*Grade Levels*	*Total Enrollment (by School Year)*							*Total Faculty (1997–1998)*			*Student to Faculty Ratio (1997–1998)*
		1991–1992	*1992–1993*	*1993–1994*	*1994–1995*	*1995–1996*	*1996–1997*	*1997–1998*	*Certified Teachers*	*Support*	*Other*	
Brownwood Elementary	K–4	381	364	365	367	416	431	437	32	6	6	14:1
Caldwell Elementary	K–4	501	543	469	449	429	445	428	34	9	7	13:1
Nelson Elementary	K–4	264	239	297	297	338	355	364	27	6	4	13:1
Page Elementary	5–6	492	498	462	436	420	420	435	29	8	5	15:1
Total primary	K–6	1,638	1,644	1,593	1,549	1,603	1,651	1,664	122	29	22	14:1
Scottsboro Junior High School	7–8	454	461	486	480	458	451	453	29	7	7	16:1
Scottsboro High School	9–12	881	868	825	812	842	800	850	56	12	9	15:1
Total secondary	7–12	1,335	1,329	1,311	1,292	1,300	1,251	1,303	85	19	16	15:1
Total system	K–12	2,973	2,973	2,904	2,841	2,903	2,902	2,967	207	48	38	14:1

K = Kindergarten.
Source: Scottsboro 1998.

The system's transportation services can accommodate up to 4,080 students transported by 34 buses on a dual-route basis, or 2,040 on a single route (Armstrong 1998). Thus, the system's transportation services can accommodate an additional 1,113 students, given a dual-route system.

The Scottsboro School System's budget for Fiscal Year 1998 (October 1, 1997, through September 30, 1998) was $18,368,433 (Scottsboro 1998). The system obtains revenue from the county, state, and Federal governments. For Fiscal Year 1997, Jackson County paid the school system $204,690 from tax revenues (Jackson County 1998). In addition, $672,657 were allocated to the school system for Fiscal Year 1998 by the Jackson County Commission from funds provided by TVA in lieu of taxes (Jackson County 1998). The budget per student was $5,120 for the 1995–1996 academic year.

Overall student enrollment in the Jackson County School System is 6,257, of which 713 are in elementary schools, 566 in middle schools, 1,273 in junior high schools, and 3,705 in high schools (Jackson County 1998). The Jackson County School System has 437 certified teachers and 35 administrators. The current student-to-teacher ratio for the system is 14:3. The system could absorb about 740 additional students without significant disruption. Eighteen new classrooms are being added system-wide. There are two private Christian academies in the county (one in Scottsboro, as mentioned above). The Jackson County School System has 100 school buses and, at an average of 66 students per bus, an overall transportation capacity of 6,600 on a single-route basis or 13,200 on a dual-route basis. This means that the system could accommodate an additional 343 students on a single-route basis and 6,943 on a dual-route basis. The Jackson County Board of Education is considering plans to consolidate three high schools: Woodville, Skyline, and Paint Rock Valley. The proposed consolidated school would be for 432 high school students. Forty-four percent of those students are currently enrolled at Skyline, 33 percent at Woodville, and 23 percent at Paint Rock (Alabama A&M 1998).

The system's budget was $42,418,000 for the 1997–1998 academic year, of which $35,765,012 were spent directly on students (about $5,716 per student, up from $4,240 for the 1995–1996 academic year) and $6,652,988 on general student services (Armstrong 1998, Jackson County 1998). The estimated budget for 1998-1999 is $43 million (Jackson County 1998). There are three revenue components to the budget: Federal, state, and county government funds. For Fiscal Year 1997, Jackson County's share was $374,403 (Jackson County 1998). In addition, $1,448,021 were allocated to the school system for Fiscal Year 1998 by the Jackson County Commission out of funds provided by TVA in lieu of taxes (Jackson County 1998).

Public Safety

This section describes public safety—specifically, fire protection and police protection—in the region of influence, including Jackson County and Scottsboro.

Fire protection in Scottsboro is provided by the Scottsboro Fire Department. There are 30 full-time firefighters and 14 volunteers (Scottsboro 1998). Jackson County has 490 volunteer firefighters. **Table 4–35** shows full-time and volunteer firefighters in the region of influence. There are 27 fire departments within the region of influence; 24 of these are in Jackson County, as noted above. The total number of firefighters for the region of influence (including all of Jackson County) is approximately 535.

Table 4–35 Fire Protection Services Available in the City of Scottsboro, Jackson County, and the Bellefonte Nuclear Plant Site Region of Influence (April 1998)

Level of Analysis	*Number of Stations (Fire Departments)*	*Number of Firefighters*		*Vehicles*		
		Full-Time	*Volunteer*	*Pumps and Tankers*	*Ladders*	*Rescue*
City of Scottsboro	3 (1)	30	14	4	1	1
Jackson County[a]	Not available (24)	31	490	24	1	21
Region of Influence[b]	Not available (27)	31	535[c]	31	1	21

[a] Including the Scottsboro Fire Department.
[b] Including the Scottsboro Fire Department, all of Jackson County's volunteer departments, and three of DeKalb County's fire departments (Henager, Sylvannia, and Powell).
[c] Minimum estimate.
Sources: Scottsboro 1998, Jackson County 1998.

Police protection in the vicinity of the Bellefonte site is provided by the Scottsboro Police Department, the Hollywood Police Department, and the Jackson County Sheriff's Office. The county has eight police departments (Scottsboro, Stevenson, Bridgeport, Hollywood, Woodville, Skyline, Section, and Pisgah). Scottsboro has 37 full-time officers, about 10 civilian dispatchers, 6 jailers, 2 clerks, and 1 maintenance employee. The Hollywood Police Department has three officers. The Sheriff's Office has 27 sworn deputies, including the Sheriff, who is based in Scottsboro (Jackson County 1998).

There are two hospitals in Jackson County. Jackson County Hospital has 170 beds and a staff of 465, including 40 physicians (Jackson County 1998). North Jackson Hospital has 40 beds and a staff of about 270, including 6 physicians.

Local Transportation

The nearest major interstate highway is Interstate Highway 59, approximately 47 kilometers (29 miles) southeast of the Bellefonte site. U.S. Highway 72, which connects Chattanooga, Tennessee, and Huntsville, Alabama, is 3.2 kilometers (2 miles) northwest of the site. Bellefonte Road is a two-lane road extending from the north across Town Creek Embayment to U.S. Highway 72. Site access from the south is provided by South Access Road, connecting to Jackson County Road 33. The CSX Railway main line between Chattanooga and Huntsville passes about 4.8 kilometers (3 miles) northwest of the Bellefonte site. The Tennessee River is navigable past the Bellefonte site; a minimum 2.7-meter (9-foot) channel depth is maintained for commercial or recreational vessels. The barge traffic in this portion of the Tennessee River navigation system is considered moderate (TVA 1997f). These transportation routes are shown in **Figure 4–18.**

Tax Revenues

Jackson County Tax Revenues

Jackson County collects tax revenues from real estate, sales taxes, and motor vehicle tags. The net assessed real estate value for Fiscal Year 1997 was $169,486,219 (Jackson County 1998). Total tax collections in Fiscal Year 1997 were $9,353,939, up from $8,618,488 in Fiscal Year 1995. **Figure 4–19** shows the total distributions by recipient for Fiscal Year 1997. **Table 4–36** shows Jackson County's tax and fee revenue distributions by recipient and by source for Fiscal Year 1997.

The Jackson County Commission also receives monthly payments from TVA of about $469,629.06, amounting to $5,635,548.72 for Fiscal Year 1998 (Jackson County 1998).

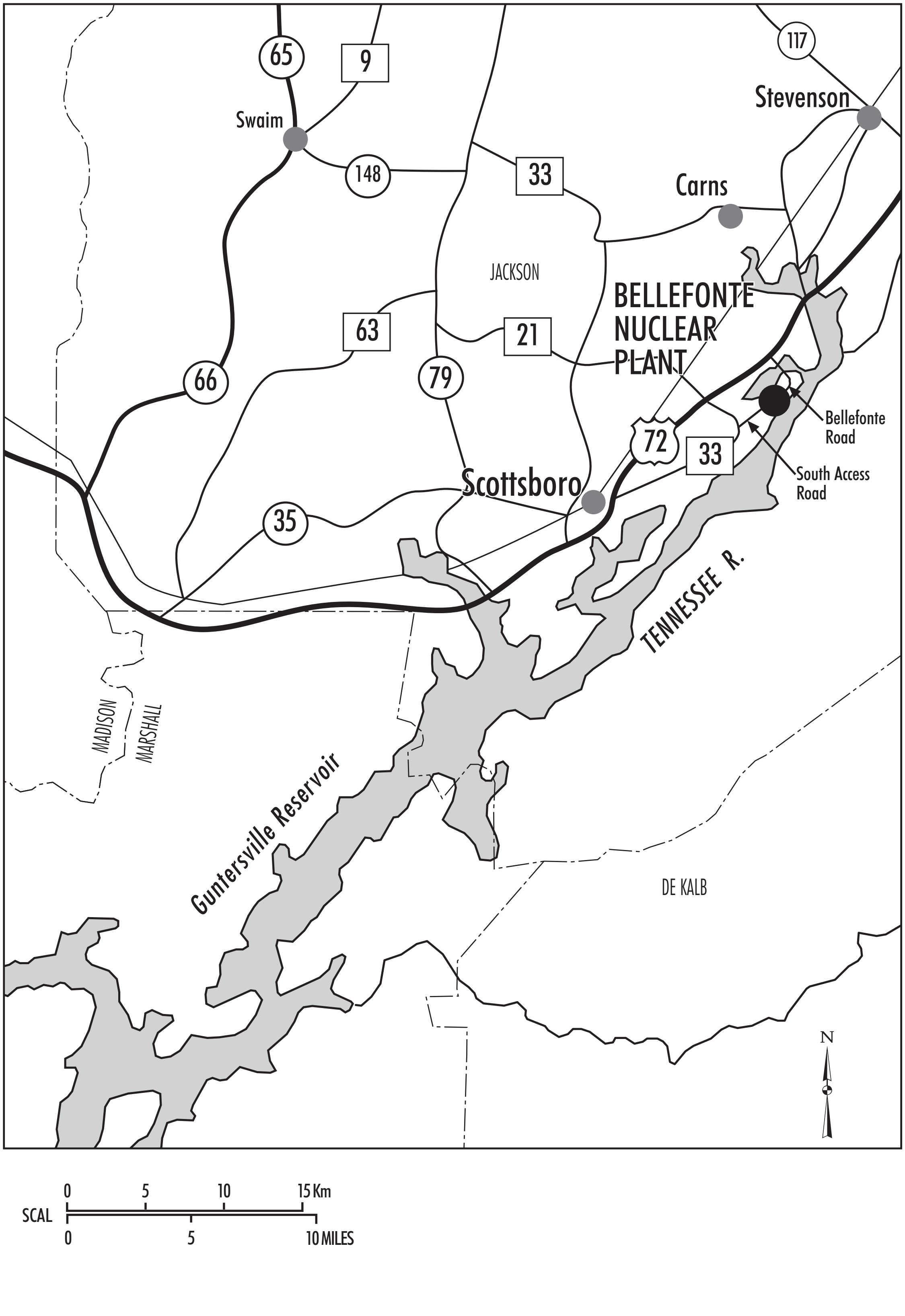

Figure 4–18 Transportation Routes in the Vicinity of the Bellefonte Nuclear Plant Site

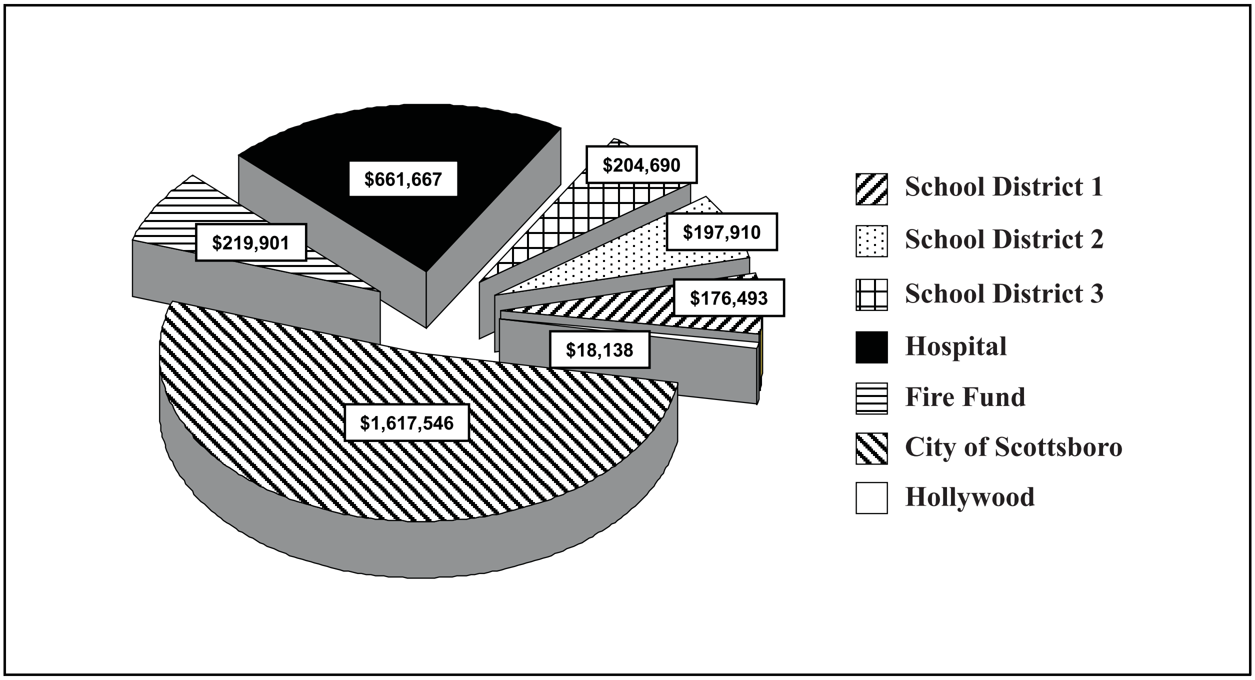

Figure 4–19 Jackson County Tax Revenue Distributions by Recipient FY 1997

Source: Jackson County 1998.

Tobacco Tax Revenues

Scottsboro City received $86,538 in tobacco tax revenues in 1997. Assuming an average $12 carton price, 30 cents would be allocated to the city, 50 cents to the county, $1.65 to the state, $2.48 to the Federal Government, and an additional 44 cents to state and local governments as sales taxes (Scottsboro 1998). Tax revenues are allocated to the city's general fund for operations. Jackson County's tobacco tax share amounts to approximately $300,000 per year (Scottsboro 1998).

Table 4–36 Jackson County Revenue Distributions by Recipient (Selected Recipients Only) and Tax and Fee Revenue Sources, Fiscal Year 1997 (October 1996 Through September 1997)

Tax or Fee Revenue Source	*County School Districts*			*County Hospitals*	*Fire Fund*	*Scottsboro*	*Hollywood*
	District 1 (Jackson County)	*District 2 (Jackson County)*	*District 3 (Scottsboro)*				
Real estate	$146,614	$158,878	$175,368	$548,437	$219,901	$1,302,747	$9,837
Motor vehicle ownership	$23,680	$35,918	$25,050	$113,230	$0	$185,722	$2,171
Motor vehicle sales	$0	$0	$0	$0	$0	$88,985	$3,596
Mobile home ownership [a]	$5,345	$485	$2,337	$0	$0	$2,337	$154
Motor vehicle tags	$855	$2,629	$1,935	$0	$0	$37,755	$2,380
Totals	$176,493	$197,910	$204,690	$661,667	$219,901	$1,617,546	$18,138

[a] Only when the land is not owned.
Source: Jackson County 1998.

4.2.3.9 Public and Occupational Health and Safety

Radiation Environment

Construction on Bellefonte 1 and 2 has not been completed. Therefore, no radiation has been released to the environment.

Background radiation exposure of individuals in the vicinity of the Bellefonte site is expected to be the same as for the Watts Bar site. The background radiation exposure at the Bellefonte site is presented in **Table 4–37**.

Table 4–37 Sources of Radiation Exposure to Individuals in the Vicinity of the Bellefonte Nuclear Plant Site[a]

Source	*Total Effective Dose Equivalent (millirem per year)*
Natural Background Radiation	
Cosmic and cosmogenic radiation	28
External terrestrial radiation	28
In the body	39
Radon in homes (inhaled)	200
Total	295
Other Sources of Radiation	
Release of radioactive material in natural gas, mining, ore processing, etc.	5
Diagnostic x-rays and nuclear medicine	53
Nuclear energy	0.28
Consumer and industrial products	0.03
Total	355

[a] Values are based on average national data, not measured values at the Bellefonte site.
Source: TVA 1998b.

Chemical Environment

Since construction of the Bellefonte Nuclear Plant has not been completed, only small amounts of hazardous chemicals are used at the site for maintenance and layup (TVA 1997f).

The Bellefonte Nuclear Plant is in compliance with the discharge requirements of the NPDES Permit issued by the Alabama Department of Environmental Management (TVA 1997f). Historical data (from 1974 to 1991) on stormwater discharges indicate that all primary pollutants (list of major health-related contaminants) were below the Method Detection Limits, except for some metals. Two specified examples of these metals are dissolved iron and manganese (TVA 1997f). The background samples from intake water were also above the Method Detection Limits for the same metals. Section 4.2.3.3, Table 4–25, and Section 4.2.3.4, Table 4–26 contain data on quantities of concentrated chemical concentrations in ambient air and surface water in the vicinity of Bellefonte.

4.2.3.10 Waste Management

Small quantities of nonradioactive wastes are generated at the Bellefonte site. Current operations include actions necessary to maintain plant systems such as the turbines.

Ongoing maintenance activities at the Bellefonte Nuclear Plant generate a small amount of solid waste. Typical solid waste is routinely put in dumpsters on site and subsequently disposed of off site by contractors. Asbestos and special wastes are sent to the local sanitary landfill after approval by the Alabama Department of Environmental Management. In 1995, the Bellefonte Nuclear Plant generated more than 2.8 cubic meters (100 cubic feet) of asbestos wastes, including insulation board, roofing material, tiles, gaskets, and filters. Special wastes generated by Bellefonte include activated alumina, grease, oil-contaminated rags, oil filters, sandblast grit, cement, and surplus chemicals. Bellefonte's special waste disposal for 1995 included 55 drums (each containing 55 gallons) of oil-contaminated materials, grease and surplus chemicals, several hundred pounds of waste cement, and lesser amounts of other wastes.

The Bellefonte site currently qualifies as an EPA Small Quantity Generator, in accordance with 40 CFR 121.5 (i.e., the site generates more than 100 kilograms, but less than 1,000 kilograms of hazardous waste in any one calendar month per year). Hazardous wastes generated by the Bellefonte Nuclear Plant include waste oil, lead wastes, nickel-cadmium batteries, acetic acid wastes, hydrazine, polyvinylchloride glue, tar, and solvents.

Some polychlorinated biphenyls wastes (e.g., lighting ballasts, small capacitors), which are regulated by the Toxic Substances Control Act, are also generated. Hazardous wastes are shipped to the TVA Hazardous Waste Storage Facility in Muscle Shoals, Alabama, which makes arrangements for disposal at a permitted disposal facility (TVA 1997f).

4.2.3.11 Spent Fuel Management

There is no spent fuel at the Bellefonte Nuclear Plant site.

Storage Capacity

Spent fuel storage has been provided for Bellefonte 1 and 2. There are two separate spent fuel pools, one for each unit. Each pool has a storage capacity of 1,058 spent fuel assemblies.

5. ENVIRONMENTAL CONSEQUENCES

Chapter 5 describes the environmental consequences of the production of tritium in commercial light water reactors. It begins with a brief introduction, followed by an elaboration of the potential environmental consequences of tritium production at each site. Included for consideration are the radiological impacts of operations and potential facility accidents. There follows a description of the consequences of activities that, although related to the reactor sites, are generic in nature and can be treated separately—specifically, reactor licensing renewal, decontamination and decommissioning, and spent fuel storage. Discussion then turns to the impacts from elements of the proposed action that are not directly related to the reactor sites, such as the fabrication and transport of tritium-producing burnable absorber rods. Also presented is a sensitivity analysis focused on tritium-producing burnable absorber rod design and the refueling cycle; separate evaluations of the implications of programmatic No Action and the impacts of commercial light water reactor facility accidents; and a description of the cumulative impacts of the proposed actions. The chapter concludes with a look at several issues common to all sites: unavoidable, adverse environmental impacts; relationships between local, short-term uses of man's environment and the enhancement of long-term productivity; irreversible, irretrievable commitments of resources; and mitigation measures.

5.1 INTRODUCTION

This environmental impact statement (EIS) is in compliance with regulations of the Council on Environmental Quality that require the affected environment of proposed Federal actions to be "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment," (40 CFR 1508.14). It focuses in part on the environmental consequences of the U.S. Department of Energy's (DOE) production of tritium in three commercial light water reactors (CLWRs) operated by the Tennessee Valley Authority (TVA)—Watts Bar Nuclear Plant Unit 1 (Watts Bar 1) and Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2)—from the perspective of a comparison of the incremental impacts of tritium production with continued operation without tritium production (the present status). Also examined are the environmental impacts of tritium production in one or both of TVA's partially completed reactors, Bellefonte Nuclear Plant Units 1 and 2 (Bellefonte 1 and 2), as well as impacts associated with the construction activities required for the completion and full operation of those units. The assessment results presented in this chapter constitute the analytical basis for a comparison of all proposed actions with the No Action Alternative detailed in Chapter 3.

5.1.1 Methodology

Specific assumptions associated with the impact analysis common to all sites are provided in the appendices. The environmental assessment methods used in assessing the environmental impacts for each resource and issue at each alternative reactor site are discussed in Appendix B of this EIS.

The methods for the evaluation of human health effects for: (1) normal operation of CLWR facilities, (2) CLWR facility accidents, and (3) overland transportation are presented in Appendices C, D, and E respectively. The results of these analyses are presented in this chapter.

The discussion of public and occupational health and safety considers the radiological and chemical impacts under normal operations as well as accident scenarios. The spectrum of potential accident scenarios evaluated in this EIS include: a reactor design-basis accident, a nonreactor design-basis accident, a handling accident involving the tritium-producing burnable absorber rods (TPBARs), two transportation cask handling accidents, and beyond design-basis reactor accidents involving core damage with loss of containment integrity. For operating reactors, the impacts from the accidents with tritium production are compared to operation without tritium production. The accident selection and the uncertainties are presented in Appendix D. Analysis of transportation impacts are considered for both routine transportation and transportation accidents. The conservatism of some of the assumptions used in these analyses are summarized below.

5.1.2 Assumptions

Conservative assumptions have been incorporated into the analysis method for this EIS to ensure that the health and safety impacts to the public and workers would not be underestimated. The following are examples of conservative assumptions incorporated in the analysis method.

- The models used to estimate the risk of latent cancers from radiation are known to overestimate the risk for low dose rates. The actual risk may be zero.

- The effective dose from an elemental tritium gas exposure is about 10,000 times less than the effective dose from an exposure to airborne tritium oxide. All tritium released to the environment from TPBARs during normal incident-free operation and/or during reactor, nonreactor, TPBAR handling, and transportation cask handling facility accidents is assumed to be converted to oxide form prior to release.

- When an accident frequency was estimated to be in a range, accident risk estimates were based on the high end of the range.

- The analyses assumed that 1 Curie of tritium from each TPBAR could permeate through the cladding and be released to the environment over a period of a year although, as discussed in Sections 1.3.4 and 3.1.2, the performance of the tritium "getter" is such that there is virtually no tritium available in a form that could permeate through the cladding.

- The analyses involving abnormal events assumed that 2 TPBARs could fail in a given core load of 3,400 TPBARs, and the entire inventory of tritium could be released to the reactor coolant and then to the environment. This is an extremely conservative assumption, considering the historic failure rate of standard burnable absorber rods, as discussed in Section 1.9.

- The analyses assumed that during the reactor design-basis accident all TPBARs would be breached and their tritium contents released to the reactor coolant system. Uncertainty exists on the actual percentage of TPBARs that would be breached during this accident.

- The analyses assumed an average tritium production of 1 gram per TPBAR per 18-month fuel cycle. This would overestimate the available tritium by about 15 percent, considering an estimated average tritium production rate of about 0.84 gram per TPBAR per cycle (WEC 1997).

- The analyses assumed that during a nonreactor design-basis accident about 10 percent of the tritium that was released to the reactor coolant system during normal operation would be released to the atmosphere.

- The analyses assumed that during a TPBAR handling accident the entire tritium inventory of 24 breached TPBARs would be released into the fuel pool and eventually to the environment. The analyses took no credit for mitigating actions that would be taken to limit the release of tritium into the fuel pool.

5.2 ENVIRONMENTAL CONSEQUENCES

Environmental consequences of the No Action Alternative and tritium production are evaluated in the following sections for Watts Bar 1, Sequoyah 1 and 2, and Bellefonte 1 and 2. The evaluation of tritium production impacts considers a tritium production reactor core with a nominal 1,000 TPBARs and a core with the maximum number of 3,400 TPBARs. Both the 1,000 and 3,400 TPBAR core configurations assume an 18-month reactor operating cycle. The impacts are evaluated for both individual and combined units at each site as applicable. In some cases the combined effects of two units at a site would be less than twice the impact of the individual units. Sensitivity analyses are performed in Section 5.2.9 to assess the changes in impacts due to TPBAR design modifications to increase tritium production per TPBAR, thereby reducing the core reload cycle to 15.5 or 12 months and reducing the number of TPBARs in the core to 100.

5.2.1 Watts Bar Nuclear Plant Unit 1

5.2.1.1 Land Resources

The land resources analysis addresses land use and visual resources for the region of influence. The region of influence for land use includes land within 3.2 kilometers (2 miles) of the Watts Bar site. The region of influence for visual resources includes those lands and waters from which the site is visible (the viewshed).

LAND USE

No Action

No land use impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

No additional property would be required for tritium production at the Watts Bar site. Land use would remain unchanged from its current industrial use. The 716-hectare (1,770-acre) site contains ample area for a dry cask spent nuclear fuel storage facility, if constructed. A description of a generic dry cask independent spent fuel storage installation (ISFSI) and its impacts is presented in Section 5.2.6.

VISUAL RESOURCES

No Action

No visual impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

There would be no change in the visual character of the Watts Bar site as a result of tritium production. The major visual elements of the plant already exist, including the cooling towers and the transmission lines. As described in Section 4.2.1.1, views of the Watts Bar Nuclear Plant from passing river traffic on the Tennessee River are partially screened by the wooded area east of the plant. Distant glimpses of the plant site can be had from locations along the river and various roads in the area.

5.2.1.2 Noise

No Action

No noise impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Noise levels should not change as a result of tritium production at the Watts Bar site. No construction would occur at the Watts Bar site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.1.3 Air Quality

NONRADIOACTIVE GASEOUS EMISSIONS

No Action

No air quality impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action (see Section 4.2.1.3, Table 4–1).

Tritium Production

Air quality should not change as a result of the production of tritium at the Watts Bar site. No construction would occur at Watts Bar unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

RADIOACTIVE GASEOUS EMISSIONS

No Action

Under the No Action Alternative, the radioactive gaseous emissions at Watts Bar 1 should continue at the levels described in Section 4.2.1.3, Table 4–2, assuming that no significant operational deviations would occur.

Tritium Production

A design objective of the TPBARs is to retain as much tritium as possible within the TPBAR. The performance of the tritium "getter" is such that there is virtually no tritium available in a form that could permeate through the TPBAR cladding. However, for the purposes of this EIS it was conservatively assumed that an average of 1 Curie of tritium per TPBAR per year could permeate to the reactor coolant (PNNL 1997b, PNNL 1999). It also was assumed that 10 percent of this tritium could be released to the environment as gaseous emission. Because of this assumption the radioactive gaseous emissions from Watts Bar 1 would increase. **Table 5–1** shows the annual radioactive gaseous emissions during tritium production at Watts Bar 1 with 0, 1,000, and 3,400 TPBARs. The method and assumptions used for the calculations are provided in Appendix C, Section C.3.4. Radiological exposures of the public and workers from radioactive emissions are presented in Section 5.2.1.9. The impacts on plants and animals are described in Section 5.2.1.6.

Table 5–1 Annual Radioactive Gaseous Emissions at Watts Bar 1

	No Action (0 TPBARs)	*Tritium Production*	
		1,000 TPBARs	*3,400 TPBARs*
Tritium release (Curies)	5.6	105.6	345.6
Other radioactive release (Curies)	283[a]	283	283
Total release (Curies)	288.6	388.6	628.6

[a] The isotopic distribution of this release is presented in Appendix C, Table C-9.
Source: TVA 1998e, TVA 1999.

5.2.1.4 Water Resources

SURFACE WATER

No Action

No surface water impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on surface water from nonradiological discharges at the Watts Bar site should not change as a result of tritium production. No construction would occur at the Watts Bar site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

GROUNDWATER

No Action

No groundwater impacts are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on groundwater at the Watts Bar site should not change as a result of tritium production. No construction would occur at the Watts Bar site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

RADIOACTIVE LIQUID EFFLUENT

No Action

Under the No Action Alternative, the liquid radioactive effluent at Watts Bar 1 should continue at the levels described in Section 4.2.1.4, Table 4–4, assuming that no significant operational deviations would occur.

Tritium Production

Based on the assumption that an average of 1 Curie of tritium per TPBAR per year could permeate to the reactor coolant and that 90 percent of this tritium could be released as liquid effluent, radioactive liquid effluent from Watts Bar 1 would increase. **Table 5–2** shows the annual radioactive releases in liquid effluent during tritium production at Watts Bar 1 with 0, 1,000, and 3,400 TPBARs. The method and assumptions used for the calculations are included in Appendix C, Section C.3. Radiological exposures of the public and workers from radioactive emissions are presented in Section 5.2.1.9. The impacts on plants and animals are described in Section 5.2.1.6.

In accordance with the Safe Drinking Water Act requirements promulgated by the Environmental Protection Agency (EPA) in 40 CFR Parts 100-149, a tritium concentration of 20,000 picocuries per liter has been established as a limit for drinking water. In view of this regulatory limit, an analysis was performed to estimate tritium concentrations in the Tennessee River that could result from tritium production at Watts Bar 1. The average expected tritium concentrations in the river were calculated using the Cornell Mixing Zone Expert System (CORMIX) (Cornell 1996). **Table 5–3** presents the potential tritium concentrations from the incident-free irradiation of 1,000 and 3,400 TPBARs at two points: (1) the edge of the near-field and (2) the nearest drinking water intake. "Near-field" in CORMIX is the area surrounding the discharge point of the effluent where initial mixing is taking place. The edge of the near-field typically extends to a few meters away from the point of discharge. Table 5–3 also presents potential tritium concentrations in the unlikely event of 2 TPBAR failures during a given 18-month operating cycle. The results indicate that tritium concentrations would remain well below the 20,000 picocuries per liter limit, and at the drinking water intake the tritium concentration would be below or close to the lower detection limit for tritium which is approximately 300 picocuries per liter. Tritium production is not expected to affect the requirements in the Watts Bar 1 National Pollution Discharge Elimination System (NPDES) Permit.

Table 5–2 Annual Radioactive Liquid Effluents at Watts Bar 1

	No Action (0 TPBARs)	*Tritium Production*	
		1,000 TPBARs	*3,400 TPBARs*
Tritium release (Curies)	639	1,539	3,699
Other radionuclides released (Curies)	1.3	1.3	1.3
Total release (Curies)	640.3	1,540.3	3,700.3

Source: TVA 1998e.

Table 5–3 Tritium Concentration in the Tennessee River from Tritium Production at Watts Bar 1

	No Action (0 TPBARs) (picocuries per liter)	*Incident-Free Tritium Production*		*2 TPBAR Failures[a] (picocuries per liter)*
		1,000 TPBARs (picocuries per liter)	*3,400 TPBARs (picocuries per liter)*	
Edge of near-field	280	674	1,620	6,109
At nearest drinking water intake	22	52	126	475

[a] See Appendix C, Table C-8 for tritium release.

5.2.1.5 Geology and Soils

No Action

No impacts on geology and soils are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on geology and soils at the Watts Bar site should not change as a result of tritium production. No construction would occur at the Watts Bar site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.1.6 Ecological Resources

No Action

No impacts on land use, air quality, or water quality are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action. Therefore, no impacts on ecological resources are expected under this alternative.

Tritium Production

Operation of Watts Bar 1 during tritium production would not change the terrestrial or aquatic habitat at the site. Thermal and nonradioactive chemical discharges that could affect the ecology at the site would remain the same. No construction would occur at Watts Bar unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

Tritium production could increase radiological releases in gaseous emissions and liquid effluents, as presented in Sections 5.2.1.3 and 5.2.1.4. When tritium is inhaled or ingested by an organism, incorporation into bodily fluids is very efficient. However, long-term accumulation in the organism is limited by its rapid elimination by exhalation, excretion in body water, and tritium's short half-life. The biological properties of tritium are discussed in Appendix C.

According to an International Atomic Energy Agency (IAEA) publication (IAEA 1992), a dose rate of 100 millirem per year to the most exposed human will lead to dose rates to plants and animals of less than 0.1 rad per day. The IAEA concluded that a dose rate of 0.1 rad per day or less for animals and 1 rad per day or less for plants would not affect these populations. Doses to the public and workers from potential releases at Watts Bar 1 are estimated and presented in Section 5.2.1.9. Tritium production could increase the annual dose to the maximally exposed individual from 0.29 millirem per year (No Action) to approximately 0.34 millirem per year (3,400 TPBARs). This cumulative exposure rate is well below the IAEA benchmarks. Therefore, the increase in tritium releases due to tritium production would have no effect on plants and animals at the Watts Bar site. TVA has notified the U.S. Fish and Wildlife Service of DOE's proposed action at Watts Bar and has provided the States of Tennessee and South Carolina and the U.S. Fish and Wildlife Service with copies of the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (*CLWR EIS). Copies of the CLWR Final EIS also will be provided to these agencies. The U.S. Fish and Wildlife Service was consulted initially concerning the identification of threatened or endangered species that should be evaluated in this EIS (DOI 1998b). TVA evaluated those species and concluded, that since small increases in tritium releases in gaseous emissions and liquid effluents are the only operational differences for the Watts Bar plant, no threatened or endangered species should be affected.

In its response to the CLWR Draft EIS, the U.S. Fish and Wildlife Service concluded that adverse effects to listed species potentially occurring at the site from the proposed action are not anticipated (DOI 1998d). TVA and DOE will continue to comply with the requirements of the Endangered Species Act and interact with the U.S. Fish and Wildlife Service, as appropriate. TVA is committed to conducting an environmental monitoring program during tritium production operations. Should the monitoring program indicate any adverse impacts to listed species, consultation with the U.S. Fish and Wildlife Service would be initiated immediately to address those impacts.

5.2.1.7 Archaeological and Historic Resources

No Action

No impacts on land use are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action. As a result, no impacts on historic and archaeological resources are expected.

Tritium Production

Since no additional land would be required for tritium production, there would be no impacts on archaeological and historic resources at the Watts Bar site. It should be noted that the Tennessee State Historic Preservation Office reviewed the CLWR Draft EIS for compliance with Section 106 of the National Historic Preservation Act and determined that tritium production at Watts Bar would have no effect upon properties listed or eligible for listing by the National Register of Historic Places (TN DEC 1998b). No construction would occur at Watts Bar unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.1.8 Socioeconomics

No Action

Under the No Action Alternative, no socioeconomic impacts are expected in the region of influence of the Watts Bar plant beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

As Watts Bar 1 is an operating facility, only the socioeconomic impacts associated with incremental tritium-related changes to plant operations have been considered. The primary costs of operating a CLWR for tritium production could relate to operations and maintenance, supplemental fuel procurement or fuel enrichment, storage of additional spent fuel, replacement power, capital upgrades or replacements, and fees to the utility. Of these costs, only operations and maintenance would have the potential for material socioeconomic impacts within the region of influence. All the other expenses would relate to nonplant functions that generate corporate income, though not local income (e.g., fees from DOE) or procurements (e.g., potential spent fuel storage casks, fuel elements, TPBARs) in other parts of the country. Minor regional costs (e.g., potential maintenance of the spent fuel storage casks) would have no measurable socioeconomic impacts.

Operation of Watts Bar 1 for tritium production should require less than 10 full-time equivalent workers in addition to normal plant operations staff. The addition of 10 full-time equivalent workers to the normal operations staff would increase local socioeconomic factors such as income, housing requirements, and indirect employment by about 1 percent compared to normal plant operations for power production. Regional income would increase by slightly more than $1 million per year.

The potential increase in spent fuel storage requirements due to tritium production would involve some additional costs, but the overall socioeconomic impacts would be small. These requirements would be met via dry cask storage (see Section 5.2.6) using casks procured from outside the region. Annual costs for additional fuel transfers, spent fuel storage cask maintenance, spent fuel cask pad expansion, and the transfer of spent fuel to shipping casks would be a maximum of $2 million.

Life extension of Watts Bar 1 as a result of tritium production (see Section 5.2.4) would have substantial regional socioeconomic benefits. An extension of normal plant operations would allow regional earnings to continue at about $100 million per year.

The transportation impacts of tritium production would be minimal and would be limited to commuter traffic by the personnel assigned to the site. The impact of 50 additional construction workers and associated construction vehicles, assuming the potential construction of a dry cask ISFSI, would be temporary and minor, and the traffic impact of 10 additional tritium production operations workers would not be noticeable. Additional truck traffic during tritium operations would include a total of 16 shipments of TPBARs to and from the plant per year.

5.2.1.9 Public and Occupational Health and Safety

This section describes the impacts of radiological and hazardous chemical releases resulting from normal operation, abnormal conditions, and accidents due to tritium production at Watts Bar 1.

5.2.1.9.1 Normal Operation

RADIOLOGICAL IMPACTS

During normal operation, there would be incremental radiological releases of tritium to the environment, as well as additional in-plant exposures. The resulting doses and potential health effects on the general public and workers are described below. There would be no immediate construction of new facilities to support tritium production operations at Watts Bar 1; therefore, there would be no associated impacts on the public or workers. Impacts from construction of a dry cask ISFSI are presented in Section 5.2.6.

The annual increase in gaseous radioactive emissions and liquid radioactive effluents from the production of tritium at Watts Bar 1 are presented in Sections 5.2.1.3 and 5.2.1.4, respectively. The radiological impacts of both gaseous and liquid radioactive releases are presented in **Table 5–4** for the maximally exposed offsite individual and the general public living within 80 kilometers (50 miles) of Watts Bar 1 in the year 2025. **Table 5–5** reflects the radiological impacts on the facility workers. A facility worker is defined as any "monitored" reactor plant employee. Doses to these workers would be kept to minimal levels through programs to ensure worker doses are as low as reasonably achievable. The tables also include the impacts of the No Action Alternative.

Background information on the effects of radiation on human health and safety is included in Appendix C. The method and assumptions used for calculating the impacts on public health and safety at Watts Bar 1 are presented in Appendix C, Section C.3.

Table 5–4 Annual Radiological Impacts to the Public from Incident-Free Tritium Production Operations at Watts Bar 1

Tritium Production	Release Media	Maximally Exposed Offsite Individual		Population Within 80 kilometers (50 miles) for the Year 2025	
		Dose (millirem)	Latent Fatal Cancer Risk	Annual Dose (person-rem)	Latent Fatal Cancers
No Action[a] (0 TPBARs)	Air	0.036	1.8×10^{-8}	0.071	0.000036
	Liquid	0.25	1.3×10^{-7}	0.48	0.00024
	Total	0.29	1.5×10^{-7}	0.55	0.00028
Incremental dose for 1,000 TPBARs	Air	0.012	6.0×10^{-9}	0.15	0.000075
	Liquid	0.0014	7.0×10^{-10}	0.19	0.000095
Total dose for 1,000 TPBARs	Air	0.048	2.4×10^{-8}	0.22	0.00011
	Liquid	0.25	1.3×10^{-7}	0.67	0.00034
	Total	0.30	1.5×10^{-7}	0.89	0.00045
Incremental dose for 3,400 TPBARs	Air	0.042	2.1×10^{-8}	0.50	0.00025
	Liquid	0.0050	2.5×10^{-9}	0.69	0.00035
Total dose for 3,400 TPBARs	Air	0.078	3.9×10^{-8}	0.57	0.00029
	Liquid	0.26	1.3×10^{-7}	1.2	0.00060
	Total	0.34	1.7×10^{-7}	1.8	0.00090

[a] Doses based on actual measurements during plant operation in 1997 with population exposure adjusted to reflect population growth to the year 2025.

Table 5–5 Annual Radiological Impacts to Workers from Incident-Free Tritium Production Operations at Watts Bar 1

Impact	No Action	1,000 TPBARs	Total With 1,000 TPBARs	3,400 TPBARs	Total With 3,400 TPBARs
Average worker dose (millirem)[a]	104	0.33	104.33	1.1	105.1
Latent fatal cancer risk	4.2×10^{-5}	1.6×10^{-7}	4.2×10^{-5}	4.5×10^{-7}	4.2×10^{-5}
Total worker dose (person-rem)	112	0.35	112.35	1.2	113.2
Latent fatal cancers	0.045	0.00014	0.045	0.00048	0.045

[a] Based on 1,073 badged workers in 1997.
Source: TVA 1998d, TVA 1998e.

No Action

Under the No Action Alternative, the health and safety risk of members of the public and facility workers at Watts Bar 1, assuming that the operating conditions did not change from those expected, would remain at the levels presented in Section 4.2.1.9. As shown in Tables 5–4 and 5–5:

- The annual dose to the maximally exposed offsite individual would remain at 0.29 millirem per year, with an associated 1.5×10^{-7} risk of a latent cancer fatality per year of operation.

- The collective dose to the population within 80 kilometers (50 miles) of Watts Bar 1 would remain at 0.55 person-rem per year, with an associated 0.00028 latent cancer fatality per year of operation.

- The collective dose to the facility workers on average would remain at 112 person-rem per year, with an associated 0.045 latent cancer fatality per year of operation.

Tritium Production

In the tritium production mode, the health and safety risk of the public and facility workers would increase due to the estimated releases of tritium in gaseous emissions and liquid effluent. As shown in Tables 5–4 and 5–5, for 3,400 TPBARs in the reactor core:

- The annual dose to the maximally exposed offsite individual would be 0.34 millirem per year, with an associated 1.7 × 10^{-7} risk of a latent cancer fatality per year of operation. This dose is 1.4 percent of the annual total dose limit of 25 millirem set by regulations in 40 CFR 190.

- The collective dose to the population within 80 kilometers (50 miles) of Watts Bar 1 would be 1.8 person-rem per year, with an associated 0.00090 latent cancer fatality per year of operation.

- The collective dose to the facility workers on average would be 113.2 person-rem per year, with an associated 0.045 latent cancer fatality per year of operation.

In addition to the assumed normal operation release of tritium through permeation, an additional potential release scenario considered in this EIS is the failure of 1 or more TPBARs, such that the inventory of the TPBARs is released to the primary coolant. The occurrence of TPBAR failure is considered to be beyond that associated with normal operating conditions and, as discussed in Section 1.9, such an assumption is extremely conservative. The radiological consequences to the public and workers resulting from the assumption of 2 TPBAR failures in a given core load of 3,400 TPBARs at Watts Bar 1 are presented in **Tables 5–6** and **5–7**. Releases, doses, and cancer risks associated with 1 TPBAR failure can be determined by dividing the values in Tables 5–6 and 5–7 by two.

Table 5–6 Radiological Impacts to the Public from the Failure of 2 TPBARs at Watts Bar 1

Release Pathway	***Release Quantity (Curies)***	***Dose to Maximally Exposed Individual (millirem)***	***Latent Fatal Cancer Risk***	***Dose to Population Within 80 kilometers (50 miles) (person-rem)***	***Latent Fatal Cancers***
Air	2,315	0.29	1.5 × 10^{-7}	3.4	0.0017
Liquid	20,835	0.033	1.7 × 10^{-8}	4.4	0.0022

Table 5–7 Radiological Impacts to Workers from the Failure of 2 TPBARs at Watts Bar 1

Impact Type	***Impact Quantity***
Average Worker Dose (millirem)[a]	7.7
Latent Fatal Cancer Risk	3.1 × 10^{-6}
Total Worker Dose (person-rem)	8.2
Latent Fatal Cancers	0.0033

[a] Based on 1,073 badged workers in 1997.
Source: TVA 1998d, TVA 1998e.

HAZARDOUS CHEMICAL IMPACTS

No Action

No impacts on public and occupational health and safety from exposure to hazardous chemicals are anticipated at Watts Bar beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Tritium production would introduce no additional operations at the plant that would require the use of hazardous chemicals.

5.2.1.9.2 Facility Accidents

RADIOLOGICAL IMPACTS

The accident set selected for evaluation of the impacts of the No Action Alternative and tritium production are described in Section 5.1 and discussed in detail in Appendix D, Section D.1. The consequences of the reactor and nonreactor design-basis accidents for the No Action Alternative at the Watts Bar plant (0 TPBARs) and for maximum tritium production (3,400 TPBARs) were estimated using the Nuclear Regulatory Commission (NRC)-based licensing approach presented in the *Watts Bar Nuclear Plant Final Safety Analysis Report* (TVA 1995c). The receptors were an individual at the reactor site exclusion area boundary and an individual at the reactor site low-population zone. The margin of safety for site dose criteria associated with the same accidents and the same receptors are presented in **Table 5–8.** Data presented for the No Action Alternative were extracted directly from the *Watts Bar Nuclear Plant Final Safety Analysis Report*. As indicated in Table 5–8 the irradiation of TPBARs at the Watts Bar plant would result in a very small increase in design-basis accident consequences and thus, a reduction in the consequence margin. The accident consequences would be dominated by the effects of the nuclide releases inherent to the No Action Alternative.

Table 5–8 Design-Basis Accident Consequence Margin to Site Dose Criteria at Watts Bar 1

Accident	Tritium Production	Dose Description[a]	Site Dose Criteria (rem)[b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%)[c]	Dose (rem)	Margin (%)[c]
Reactor design-basis accident	0 TPBARs (No Action)[d]	Thyroid inhalation dose	300	34.1	88.6	11.0	96.3
		Beta + gamma whole body dose	25	3.5	86.1	3.4	86.2
	3,400 TPBARs	Thyroid inhalation dose	300	34.1	88.6	11.0	96.3
		Beta + gamma whole body dose	25	3.5	86.1	3.4	86.2
Nonreactor design-basis accident	0 TPBARs (No Action)[d]	Thyroid inhalation dose	300	0.018	99.99	0.0042	99.999
		Beta + gamma whole body dose	25	0.13	99.5	0.031	99.9
	3,400 TPBARs	Thyroid inhalation dose	300	0.025	99.92	0.0058	99.998
		Beta + gamma whole body dose	25	0.13	99.5	0.031	99.9

[a] Dose is the total dose from the reactor plus the contribution from the TPBARs.
[b] 10 CFR 100.11.
[c] Margin below the site dose criteria.
[d] TVA 1995c.

Table 5–9 presents the incremental risks due to tritium production for the postulated set of design-basis and handling accidents and the total risks from beyond design-basis accidents to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, and a noninvolved worker 640 meters (0.4 miles) from the release point. Accident consequences for the same receptors are summarized in **Table 5–10**. The assessment of dose and the associated cancer risk to the noninvolved worker are not applicable for beyond design-basis accidents. A site emergency would have been declared early in the beyond design-basis accident sequence; all nonessential site personnel would have evacuated the site in accordance with site emergency procedures before any radiological release to the environment. In accordance with emergency action guidelines, evacuation of the public within 16.1 kilometers (10 miles) of the plant would have been initiated.

Table 5–9 Annual Accident Risks at Watts Bar 1

Accident	*Tritium Production*	*Maximally Exposed Offsite Individual*[a]	*Average Individual in Population to 80 kilometers (50 miles)*[a]	*Noninvolved Worker*[a]
Design-Basis Accidents				
Reactor design-basis accident[b]	1,000 TPBARs	1.4×10^{-10}	1.1×10^{-12}	1.9×10^{-12}
	3,400 TPBARs	4.8×10^{-10}	3.8×10^{-12}	6.4×10^{-12}
Nonreactor design-basis accident[b]	1,000 TPBARs	3.4×10^{-8}	4.0×10^{-10}	4.2×10^{-10}
	3,400 TPBARs	1.1×10^{-7}	1.4×10^{-9}	1.5×10^{-9}
Sum of design-basis accident risks	1,000 TPBARs	3.4×10^{-8}	4.0×10^{-10}	4.2×10^{-10}
	3,400 TPBARs	1.1×10^{-7}	1.4×10^{-9}	1.5×10^{-9}
Handling Accidents				
TPBAR handling accident	1,000 TPBARs	2.4×10^{-8}	2.7×10^{-10}	1.2×10^{-9}
	3,400 TPBARs	8.1×10^{-8}	9.3×10^{-10}	3.9×10^{-9}
Truck cask handling accident	1,000 TPBARs	1.9×10^{-13}	2.1×10^{-15}	9.0×10^{-15}
	3,400 TPBARs	5.8×10^{-13}	6.4×10^{-15}	2.7×10^{-14}
Rail cask handling accident	1,000 TPBARs	9.7×10^{-14}	1.1×10^{-15}	4.6×10^{-15}
	3,400 TPBARs	2.9×10^{-13}	3.2×10^{-15}	1.4×10^{-14}
Sum of handling accident risks	1,000 TPBARs	2.4×10^{-8}	2.7×10^{-10}	1.2×10^{-9}
	3,400 TPBARs	8.1×10^{-8}	9.3×10^{-10}	3.9×10^{-9}
Beyond Design-Basis Accidents (Severe Reactor Accidents)				
Reactor core damage accident with early containment failure	0 TPBARs (No Action)	6.7×10^{-9}	8.8×10^{-11}	Not applicable
	3,400 TPBARs	6.7×10^{-9}	8.8×10^{-11}	Not applicable
Reactor core damage accident with containment bypass	0 TPBARs (No Action)	2.2×10^{-8}	1.2×10^{-9}	Not applicable
	3,400 TPBARs	2.2×10^{-8}	1.2×10^{-9}	Not applicable
Reactor core damage accident with late containment failure	0 TPBARs (No Action)	2.4×10^{-9}	1.1×10^{-10}	Not applicable
	3,400 TPBARs	2.5×10^{-9}	1.2×10^{-10}	Not applicable
Sum of severe reactor accident risks	0 TPBARs (No Action)	3.1×10^{-8}	1.4×10^{-9}	Not applicable
	3,400 TPBARs	3.1×10^{-8}	1.4×10^{-9}	Not applicable

[a] Increased likelihood of cancer fatality per year.
[b] Design-basis accident risks only reflect the incremental increase in accident risk due to the production of tritium in TPBARs.

Table 5–10 Accident Frequencies and Consequences at Watts Bar 1

Accident	Accident Frequency (per year)	Tritium Production	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
			Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Design-Basis Accidents								
Reactor design-basis accident [b]	0.0002	1,000 TPBARs	0.0014	7.0×10^{-7}	0.000011	5.5×10^{-9}	0.000024	9.6×10^{-9}
		3,400 TPBARs	0.0047	2.4×10^{-6}	0.000038	1.9×10^{-8}	0.000081	3.2×10^{-8}
Nonreactor design-basis accident [b]	0.01	1,000 TPBARs	0.0067	3.4×10^{-6}	0.000079	4.0×10^{-8}	0.00010	4.2×10^{-8}
		3,400 TPBARs	0.022	0.000011	0.00027	1.4×10^{-7}	0.00036	1.5×10^{-7}
Handling Accidents								
TPBAR handling accident	0.0017/ 0.0058[c]	All TPBAR Configurations	0.028	0.000014	0.00031	1.6×10^{-7}	0.0017	6.8×10^{-7}
Truck cask handling accident	5.3×10^{-7}/ 1.6×10^{-6} [c]	All TPBAR configurations	0.00072	3.6×10^{-7}	8.0×10^{-6}	4.3×10^{-9}	0.000043	1.7×10^{-8}
Rail cask handling accident	2.7×10^{-7}/ 8.0×10^{-7} [c]	All TPBAR configurations	0.00072	3.6×10^{-7}	8.0×10^{-6}	4.3×10^{-9}	0.000045	1.8×10^{-8}
Beyond Design-Basis Accidents (Severe Reactor Accidents)								
Reactor core damage with early containment failure	6.8×10^{-7}	0 TPBARs (No Action)	19.7	0.0099	0.25	0.00013	N/A	N/A
		3,400 TPBARs	19.8	0.0099	0.25	0.00013	N/A	N/A
Reactor core damage with containment bypass	6.9×10^{-6}	0 TPBARs (No Action)	6.4	0.0032	0.35	0.00018	N/A	N/A
		3,400 TPBARs	6.4	0.0032	0.35	0.00018	N/A	N/A
Reactor core damage with late containment failure	9.1×10^{-6}	0 TPBARs (No Action)	0.51	0.00026	0.024	0.000012	N/A	N/A
		3,400 TPBARs	0.53	0.00027	0.025	0.000013	N/A	N/A

N/A = Not applicable.
[a] Increased likelihood of cancer fatality.
[b] Design-basis accident consequences only reflect the incremental increase in accident consequences due to the production of tritium in TPBARs.
[c] Frequency for 1,000 TPBARs/frequency for 3,400 TPBARs.

Presented in Tables 5–9 and 5–10 are calculations of the risks and consequences of both the No Action Alternative (0 TPBARs) and maximum tritium production (3,400 TPBARs) for severe reactor accidents. Tritium release is governed by the nature of the core melt accident scenarios analyzed; accident risks and consequences are governed by actions taken in accordance with the EPA Plant Protective Action Guidelines (e.g., evacuation of the public, interdiction of the food and water supply, condemnation of farmland and public property) in response to the postulated core melt accident with containment failure or containment bypass.

The severity of the reactor accident dominates the consequences, is the basis for implementation of protective actions, and is independent of the number of TPBARs. The accident risk is the product of the accident probability (i.e, accident frequency) times the accident consequences. In this EIS, risk is expressed as the increased likelihood of a cancer fatality per year for an individual (e.g., the maximally exposed offsite individual, an average individual in the population within 80 kilometers [50 miles] of the reactor site, or a noninvolved worker). Table 5–9 indicates that the risks associated with tritium production are low. The highest risk to each individual—the maximally exposed offsite individual, one fatality every 9.1 million years (1.1 × 10^{-7} per year); an average member of the public, one fatality every 710 million years (1.4 × 10^{-9} per year); the exposed population, one fatality every 3.8 thousand years (0.00026 per year); and a noninvolved worker, one fatality every 670 million years (1.5 × 10^{-9} per year)—is from the nonreactor design-basis accident.

The nonreactor design-basis accident has the highest consequence of the design-basis and handling accidents because the postulated accident scenario entails an acute release of tritium in oxide form directly to the environment without any mitigation. Review of Table 5–10 indicates that there would be a very small increase of severe reactor accident consequences due to the irradiation of TPBARs at the Watts Bar plant. The accident consequences are dominated by the effects of the radionuclide releases inherent to the No Action Alternative. The secondary impacts of severe reactor accidents are discussed in Section 5.2.13.

HAZARDOUS CHEMICALS IMPACTS

No Action

No impacts on public and occupational health and safety from exposure to hazardous chemicals are anticipated at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Tritium production would introduce no additional operations at the plant that would require the use of hazardous chemicals.

5.2.1.10 Environmental Justice

As discussed in Appendix G, Executive Order 12898 directs Federal agencies to address disproportionately high and adverse health or environmental effects of alternatives on minority and low-income populations. The Executive Order does not alter prevailing statutory interpretations under the National Environmental Policy Act (NEPA) or existing case law. Regulations prepared by the Council on Environmental Quality remain the foundation for the preparation of environmental documentation in compliance with NEPA (40 CFR, 1500 through 1508).

No Action

Under the No Action Alternative, there would be no impacts on the general population and thus, no disproportionately high and adverse consequences for minority and low-income populations beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Analyses of incident-free operations and accidents show the risk of latent cancer fatalities among the public residing within 80 kilometers (50 miles) of the reactor site to be much less than 1. Because tritium production would not have high and adverse consequences for the population at large, no minority or low-income populations would be expected to experience disproportionately high and adverse consequences.

5.2.1.11 Waste Management

No Action

Under the No Action Alternative, waste generation at Watts Bar 1 should continue at the levels described in Section 4.2.1.10. Provisions for the management of these wastes would continue unchanged.

Tritium Production

No additional hazardous waste, nonhazardous solid waste, or sanitary liquid waste should be generated at Watts Bar 1 as a result of tritium production. Management of these wastes would continue as described in Section 4.2.1.10. However, it is expected that an additional 0.43 cubic meters per year (15 cubic feet per year) of low-level radioactive waste would be generated as a result of tritium production (WEC 1999). It would consist of the approximately 140 base plates and other irradiated hardware remaining after the TPBARs were separated from their assemblies to be placed in the 17 × 17 array consolidation baskets at the reactor site.

Similar to the quantities of low-level radioactive waste generated as a result of activities independent of this action, the additional low-level radioactive waste generated as a result of tritium production (with the exception of the base plates and associated hardware) would be shipped to a commercial processor where it would be compacted to a lesser volume and shipped to the Barnwell, South Carolina, low-level radioactive waste disposal facility. The base plates and associated hardware would accumulate until a sufficient amount were on hand to ship directly to Barnwell for disposal. The additional low-level radioactive waste of 0.43 cubic meters (15 cubic feet) represents approximately 0.1 percent of the total low-level radioactive waste currently generated at the site.

For completeness, this EIS also analyzes the management of the additional volume of low-level radioactive waste (0.43 cubic meters [15 cubic feet]) generated as a result of tritium production at DOE-owned facilities at the Savannah River Site. Under this scenario, the additional low-level radioactive wastes could be transported to the Low-Level Radioactive Waste Disposal Facility at the Savannah River Site near Aiken, South Carolina. The facility consists of a series of vaults in E-Area that have been operational since September 1994. The operating capacity of each vault is 30,500 cubic meters of low-level radioactive waste (DOE 1998c, DOE 1999b). Therefore, the addition of low-level radioactive waste from the proposed action at Watts Bar for a 40-year period would be approximately 0.06 percent of the capacity of a single vault.

5.2.1.12 Spent Fuel Management

Production of tritium at Watts Bar 1 would not increase the generation of spent nuclear fuel if less than approximately 2,000 TPBARs were irradiated in a fuel cycle. For the irradiation of the maximum number of 3,400 TPBARs, up to 140 spent nuclear fuel assemblies could be generated. This represents up to 60 additional spent nuclear fuel assemblies beyond the normal refueling batch of 80 assemblies. For the purposes of this EIS, it is assumed that the additional spent nuclear fuel would be stored on site for the duration of the proposed action. If needed, a dry cask ISFSI would be constructed at the site. Environmental impacts of the construction and operation of a generic dry cask ISFSI are presented in Section 5.2.6.

5.2.2 Sequoyah Nuclear Plant Units 1 and 2

5.2.2.1 Land Resources

The land resources analysis addresses land use and visual resources for the region of influence. The region of influence for land use includes land within 3.2 kilometers (2 miles) of the site. The region of influence for visual resources includes those lands and waters from which the Sequoyah Nuclear Plant is visible (the viewshed).

LAND USE

No Action

No land use impacts are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

No additional property would be required and no additional land would be disturbed to prepare for tritium production at the Sequoyah Nuclear Plant site. Land use would remain unchanged from its current industrial use. The 212-hectare (525-acre) site contains ample area for construction of a dry cask ISFSI. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

VISUAL RESOURCES

No Action

No visual impacts are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

There would be no change in the visual character of the Sequoyah site as a result of tritium production. The major visual elements of the plant already exist, including the cooling towers and the transmission lines. As described in Section 4.2.2.1, views of the Sequoyah Nuclear Plant from passing river traffic on the Tennessee River are partially screened by the wooded area east of the plant (TVA 1974a).

5.2.2.2 Noise

No Action

No noise impacts are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Noise levels should not change as a result of tritium production at the Sequoyah site. No construction would occur at the Sequoyah site, unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.2.3 Air Quality

NONRADIOACTIVE GASEOUS EMISSIONS

No Action

No air quality impacts are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action (see Section 4.2.2.3, Table 4–13).

Tritium Production

Air quality should not change as a result of the production of tritium at the Sequoyah site. No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

RADIOACTIVE GASEOUS EMISSIONS

No Action

Under the No Action Alternative, the radioactive gaseous emissions at Sequoyah 1 or Sequoyah 2 should continue at the levels described in Section 4.2.2.3, Table 4–14, assuming that no significant operational deviations would occur.

Tritium Production

A design objective of the TPBARs is to retain as much tritium as possible within the TPBAR. The performance of the tritium "getter" is such that there is virtually no tritium available in a form that could permeate through the TPBAR cladding. However, for the purposes of this EIS it was conservatively assumed that an average of 1 Curie of tritium per TPBAR per year could permeate to the reactor coolant (PNNL 1997b, PNNL 1999). It also was assumed that 10 percent of this tritium could be released to the environment as gaseous emission. Because of this assumption the radioactive gaseous emissions from Sequoyah 1 or Sequoyah 2 would increase. **Table 5–11** shows the annual radioactive gaseous emissions during tritium production at Sequoyah 1 or Sequoyah 2 with 0, 1,000, and 3,400 TPBARs. The method and assumptions used for the calculations are included in Appendix C, Section C.3.4. Radiological exposures of the public and workers from radioactive emissions are presented in Section 5.2.2.9. The impacts on plants and animals are described in Section 5.2.2.6.

Table 5–11 Annual Radioactive Gaseous Emissions at Sequoyah 1 or Sequoyah 2

	No Action (0 TPBARs)	*Tritium Production*	
		1,000 TPBARs	*3,400 TPBARs*
Tritium release (Curies)	25	125	365
Other radioactive release (Curies)	120[a]	120	120
Total release (Curies)	145	245	485

[a] The isotopic distribution of this release is presented in Appendix C, Table C-10.
Source: TVA 1998a.

5.2.2.4 Water Resources

SURFACE WATER

No Action

No surface water impacts are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on surface water from nonradiological discharges at the Sequoyah site should not change as a result of tritium production. No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

GROUNDWATER

No Action

No groundwater impacts are anticipated at Sequoyah beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on groundwater at Sequoyah 1 or Sequoyah 2 should not change as a result of tritium production. No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

RADIOACTIVE LIQUID EFFLUENT

No Action

Under the No Action Alternative, the liquid radioactive effluent at Sequoyah 1 or Sequoyah 2 should continue at the levels described in Section 4.2.2.4, Table 4–16, assuming that no significant operational deviations would occur.

Tritium Production

Based on the assumption that, on average, 1 Curie of tritium per TPBAR per year could permeate to the reactor coolant and 90 percent of this tritium could be released as liquid effluent, radioactive liquid effluents from Sequoyah 1 or Sequoyah 2 would increase. **Table 5–12** shows the increase in tritium release in liquid effluent during tritium production at Sequoyah 1 or Sequoyah 2 with 0, 1,000, and 3,400 TPBARs. The method and assumptions used for the calculations are included in Appendix C, Section C.3. Radiological exposures of the public and workers from radioactive emissions are presented in Section 5.2.2.9. The impacts on plants and animals are described in Section 5.2.2.6.

In accordance with the Safe Drinking Water Act requirements, promulgated by the EPA in 40 CFR, 100-149, a tritium concentration of 20,000 picocuries per liter has been established as a limit for drinking water. In view of this regulatory limit, an analysis was performed to estimate tritium concentrations in the Tennessee River that could result from tritium production at Sequoyah 1 or Sequoyah 2. The average expected tritium concentrations in the river were calculated using CORMIX (Cornell 1996). **Table 5–13** presents the potential tritium concentrations from the incident-free irradiation of 1,000 and 3,400 TPBARs at two points: (1) the edge of the near-field, and (2) the nearest drinking water intake. "Near-field" in CORMIX is the area surrounding the discharge point of the effluent where initial mixing is taking place. The edge of the near-field typically extends to a few meters away from the point of discharge. Table 5–13 also presents potential tritium concentrations in the unlikely event of 2 TPBAR failures during a given 18-month operating cycle. The results indicate that tritium concentrations would remain well below the 20,000 picocuries per liter limit, and at the drinking water intake the tritium concentration would be below or close to the lower detection limit for tritium which is approximately 300 picocuries per liter. Tritium production is not expected to affect the requirements in the Sequoyah NPDES Permit.

Table 5–12 Annual Radioactive Liquid Effluent at Sequoyah 1 or Sequoyah 2

	No Action (0 TPBARs)	*Tritium Production*	
		1,000 TPBARs	*3,400 TPBARs*
Tritium release (Curies)	714	1,614	3,774
Other radioactive release (Curies)	1.15	1.15	1.15
Total release (Curies)	715.2	1,615.2	3,775.2

Source: TVA 1998e, TVA 1999.

Table 5–13 Tritium Concentration in the Tennessee River from Tritium Production at Sequoyah 1 or Sequoyah 2

	No Action (0 TPBARs) (picocuries per liter)	*Incident-Free Tritium Production*[a]		*2 TPBAR Failures*[b] *(picocuries per liter)*
		1,000 TPBARs (picocuries per liter)	*3,400 TPBARs (picocuries per liter)*	
Edge of near-field	93	150	286	879
At nearest drinking water intake	63	102	195	600

[a] Concentrations include the effect of one nontritium-producing unit.
[b] See Appendix C, Table C-8 for tritium release.

5.2.2.5 Geology and Soils

No Action

No impacts on geology and soils are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Impacts on geology and soils at the Sequoyah site should not change as a result of tritium production. No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.2.6 Ecological Resources

No Action

No impacts on land use, air quality, or water quality are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action. Therefore, no impacts on ecological resources are expected under this alternative.

Tritium Production

Operation of Sequoyah 1 or Sequoyah 2 in a tritium production mode would not involve any physical changes to the terrestrial or aquatic habitat at the site. Thermal and nonradioactive chemical discharges that could affect the ecology at the site would remain the same. No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

Tritium production could increase the release of tritium in gaseous emissions and liquid effluents, as presented in Sections 5.2.2.3 and 5.2.2.4. When tritium is inhaled or ingested by an organism, incorporation into bodily fluids is very efficient. However, long-term accumulation in the organism is limited by tritium's rapid elimination by exhalation, excretion in body water, and its short half-life. The biological properties of tritium are discussed in Appendix C.

According to an IAEA publication (IAEA 1992), a dose rate of 100 millirem per year to the maximally exposed human will lead to dose rates to plants and animals of less than 0.1 rad per day. The IAEA concluded that a dose rate of 0.1 rad per day or less for animals and 1 rad per day or less for plants would not affect these populations. Doses to the public and workers from potential releases at Sequoyah 1 have been estimated and are presented in Section 5.2.2.9. Tritium production could increase the annual dose to the maximally exposed individual of the public from 0.053 millirem per year (No Action) to approximately 0.11 millirem per year (3,400 TPBARs). This cumulative exposure rate is below the IAEA's benchmarks. Therefore, the increase in tritium releases due to tritium production would have no effect on plants and animals at the Sequoyah site. TVA has notified the U.S. Fish and Wildlife Service of DOE's proposed action at Sequoyah and has provided the States of Tennessee and South Carolina and the U.S. Fish and Wildlife Service with copies of the CLWR Draft EIS. Copies of the CLWR Final EIS also will be provided to these agencies. The U.S. Fish and Wildlife Service was consulted concerning the identification of threatened or endangered species that should be evaluated in this EIS (DOI 1998b). TVA evaluated those species and concluded that, since small increases in tritium releases in gaseous emissions and liquid effluents are the only operational differences for the Sequoyah plant, no threatened or endangered species should be affected.

In its response to the CLWR Draft EIS, the U.S. Fish and Wildlife Service concluded that adverse effects to listed species potentially occurring at the site from the proposed action are not anticipated (DOI 1998d). TVA and DOE will continue to comply with the requirements of the Endangered Species Act and interact with the U.S. Fish and Wildlife Service as appropriate. TVA is committed to conducting an environmental monitoring program during tritium production operations. Should the monitoring program indicate any adverse impacts to listed species, consultation with the U.S. Fish and Wildlife Service would be initiated immediately to address those impacts.

5.2.2.7 Archaeological and Historic Resources

No Action

No impacts on land use are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action. As a result, no impacts on historic and archaeological resources are expected.

Tritium Production

Since no additional land would be required for tritium production, there would be no impacts on archaeological and historic resources at the Sequoyah site. It should be noted that the Tennessee State Historic Preservation Office reviewed the CLWR Draft EIS for compliance with Section 106 of the National Historic Preservation Act and determined that tritium production at Sequoyah would have no effect upon properties listed or eligible for listing by the National Register of Historic Places (TN DEC 1998b). No construction would occur at the Sequoyah site unless a dry cask ISFSI were constructed. A description of a generic dry cask ISFSI and its impacts is presented in Section 5.2.6.

5.2.2.8 Socioeconomics

No Action

Under the No Action Alternative, no adverse socioeconomic impacts are expected in the region of influence of the Sequoyah plant beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

As Sequoyah 1 and 2 are operating facilities, only the socioeconomic impacts associated with incremental tritium-related changes to plant operations have been considered. The primary costs to operate a CLWR for tritium production could relate to operations and maintenance, supplemental fuel procurement or fuel enrichment, storage of additional spent fuel, replacement power, capital upgrades or replacements, and fees to the utility. Of these costs, only operations and maintenance would have the potential for material socioeconomic impacts within the region of influence. All the other expenses would relate to nonplant functions that generate corporate income, though not local income (e.g., fees from DOE) or procurements (e.g., potential spent fuel storage casks, fuel elements, TPBARs) in other parts of the country. Small regional costs (e.g., potential maintenance of the spent fuel storage casks) would have no measurable socioeconomic impacts.

Operation of Sequoyah 1 or Sequoyah 2 for tritium production should require less than 10 full-time equivalent workers per unit in addition to normal plant operations staff. The addition of 10 full-time equivalent workers to a normal operations staff would increase local socioeconomic factors such as income, housing requirements, and indirect employment by about 1 percent compared to normal plant operations for power production. Regional income would increase by slightly more than $1 million per year.

The potential increase in spent fuel storage requirements resulting from tritium production would involve some additional costs, but the overall socioeconomic impacts would be small. These requirements would be met via dry cask storage (see Section 5.2.6), using casks procured from outside the region. Annual costs for activities such as additional fuel transfers, spent fuel storage cask maintenance, spent fuel cask pad expansion, and the transfer of spent fuel to shipping casks would be a maximum of $2 million.

Life extension of Sequoyah 1 and 2 as a result of tritium production (see Section 5.2.4) would have substantial regional socioeconomic benefits. An extension of normal plant operations would allow regional earnings to continue at about $100 million per year.

The transportation impacts associated with tritium production would be minimal and would be limited to commuter traffic by the personnel assigned to the site. The impact of 50 additional construction workers and associated construction vehicles, assuming potential construction of the dry cask ISFSI, would be temporary and minor. The traffic impact from 10 to 20 additional tritium production operations workers commuting to and from the plant would not be noticeable. Additional truck traffic during tritium operations would include a total of 16 shipments of TPBARs to and from the plant per year.

5.2.2.9 Public and Occupational Health and Safety

This section describes the impacts of radiological and hazardous chemical releases resulting from normal operation, abnormal conditions, and accidents due to tritium production at Sequoyah 1 or Sequoyah 2.

5.2.2.9.1 Normal Operations

RADIOLOGICAL IMPACTS

During normal operation, there would be incremental radiological releases of tritium to the environment, as well as additional in-plant exposures. The resulting dose and potential health effects on the general public and workers are described below. There would be no new construction of facilities to support tritium production operations at the Sequoyah plant site; therefore, there would be no associated impacts on the public or workers.

The annual increase in gaseous radioactive emissions and liquid radioactive effluents from the production of tritium at Sequoyah 1 or Sequoyah 2 are presented in Sections 5.2.2.3 and 5.2.2.4, respectively. The radiological impacts of both gaseous and liquid radioactive releases are presented in **Table 5–14** for the maximally exposed offsite individual and the general public living within 80 kilometers (50 miles) of Sequoyah 1 or Sequoyah 2 in the year 2025. **Table 5–15** reflects the radiological impacts on the facility workers. A facility worker is defined as any "monitored" reactor plant employee. Doses to these workers would be kept to minimal levels through programs to ensure worker doses are as low as reasonably achievable. The tables also include the impacts of the No Action Alternative.

Background information on the effects of radiation on human health and safety is included in Appendix C. The method and assumptions used in calculating the impacts on public health and safety at Sequoyah 1 or Sequoyah 2 are presented in Appendix C, Section C.3.

Table 5–14 Annual Radiological Impacts to the Public from Incident-Free Tritium Production Operations at Sequoyah 1 or Sequoyah 2

Tritium Production	Release Media	*Maximally Exposed Offsite Individual*		*Population Within 80 kilometers (50 miles) for the Year 2025*	
		Dose (millirem)	*Latent Fatal Cancer Risk*	*Annual Dose (person-rem)*	*Latent Fatal Cancers*
No Action [a] (0 TPBARs)	Air	0.031	1.6×10^{-8}	0.49	0.00025
	Liquid	0.022	1.1×10^{-8}	1.1	0.00055
	Total	0.053	2.7×10^{-8}	1.6	0.00080
Incremental dose for 1,000 TPBARs	Air	0.015	7.5×10^{-9}	0.16	0.000080
	Liquid	0.0016	8.0×10^{-10}	0.41	0.00021

Tritium Production	*Release Media*	*Maximally Exposed Offsite Individual*		*Population Within 80 kilometers (50 miles) for the Year 2025*	
		Dose (millirem)	*Latent Fatal Cancer Risk*	*Annual Dose (person-rem)*	*Latent Fatal Cancers*
Total dose for 1,000 TPBARs	Air	0.046	2.3×10^{-8}	0.65	0.00033
	Liquid	0.024	1.2×10^{-8}	1.5	0.00075
	Total	0.070	3.5×10^{-8}	2.2	0.0011
Incremental dose for 3,400 TPBARs	Air	0.052	2.6×10^{-8}	0.54	0.00027
	Liquid	0.0054	2.7×10^{-9}	1.4	0.00070
Total dose for 3,400 TPBARs	Air	0.083	4.2×10^{-8}	1.0	0.00050
	Liquid	0.027	1.4×10^{-8}	2.5	0.0013
	Total	0.11	5.6×10^{-8}	3.5	0.0018

[a] Doses based on actual measurements during plant operation in 1997 adjusted to reflect population growth to the year 2025.

Table 5–15 Annual Radiological Impacts to Workers from Incident-Free Tritium Production Operations at Sequoyah 1 or Sequoyah 2

Impact	*No Action*	*1,000 TPBARs*	*Total With 1,000 TPBARs*	*3,400 TPBARs*	*Total With 3,400 TPBARs*
Average worker dose (millirem)[a]	90	0.24	90.24	0.82	90.82
Latent fatal cancer risk	3.6×10^{-5}	9.6×10^{-8}	3.6×10^{-5}	3.3×10^{-7}	3.6×10^{-5}
Total worker dose (person-rem)	132	0.35	132.35	1.2	133.2
Latent fatal cancers	0.053	0.00014	0.053	0.00048	0.053

[a] Based on 1,470 badged workers per unit for a total of 2,940 badged workers for the site.
Source: NRC 1997b, TVA 1998d.

No Action

Under the No Action Alternative, the health and safety risk of members of the public and facility workers at Sequoyah 1 or Sequoyah 2, assuming that the operating conditions did not change from those expected, would remain at the levels presented in Section 4.2.2.9. As shown in Tables 5–14 and 5–15:

- The annual dose to the maximally exposed offsite individual would remain at 0.053 millirem per year, with an associated 2.7×10^{-8} risk of a latent cancer fatality per year of operation.
- The collective dose to the population within 80 kilometers (50 miles) of Sequoyah 1 or Sequoyah 2 would remain at 1.6 person-rem per year, with an associated 0.00080 latent cancer fatality per year of operation.
- The collective dose to the facility workers would remain at 132 person-rem per year, with an associated 0.053 latent cancer fatality per year of operation.

Tritium Production

In the tritium production mode, the health and safety risk of the public and facility workers would increase due to the estimated releases of tritium in gaseous emissions and liquid effluents. As shown in Tables 5–14 and 5–15 for 3,400 TPBARs in the reactor core:

- The annual dose to the maximally exposed offsite individual would be 0.11 millirem per year, with an associated 5.6×10^{-8} risk of a latent cancer fatality per year of operation. This dose is 0.44 percent of the annual total dose limit of 25 millirem set by regulations in 40 CFR 190.

- The collective dose to the population within 50 miles of Sequoyah 1 or Sequoyah 2 would be 3.5 person-rem per year, with an associated 0.0018 latent cancer fatality per year of operation.

- The collective dose to the facility workers would be 133.2 person-rem per year, with an associated 0.053 latent cancer fatality per year of operation.

In addition to the assumed normal operation release of tritium through permeation, an additional potential release scenario considered in this EIS is the failure of 1 or more TPBARs, such that the inventory of the TPBARs is released to the primary coolant. The occurrence of TPBAR failure is considered to be beyond that associated with normal operating conditions and, as discussed in Section 1.9, such an assumption is extremely conservative. The radiological consequences to the public and workers resulting from the assumption of 2 TPBAR failures in a given core load of 3,400 TPBARs at Sequoyah 1 or Sequoyah 2 are presented in **Tables 5-16** and **5-17**. Releases, doses, and cancer risks associated with 1 TPBAR failure can be determined by dividing the values in Tables 5-16 and 5-17 by two.

Table 5–16 Radiological Impacts to the Public from the Failure of 2 TPBARs at Sequoyah 1 or 2

Release Pathway	*Release Quantity (Curies)*	*Dose to Maximally Exposed Individual (millirem)*	*Latent Fatal Cancer Risk*	*Dose to Population Within 80 kilometers (50 miles) (person-rem)*	*Latent Fatal Cancers*
Air	2,315	0.36	1.8×10^{-7}	3.7	0.0018
Liquid	20,835	0.037	1.9×10^{-8}	9.2	0.0046

Table 5–17 Radiological Impacts to Workers from the Failure of 2 TPBARs at Sequoyah 1 or Sequoyah 2

Impact Type	*Impact Quantity*
Average Worker Dose (millirem)[a]	5.6
Latent Fatal Cancer Risk	2.2×10^{-6}
Total Worker Dose (person-rem)	8.2
Latent Fatal Cancers	0.0033

[a] Based on 1,470 badged workers per unit.
Source: NRC 1997b, TVA 1998d.

HAZARDOUS CHEMICAL IMPACTS

No Action

No impacts on public and occupational health and safety from exposure to hazardous chemicals are anticipated at Sequoyah beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Tritium production would introduce no additional operations at the plant that would require the use of hazardous chemicals.

5.2.2.9.2 Facility Accidents

RADIOLOGICAL IMPACTS

The accident set selected for evaluation of the impacts of the No Action Alternative and tritium production are described in Section 5.1 and discussed in detail in Appendix D, Section D.1. The consequences of the reactor and nonreactor design-basis accidents for the No Action Alternative at the Sequoyah plant (0 TPBARs) and for maximum tritium production (3,400 TPBARs) were estimated using the NRC-based deterministic approach presented in the *Sequoyah Nuclear Plant Final Safety Analysis Report* (TVA 1996b). The receptors were an individual at the reactor site exclusion area boundary and an individual at the reactor site low-population zone. The margin of safety for site dose criteria associated with the same accidents and the same receptors are presented in **Table 5–18.** Data presented for the No Action Alternative were extracted directly from the *Sequoyah Nuclear Plant Final Safety Analysis Report*. As indicated in Table 5–18, the irradiation of TPBARs at the Sequoyah plant would result in a very small increase in design-basis accident consequences and thus, a reduction in the consequence margin. The accident consequences would be dominated by the effects of the nuclide releases inherent to the No Action Alternative.

Table 5–18 Design-Basis Accident Consequence Margin to Site Dose Criteria at Sequoyah 1 or Sequoyah 2

Accident	Tritium Production	Dose Description [a]	Site Dose Criteria (rem) [b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%) [c]	Dose (rem)	Margin (%) [c]
Reactor design-basis accident	0 TPBARs (No Action)[d]	Thyroid inhalation dose	300	145	51.6	27	91.0
		Beta + gamma whole body dose	25	12.2	51.1	2.9	88.4
	3,400 TPBARs	Thyroid inhalation dose	300	145	51.6	27	91.0
		Beta + gamma whole body dose	25	12.2	51.1	2.9	88.4
Nonreactor design-basis accident	0 TPBARs (No Action)[d]	Thyroid inhalation dose	300	0.000013	100	1.1×10^{-6}	100
		Beta + gamma whole body dose	25	0.0017	99.993	0.00014	99.999
	3,400 TPBARs	Thyroid inhalation dose	300	0.019	99.994	0.0022	99.999
		Beta + gamma whole body dose	25	0.0028	99.989	0.00027	99.998

[a] Dose is the total dose from the reactor plus the contribution from the TPBARs.
[b] 10 CFR 100.11.
[c] Margin below the site dose criteria.
[d] TVA 1996b.

Table 5–19 presents the incremental risks due to tritium production for the postulated set of design-basis and handling accidents and the total risks from beyond design-basis accidents to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, and a noninvolved worker at the site boundary 556 meters (0.35 miles) from the release point. Accident consequences for the same receptors are summarized in **Table 5–20**. The assessment of dose and the associated cancer risk to the noninvolved worker are not applicable for beyond design-basis accidents. A site emergency would have been declared early in the beyond design-basis accident sequence; all nonessential site personnel would have evacuated the site in accordance with site emergency procedures before any radiological release to the environment. In accordance with emergency action guidelines, evacuation of the public within 16.1 kilometers (10 miles) of the plant would have been initiated.

Table 5–19 Annual Accident Risks at Sequoyah 1 or Sequoyah 2

Accident	*Tritium Production*	*Maximally Exposed Offsite Individual* [a]	*Average Individual in Population to 80 kilometers (50 miles)* [a]	*Noninvolved Worker* [a]
Design-Basis Accidents				
Reactor design-basis accident [b]	1,000 TPBARs	1.9×10^{-10}	2.2×10^{-12}	6.4×10^{-13}
	3,400 TPBARs	6.6×10^{-10}	7.6×10^{-12}	2.2×10^{-12}
Nonreactor design-basis accident [b]	1,000 TPBARs	7.9×10^{-9}	6.1×10^{-10}	1.3×10^{-10}
	3,400 TPBARs	2.7×10^{-8}	2.1×10^{-9}	4.5×10^{-10}
Sum of design-basis accident risks	1,000 TPBARs	8.1×10^{-9}	6.1×10^{-10}	1.3×10^{-10}
	3,400 TPBARs	2.8×10^{-8}	2.1×10^{-9}	4.5×10^{-10}
Handling Accidents				
TPBAR handling accident	1,000 TPBARs	3.1×10^{-8}	2.6×10^{-10}	9.5×10^{-10}
	3,400 TPBARs	1.0×10^{-7}	8.7×10^{-10}	3.2×10^{-9}
Truck cask handling accident	1,000 TPBARs	2.5×10^{-13}	2.0×10^{-15}	7.4×10^{-15}
	3,400 TPBARs	7.5×10^{-13}	6.1×10^{-15}	2.2×10^{-14}
Rail cask handling accident	1,000 TPBARs	1.3×10^{-13}	1.0×10^{-15}	3.8×10^{-15}
	3,400 TPBARs	3.8×10^{-13}	3.0×10^{-15}	1.1×10^{-14}
Sum of handling risks	1,000 TPBARs	3.1×10^{-8}	2.6×10^{-10}	9.5×10^{-10}
	3,400 TPBARs	1.0×10^{-7}	8.7×10^{-10}	3.2×10^{-9}
Beyond Design-Basis Accidents (Severe Reactor Accidents)				
Reactor core damage accident with early containment failure	0 TPBARs (No Action)	1.7×10^{-8}	1.6×10^{-10}	Not applicable
	3,400 TPBARs	1.7×10^{-8}	1.6×10^{-10}	Not applicable
Reactor core damage accident with containment bypass	0 TPBARs (No Action)	2.1×10^{-8}	1.4×10^{-9}	Not applicable
	3,400 TPBARs	2.1×10^{-8}	1.5×10^{-9}	Not applicable
Reactor core damage accident with late containment failure	0 TPBARs (No Action)	3.9×10^{-9}	2.4×10^{-10}	Not applicable
	3,400 TPBARs	4.0×10^{-9}	2.5×10^{-10}	Not applicable
Sum of severe reactor accident risks	0 TPBARs (No Action)	4.2×10^{-8}	1.4×10^{-9}	Not applicable
	3,400 TPBARs	4.2×10^{-8}	1.5×10^{-9}	Not applicable

[a] Increased likelihood of cancer fatality per year.
[b] Design-basis accident risks only reflect the incremental increase in accident risk due to the production of tritium in TPBARs.

Table 5–20 Accident Frequencies and Consequences at Sequoyah 1 or Sequoyah 2

Accident	Accident Frequency (per year)	Tritium Production	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
			Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Design-Basis Accidents								
Reactor design-basis accident [b]	0.0002	1,000 TPBARs	0.0019	9.5×10^{-7}	0.000022	1.1×10^{-8}	8.1×10^{-6}	3.2×10^{-9}
		3,400 TPBARs	0.0065	3.3×10^{-6}	0.000075	3.8×10^{-8}	0.000028	1.1×10^{-8}
Nonreactor design-basis accident [b]	0.01	1,000 TPBARs	0.0016	7.9×10^{-7}	0.00012	6.1×10^{-8}	0.000032	1.3×10^{-8}
		3,400 TPBARs	0.0054	2.7×10^{-6}	0.00042	2.1×10^{-7}	0.00011	4.5×10^{-8}
Handling Accidents								
TPBAR handling accident	0.0017/ 0.0058[c]	All TPBAR Configurations	0.036	0.000018	0.00029	1.5×10^{-7}	0.0014	5.6×10^{-7}
Truck cask handling accident	5.3×10^{-7}/ 1.6×10^{-6} [c]	All TPBAR Configurations	0.00093	4.7×10^{-7}	7.5×10^{-6}	3.8×10^{-9}	0.000036	1.4×10^{-8}
Rail cask handling accident	2.7×10^{-7}/ 6.0×10^{-7} [c]	All TPBAR Configurations	0.00093	4.7×10^{-7}	7.5×10^{-6}	3.8×10^{-9}	0.000036	1.4×10^{-8}
Beyond Design-Basis Accidents (Severe Reactor Accidents)								
Reactor core damage with early containment failure	6.8×10^{-7}	0 TPBARs (No Action)	25.0 [d]	0.025 [d]	0.48	0.00024	N/A	N/A
		3,400 TPBARs	25.1 [d]	0.025 [d]	0.48	0.00024	N/A	N/A
Reactor core damage with containment bypass	4.0×10^{-6}	0 TPBARs (No Action)	10.4	0.0052	0.72	0.00036	N/A	N/A
		3,400 TPBARs	10.4	0.0052	0.73	0.00037	N/A	N/A
Reactor core damage with late containment failure	9.2×10^{-6}	0 TPBARs (No Action)	0.84	0.00042	0.051	0.000026	N/A	N/A
		3,400 TPBARs	0.87	0.00044	0.053	0.000027	N/A	N/A

N/A = Not applicable.
[a] Increased likelihood of cancer fatality.
[b] Design-basis accident consequences only reflect the incremental increase in accident consequences due to the production of tritium in TPBARs.
[c] Frequency for 1,000 TPBARs/frequency for 3,400 TBPARs.
[d] Dose greater than 20 rem. Cancer fatality risk doubled.

Presented in Tables 5–19 and 5–20 are calculations of both risks and consequences of the No Action Alternative (0 TPBARs) and maximum tritium production (3,400 TPBARs) for severe reactor accidents. The tritium release is governed by the nature of the core melt accident scenarios analyzed; the accident risks and consequences are governed by actions taken in accordance with the EPA Protective Action Guidelines (e.g., evacuation of the public, interdiction of the food and water supply, condemnation of farmland and public property) in response to the postulated core melt accident with containment failure or containment bypass.

The severity of the reactor accident dominates the consequences, is the basis for implementation of protective actions, and is independent of the number of TPBARs. The accident risk is the product of the accident probability (i.e, accident frequency) times the accident consequences. In this EIS, risk is expressed as the increased likelihood of cancer fatality per year for an individual (i.e., the maximally exposed offsite individual, an average individual in the population within 80 kilometers [50 miles] of the reactor site, or a noninvolved worker). Table 5–19 indicates that the risks associated with tritium production are low. The highest risk to each individual—the maximally exposed offsite individual, one fatality every 37 million years (2.7×10^{-8} per year); an average member of the public, one fatality every 480 million years (2.1×10^{-9} per year); the exposed population, one fatality every 1.9 thousand years (0.00052 per year); and a noninvolved worker, one fatality every 2.2 billion years (4.5×10^{-10} per year)—is from the nonreactor design-basis accident.

The nonreactor design-basis accident has the highest consequence of the design-basis and handling accidents because the postulated accident scenario entails an acute release of tritium, in oxide form, directly to the environment without any mitigation. Review of Table 5–20 indicates that there would be a very small increase of severe reactor accident consequences due to the irradiation of TPBARs at the Sequoyah plant. The accident consequences are dominated by the effects of the radionuclide releases inherent to the No Action Alternative. The secondary impacts of severe reactor accidents are presented in Section 5.2.13.

HAZARDOUS CHEMICAL IMPACTS

No Action

No impacts on public and occupational health and safety from exposure to hazardous chemicals are anticipated at the Sequoyah site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Tritium production would introduce no additional operations at the plant that would require the use of hazardous chemicals.

5.2.2.10 Environmental Justice

As discussed in Appendix G, Executive Order 12898 directs Federal agencies to address disproportionately high and adverse health or environmental effects of alternatives on minority and low-income populations. The Executive Order does not alter prevailing statutory interpretations under NEPA or existing case law. Regulations prepared by the Council on Environmental Quality remain the foundation for the preparation of environmental documentation in compliance with NEPA (40 CFR, 1500 through 1508). As discussed previously, the alternatives would have no adverse or beneficial environmental effects on the general population, nor would they have any effects on any particular group within the general population, including minority and low-income populations.

No Action

Under the No Action Alternative, there would be no impacts on the general population. Therefore, no disproportionately high and adverse consequences for minority and low-income populations are expected beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Analyses of incident-free operations and accidents show the risk of latent cancer fatalities among the public residing within 80 kilometers (50 miles) of the reactor site to be much less than 1. Because tritium production would not have high and adverse consequences for the population at large, no minority or low-income populations would be expected to experience disproportionately high and adverse consequences.

5.2.2.11 Waste Management

No Action

Under the No Action Alternative, waste generation at Sequoyah 1 or Sequoyah 2 should continue at the levels described in Section 4.2.2.10. Provisions for the management of these wastes would continue unchanged.

Tritium Production

No additional hazardous waste, nonhazardous solid waste, or sanitary liquid waste should be generated at Sequoyah 1 or Sequoyah 2 as a result of tritium production. Management of these wastes would continue as described in Section 4.2.2.10. However, it is expected that an additional 0.43 cubic meters per year (15 cubic feet per year) of low-level radioactive waste would be generated as a result of tritium production (WEC 1999). It would consist of the approximately 140 base plates and other irradiated hardware remaining after the TPBARs were separated from their assemblies to be placed in the 17 × 17 array consolidation baskets at the reactor site.

Similar to the quantities of low-level radioactive waste generated as a result of activities independent of this action, the additional low-level radioactive waste generated as a result of tritium production (with the exception of the base plates and associated hardware) would be shipped to a commercial processor where it would be compacted to a lesser volume and shipped to the Barnwell, South Carolina, low-level radioactive waste disposal facility. The base plates and associated hardware would accumulate until a sufficient amount were on hand to ship directly to Barnwell for disposal. The additional low-level radioactive waste of 0.43 cubic meters (15 cubic feet) represents less than 0.1 percent of the total low-level radioactive waste generated currently at Sequoyah 1 or Sequoyah 2.

For completeness, this EIS also analyzes the management of the additional volume of low-level radioactive waste (0.43 cubic meters [15 cubic feet]) generated as a result of tritium production at DOE-owned facilities at the Savannah River Site. Under this scenario, the additional low-level radioactive waste could be transported to the Low-Level Radioactive Waste Disposal Facility at the Savannah River Site near Aiken, South Carolina. The facility consists of a series of vaults in E-Area that have been operational since September 1994. The operating capacity of each vault is 30,500 cubic meters of low-level radioactive waste (DOE 1998c, DOE 1999b). Therefore, the addition of low-level radioactive waste from the proposed action at Sequoyah 1 or Sequoyah 2 for a 40-year period would be approximately 0.06 percent of the capacity of a single vault.

5.2.2.12 Spent Fuel Management

Production of tritium at Sequoyah 1 or Sequoyah 2 would not increase the generation of spent nuclear fuel if less than approximately 2,000 TPBARs were irradiated in a fuel cycle. For the irradiation of the maximum number of 3,400 TPBARs, up to 140 spent nuclear fuel assemblies could be generated. This represents up to 60 additional spent nuclear fuel assemblies beyond the normal refueling batch of 80 assemblies. For the purposes of this EIS it is assumed that the additional spent nuclear fuel would be stored on site for the duration of the proposed action. If needed, a dry cask ISFSI would be constructed at the site. Environmental impacts of the construction and operation of a generic dry cask ISFSI are presented in Section 5.2.6.

5.2.3 Bellefonte Nuclear Plant Units 1 and 2

5.2.3.1 Land Resources

The land resources analysis addresses land use and visual resources for the region of influence. The region of influence for land use includes land within 3.2 kilometers (2 miles) of the site. The region of influence for visual resources includes those lands from which the Bellefonte Nuclear Plant is visible (the viewshed). The land use impacts of tritium production are compared with the existing land use patterns. Visual resource impacts are associated with changes in the existing landscape character that could result from tritium production.

LAND USE

No Action

No land use impacts are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

The land use analysis considers the magnitude and extent of potential impacts on current land use patterns and densities that are attributable to the alternative. The amount of land disturbed during construction and used during operation is identified, as are the potential changes in land use and conflicts with land use policies, plans, and controls.

Construction

The 607-hectare (1,500-acre) site contains ample existing construction laydown areas that are conveniently located near large warehouse storage buildings and yard storage areas. Land disturbance would be limited to that required for new support buildings. Completing construction of Bellefonte 1 alone or both Bellefonte 1 and 2 would require land already disturbed during previous construction at the site. There would be no impacts on undisturbed grassland and forest land. Completing construction should not impact the ability to continue hay production on areas of the site. The total land disturbed is discussed in Section 4.2.3.1. Land use would remain unchanged from its current industrial and agricultural uses.

An electric power distribution system exists to adequately support the power demands of plant equipment, construction shops, and employee facilities. No additional land area would be required for furnishing utilities to the site. Utility distribution systems are in place and occupy sufficient land area to accommodate any required additions or enhancements.

Based on the evaluation of land use impacts for the Bellefonte Conversion Project (for completion of Bellefonte 1 or both Bellefonte 1 and 2) there would be a small increase in the amount of land used for residential development and mobile homes to accommodate construction workers. The overall impact, however, should be very small (TVA 1997f).

Operation

Operation of Bellefonte 1 or both Bellefonte 1 and 2 would require no additional undisturbed land on the site other than that described for construction.

Based on the evaluation of the land use impacts for the Bellefonte Conversion Project (TVA 1997f) and the projected operations employment at Bellefonte 1 or both units, the anticipated population increase in Jackson County from operation of the Bellefonte Nuclear Plant would result in an increased demand for new housing units, as discussed in Section 5.2.3.8. According to the latest population estimates by the U.S. Census Bureau, Jackson County has averaged an increase of about 391 persons per year since the 1990 Census of Population was taken. The population increase resulting from completion and operation of the Bellefonte plant would noticeably exceed normal growth. Therefore, an increased demand for housing would increase the amount of land needed for residential development, but this would not be an important impact in the context of the county land base.

VISUAL RESOURCES

The visual resources analysis addresses the magnitude and extent of potential changes in the visual environment that could result from tritium production. Visual resources impact assessments are conducted using the Bureau of Land Management Visual Resource Management method (DOI 1986a). The existing landscape at a site is assigned a classification ranging from 1 to 4. The existing landscape at the Bellefonte site would be Class 3 or 4. Class 3 includes areas in which there have been moderate changes in the landscape that could attract attention, but do not dominate the view of the casual observer. Class 4 includes areas in which major modifications to the character of the landscape have occurred. These changes may be dominant features of the view and the major focus of viewer attention (DOI 1986b).

Class designations are derived from an inventory of the scenic quality, sensitivity levels, and distance zones of a particular area. The elements of scenic quality are landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modification. Scenic value is determined by the variety and harmonious composition of the elements of scenic quality. Sensitivity levels are determined by user volumes and user attention. Distance zones concern the relative visibility from travel routes or observation points. They include the following categories: foreground–middleground, less than 4.8 to 8 kilometers (3 to 5 miles) away; background, 4.8 to 24 kilometers (3 to 15 miles); and seldom seen, 24 kilometers (15 miles) to infinity and areas blocked or screened from view. The analysis objectives include identification of the degree of contrast between the proposed action and the existing landscape, the location and sensitivity levels of viewpoints accessible to the public, and the visibility of the proposed action from the viewpoints. The distance from a viewpoint to the affected area and the atmospheric conditions also are taken into consideration because distance and haze can diminish the degree of contrast and visibility (DOI 1986a, DOI 1986b, DOE 1996c).

No Action

No visual impacts are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Construction

Little physical change would be required to the parts of the Bellefonte Nuclear Plant that are visible to the public. The major visual elements of the plant, the two hyperbolic cooling towers and the transmission lines, already exist. As discussed in Section 4.2.3.1, views of Bellefonte from passing river traffic on the Tennessee River are partially screened by the ridge lines close to the shoreline. The plant is overlooked by a few residences on Sand Mountain on the east side of the river. Distant glimpses of the plant site can be had from the coves and hollows along the Sand Mountain rim, from State Roads 35 and 40 as they traverse Sand Mountain, and from Comer Bridge, which crosses Guntersville Reservoir (TVA 1997f). The plant also can be seen from various locations along U.S. Highway 72 to the northwest and from residences on the north shore of Town Creek Embayment. Completion of construction would result in little or no visual change from offsite viewpoints.

Operation

During operation, additional visual impacts would result from the vapor plume associated with the 145-meter (477-foot) cooling towers; one would be operating with Bellefonte 1, and two would be operating with the combination of Bellefonte 1 and 2. The plume would be visible up to 16 kilometers (10 miles) away. The plume would vary with atmospheric conditions, being most visible during cooler months and after the passage of weather fronts. Plumes would be less visible during summer months when hazy conditions persist and morning fog is more common. Since the reactor site represents an existing condition that would be classified as Visual Resource Management Class 4, contrasts created by minor changes at the plant site and the cooling tower plume are considered to be moderate to none; that is, there would be no visual impact when there is no plume (TVA 1974b, TVA 1997f). Vapor plumes would have an aesthetic impact on the towns of Pisgah, Hollywood, and Scottsboro, as well as on traffic along U.S. Highway 72 (TVA 1974b).

5.2.3.2 Noise

Sound results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. The propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities (e.g., hearing, sleep), damage hearing, or diminish the quality of the environment (i.e., cause annoyance).

Sound-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated for by an A-weighting scale that accounts for the hearing response characteristics (i.e., frequency) of the human ear. Sound levels are expressed in decibels (dB) or, in the case of A-weighted measurements, decibels A-weighted (dBA). The most common measure of environmental noise impact is the day-night average sound level, a 24-hour, A-weighted equivalent sound level with a 10-dBA penalty added to sound levels between 10:00 p.m. and 7:00 a.m to account for increased annoyance due to noise during nighttime hours. The EPA has developed noise-level guidelines for different land use classifications that are based on the day-night average and equivalent sound levels. The U.S. Department of Housing and Urban Development has established noise impact guidelines for residential areas that are based on day-night average sound levels. Some states and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land use category. The State of Alabama has not developed a noise regulation that specifies acceptable numerical community noise levels.

For the purpose of this document, noise impacts are assessed using a day-night average sound level of 65 dBA as the level above which noise impacts would be considered “significant impacts” and an increase of 2 dBA as an indicator of “substantial” increases in noise. This approach is based on the TVA noise analysis for the Bellefonte Conversion Project (TVA 1997f). Short-term noises above a level of about 75 dBA, such as steam releases, could have a “startle” effect on humans and wildlife (TVA 1997f).

The noise analysis conducted by TVA for the conversion project considered the nearest fence line receptor as representative of a future residential land use or other use, as well as the nearest existing residential area (across Town Creek), the nearest ecologically sensitive area (a heron rookery near the confluence of Town Creek and the Tennessee River), and a location on the high bluffs on Sand Mountain across the Tennessee River from the site. Measured sound levels near the boundaries of the site range from a day-night average sound level of 50 dBA to 55 dBA. For the purpose of the analysis, a background day-night average sound level of 50 dBA was used. This level is typical of a low-density residential or rural location (TVA 1997f).

No Action

No noise impacts are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Construction

The location of the Bellefonte facilities relative to the Bellefonte site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include materials-handling equipment (e.g., cranes and forklifts), employee vehicles, and truck traffic. Traffic noise associated with construction of these facilities would occur both on site and along offsite local and regional transportation routes used to bring construction materials and workers to the site.

The Bellefonte Conversion Project noise analysis was based on a composite of construction noise. This composite included excavation and structure erection activities, with all activities occurring during daylight hours between 7 a.m. and 5 p.m. Noise impacts from these construction activities would depend on the equipment used, the noise levels from individual equipment items, the number of sources, the duration and frequency of operation, the time of day, and other factors. Most of the activities associated with completion of Bellefonte 1 or both Bellefonte 1 and 2 would be indoors. Activities occurring outdoors would not be expected to produce the high levels of noise that were analyzed for the Bellefonte Conversion Project. The analysis indicated that the daytime equivalent sound levels would not increase at the two more distant sensitive receptors evaluated, the heron rookery and Sand Mountain. At the fence line receptor and the nearest residential area, the daytime equivalent sound levels would increase less than 1 dBA. Regular sounding of the shift change whistle would be heard at the fence line receptor and at the nearest residence.

Table 5–21 presents a range of noise levels for the major construction equipment expected to be used during construction activities for Bellefonte 1 or both Bellefonte 1 and 2. In addition, a variety of other noise-producing equipment would be used, including pumps, generators, compressors, pneumatic wrenches, vibrators, saws, hand compactors, concrete mixers, concrete pumps, pavers, and compactors. These items are typically somewhat quieter than the items shown in the table.

Table 5–21 General Construction Equipment Noise Levels

Activity	*Item*	*Maximum Noise Level (dBA) at 15 meters (50 feet)*
Earthmoving:	Front-end loaders	82–86
	Backhoes	81–84
	Tractors	82–86
	Scrapers, graders	86–91
	Trucks	81–87
	Dozers	81–90
Materials handling:	Concrete trucks	81–87
	Cranes (movable)	80–85
	Cranes (derrick)	82–86
	Fork-lift trucks	82–86
	Delivery trucks	81–87
Impact equipment:	Jack hammers, rock drills	83–99
	Pile drivers	81–96

Source: BBN 1977, TVA 1998a.

Noise from traffic associated with construction of these facilities should result in a less than 1 dBA increase in day-night average sound level from traffic along U.S. Highway 72 near the Bellefonte plant entrance. This noise level should not result in any increased annoyance of the public. Peak-hour construction traffic noise at the beginning and end of the workday would result in about a 2 dBA increase in traffic noise levels (1-hour equivalent sound level) along U.S. Highway 72 from about 65 dBA at 30 meters (100 feet) to about 67 dBA.

Traffic noise levels along the access road, which has been fairly quiet since construction of Bellefonte was deferred, would increase to a day-night average sound level of about 55 dBA during construction. Much of the traffic during the construction period would be at the beginning and end of the work day. Peak-hour traffic noise would increase by about 12 dBA along the access road. Traffic noise during the peak hours should be noticeable at the nearby residences.

Operation

The location of Bellefonte 1 and 2 relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operation would include cooling towers; heating, ventilation, and air conditioning systems; vents; motors; pumps; transformers; switchyard equipment; generators; material-handling equipment; audible paging systems; sirens; employee vehicles; and truck traffic. Traffic noise associated with operation of these facilities would occur both on site and along offsite local and regional transportation routes used to bring materials and workers to the site. Operational noise sources would be primarily in the center of the site near the switchyard, turbine building, and cooling towers. Modeling of routine onsite noise sources associated with the operation of Bellefonte 1 or both Bellefonte 1 and 2 indicates that day-night average sound levels would increase to about 51 dBA at the site boundary receptor and at the nearest residence receptor. Day-night average sound levels at the other two receptors considered, the heron rookery and Sand Mountain, would not change from the 50-dBA background level. The routine noise should have no impact (less than 2 dBA) on the nearby residential areas. Other noise sources such as the infrequent actuation of the modulating atmospheric dump valves would result in higher noise levels at the site boundary and could disturb wildlife on the site. Noise from traffic associated with the operation of Bellefonte 1 or both Bellefonte 1 and 2 should result in an increase of less than 4 dBA in the day-night average sound level along U.S. Highway 72, and could be noticeable at nearby residences. Peak-hour operations traffic noise at shift changes would result in an increase in traffic noise levels along U.S. Highway 72 from about 65 dBA at 30 meters (100 feet) to about 67 dBA.

Traffic noise levels along the access road would increase to a day-night average sound level of about 57 dBA during operation. Peak-hour traffic would result in an increase in traffic noise levels along the access road from about 51 dBA at 30 meters (100 feet) to about 58 dBA. This increase in noise levels could be noticeable at nearby residences.

Regular testing of the emergency warning siren system would result in outdoor noise levels of about 60 dBC (C-weighted) in areas within a radius of about 16 kilometers (10 miles) of the site. At other nuclear plants TVA typically tests siren systems on a given day of the month at noon (TVA 1998a).

Noise exposure for workers is regulated under Occupational Safety and Health Administration regulations (29 CFR 1910.95). Where the 8-hour noise exposure guidelines would be exceeded, appropriate administrative and engineering controls would be implemented to control noise exposure, and a hearing protection program would be implemented.

5.2.3.3 Air Quality

NONRADIOACTIVE GASEOUS EMISSIONS

Air pollution refers to any substance in the air that could harm human or animal populations, vegetation, or structures, or that unreasonably interferes with the comfortable enjoyment of life and property. For the purpose of this document, only outdoor air pollutants are addressed. These may be in the form of solid particles, liquid droplets, gases, or any combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described in terms of a comparison of the concentrations of various pollutants in the atmosphere against the corresponding standards. Ambient air quality standards have been established by Federal and state agencies to ensure an adequate margin of safety for the protection of the public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy. Concentrations below the corresponding standards are considered acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air compounds. The criteria pollutants are those listed in 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards. The hazardous air pollutants and other toxic compounds are those listed in Title III of the 1990 Clean Air Act, as amended; those regulated by the National Emissions Standards for Hazardous Air Pollutants; and those that have been proposed or adopted for regulation by the state or are listed in state guidelines. Also of concern are air pollutant emissions that may contribute to the depletion of stratospheric ozone or to global warming.

An assessment of the impacts on air quality is based on a comparison of air pollutant concentrations with applicable Federal and state ambient air quality standards and concentration limits. The more stringent of either the EPA or state standards serve as the assessment criteria. The primary air pollutant emissions resulting from completing the construction of Bellefonte 1 and the operation of Bellefonte 1 or both Bellefonte 1 and 2 would consist largely of sulfur dioxide, nitrogen oxide compounds, particulate matter, and carbon monoxide, as shown in **Table 5–22**. The ambient standards for these pollutants are presented in **Table 5–23**. Compliance with the new standards for particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) was not evaluated because the currently available emission factors are for particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}).

No Action

No air quality impacts are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Construction

The potential air quality impacts of construction activities required to complete Bellefonte 1 or both Bellefonte 1 and 2 were evaluated. Since most of the activities such as earth-moving, excavation, and erection of major structures have been completed, the air pollution sources associated with unit completion would be similar to those associated with ongoing maintenance of the facilities and sources associated with completion of interior work and a few structures (e.g., piping systems). These include diesel generators, auxiliary boilers, employee vehicles, and trucks moving materials and wastes. Emissions from the currently operating generators and boilers are discussed in Section 4.2.3.3.

Air pollutant concentrations during construction should be similar to those for maintenance of the existing facilities, as discussed in Section 4.2.3.3, except for increased vehicular traffic; additional emissions from materials-handling equipment such as trucks, cranes, and forklifts; welding fumes; and emissions of cleaning solvents. Estimated emissions from these sources are presented in Table 5–22.

Table 5–22 Annual Nonradioactive Gaseous Emissions from Bellefonte 1 or Both Bellefonte 1 and 2 During Construction

	Emissions (kilograms per year)			
			Vehicles	
Pollutant	*Bellefonte 1 Equipment*	*Bellefonte 1 and Bellefonte 2 Equipment*	*Bellefonte 1*	*Bellefonte 1 and Bellefonte 2*
Carbon monoxide	20,800	24,700	57,800	87,300
Nitrogen dioxide	54,400	64,700	16,400	24,800
Particulate matter	4,220	5,000	57,300	86,700
Sulfur dioxide	6,110	7,160	0	0
Formaldehyde	6.34	6.34	0	0
Arsenic	0.0658	0.0658	0	0
Beryllium	0.0392	0.0392	0	0
Cadmium	0.172	0.172	0	0
Chromium	1.05	1.05	0	0
Lead	0.14	0.14	0	0
Manganese	0.219	0.219	0	0
Mercury	0.047	0.047	0	0
Nickel	2.66	2.66	0	0

Source: TVA 1995c, TVA 1998a.

The total amount of these emissions would be small and would result in minimal offsite impacts, as shown in Table 5–23. As described in Appendix B, the short-term version of the ISC3 model, ISCST3, was used to calculate concentrations with averaging times of 1 to 24 hours, as well as calendar quarter concentrations and annual average concentrations. Construction equipment and other associated emissions for each alternative were evaluated as a volume source using the ISC3 model. Although there would be finite increases in air pollutant concentrations from construction activities, they would not exceed the ambient air quality standards.

Concentrations of toxic air pollutants from the combustion of diesel fuel in the auxiliary boilers, diesel generators, and construction equipment were also evaluated. There are no Alabama State standards that specify acceptable ambient concentrations of toxic air pollutants. During the permitting process, Alabama compares 1-hour concentrations of toxic air pollutants to 1/40 of the applicable threshold limit value for a pollutant to assess whether the pollutant is of concern and should be evaluated in more detail. Offsite concentrations of all toxic pollutants evaluated for construction at Bellefonte would be below 1 percent of the applicable threshold limit value.

Table 5–23 Annual Air Pollutant Concentrations from Bellefonte 1 and 2 During Construction

Pollutant	*Averaging Period*	*Most Stringent Standard or Guidelines[a] (μg/m³)*	*Construction's Contribution (μg/m³)*	*Total Concentration[b] (μg/m³)*	*Percent of Standard or Guideline*
Carbon monoxide	8-hour 1-hour	10,000 40,000	211 846	4,350 6,370	44 16
Lead	Calendar Quarter 1-hour	1.5 3.75	0.00007 0.00275	0.0301 0.00275	2.0 0.22
Nitrogen dioxide	Annual	100	69.1	93.2	93
Ozone	8-hour (3-year average of annual 4th highest)	157	Not applicable	c	c
Particulate matter	PM_{10} Annual 24-hour	 50 150	 5.29 24.2	 29.3 70.2	 59 47
Sulfur dioxide	Annual 24-hour 3-hour	80 365 1,300	7.04 31.1 79.7	20.0 105 290	25 29 22
Formaldehyde	1-hour	9.25	0.126	0.126	1.4
Arsenic	1-hour	0.25	0.00130	0.00130	0.52
Beryllium	1-hour	0.05	0.000773	0.000773	1.5
Cadmium	1-hour	0.05	0.0034	0.0034	6.8
Chromium	1-hour	12.5	0.0207	0.0207	0.17
Manganese	1-hour	5.0	0.00432	0.00432	0.086
Mercury	1-hour	0.625	0.000928	0.000928	0.15
Nickel	1-hour	1.25	0.0526	0.0526	2.1

$\mu g/m^3$ = micrograms per cubic meter.
PM_n = Particulate matter less than or equal to *n* micrometers.
[a] The more stringent of the Federal and state standards are presented for the averaging time. For toxic air pollutants, a value of 1/40 of the applicable threshold limit value is used for comparison.
[b] Sum of the maximum ambient monitored concentration and the construction contribution.
[c] There is insufficient monitoring data to compare to the 8-hour standard for ozone.
Note: The National Ambient Air Quality Standards (40 CFR 50), other than those for particulate matter and those based on annual averages, are not to be exceeded more than once per year. The 1-hour ozone standard applies only to nonattainment areas. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 157 $\mu g/m^3$. The 24-hour particulate matter standard is attained when the expected number of days with a 24-hour average concentration above the standards is ≤ 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. EPA recently revised the ambient air quality standards for particulate matter. The new standards were finalized on July 18, 1997. The current PM_{10} annual standard was retained and two $PM_{2.5}$ (particulate matter less than or equal to 2.5 micrometers) standards were added. These standards were set at 15 $\mu g/m^3$ 3-year annual average arithmetic mean based on community-oriented monitors and 65 μg/cubic meters 3-year average of the 98th percentile of 24-hour concentrations at population-oriented monitors. The current 24-hour PM_{10} standard was revised to be based on the 99th percentile of 24-hour concentrations. The existing PM_{10} standards would continue to apply in the interim period (62 FR 38652).
Source: ADEM 1972, TVA 1998a, TVA 1995b, ADEM 1995.

Operation

Operational impacts would result from emissions from four diesel generators, four diesel fuel-fired fire pumps, a security power diesel generator, two auxiliary boilers fueled with No. 2 fuel oil (0.05 percent sulfur), two cooling towers, two turbogenerator lube oil systems, and two fixed-roof tanks for storing No. 2 fuel oil (TVA 1997d). Emissions from these sources based on recent operating experience at TVA's Sequoyah Nuclear Plant are summarized in **Table 5–24.** In addition to these sources, there would be emissions from employee vehicles and trucks moving materials and wastes.

Table 5–24 Nonradioactive Gaseous Emissions from Bellefonte 1 and 2 During Operations

Pollutant	*Emissions (kilograms per year)*	
	Stationary Sources[a]	*Vehicles*
Carbon monoxide	23,714	48,100
Nitrogen dioxide	90,707	13,700
Particulate matter	12,611	47,800
Sulfur dioxide	8,869	0
Volatile organic compound	2,105	6,230
Benzene	16.9	0
Toluene	6.13	0
Xylenes	4.21	0
1,3-Butadiene	0.00696	0
Formaldehyde	62.9	0
Acetaldehyde	0.679	0
Acrolein	0.186	0
Arsenic	0.632	0
Beryllium	0.376	0
Cadmium	1.66	0
Chromium	10.1	0
Lead	1.34	0
Manganese	2.11	0
Mercury	0.451	0
Nickel	25.6	0

[a] Stationary sources include diesel generators, diesel fuel-fired fire pumps, security power diesel generators, auxiliary boilers, the lube oil system, fuel oil storage, and cooling towers.
Source: TVA 1997d, TVA 1998a

Maximum air pollutant concentrations resulting from the stationary sources (diesel generators, diesel fuel-fired fire pumps, security power diesel generators, and auxiliary boilers) are summarized in **Table 5–25**. There would be finite increases in air pollutant concentrations from operational activities, but even in combination with air pollutant concentrations from offsite sources (see Section 4.2.3.3), they would continue to meet the ambient air quality standards for carbon monoxide, nitrogen dioxide, PM_{10}, and sulfur dioxide. Concentrations of toxic air pollutants from the combustion of diesel fuel in the auxiliary boilers and diesel generators also were evaluated. There are no Alabama State standards that specify acceptable ambient concentrations of toxic air pollutants. During the permitting process, Alabama compares the concentrations of toxic air pollutants to 1/40 of the applicable threshold limit value for a pollutant to assess whether the pollutant is of concern and should be evaluated in more detail. The offsite concentrations of all the toxic pollutants evaluated for operations at Bellefonte would be below 15 percent of the applicable 1/40 of the threshold limit value. Emissions and resulting concentrations of air pollutants from the operation of Bellefonte 1 individually would be similar to those from operation of the combined units, since the testing and maintenance of the stationary sources would not vary.

Table 5–25 Annual Air Pollutant Concentrations from Bellefonte 1 and 2 During Operations

Air Pollutant	*Averaging Period*	*Most Stringent Standard or Guidelines[a] (μg/m³)*	*Operation's Contribution (μg/m³)*	*Total Concentration (μg/m³)*	*Percent of Standard or Guideline*
Carbon monoxide	8-hour 1-hour	10,000 40,000	404.0 662.0	4,540 6,180	45 15
Lead	Calendar Quarter 1-hour	1.5 1.25	0.000132 0.00541	0.0301 0.00541	2 0.43
Nitrogen dioxide	Annual	100	1.19	25.3	25
Ozone	8-hour (3-year average of annual 4th highest)	157	Not applicable	b	b
Particulate matter	PM_{10} Annual 24-hour	 50 150	 0.169 18.6	 24.2 64.6	 48 43
Sulfur dioxide	Annual 24-hour 3-hour	80 365 1,300	0.198 15.6 64.6	13.2 89 275	16 24 21
Benzene	1-hour	24	0.618	0.618	2.6
Toluene	1-hour	4,700	0.226	0.226	0.0048
Xylenes	1-hour	10,850	0.15	0.15	0.0014
1,3-Butadiene	1-hour	110	0.00148	0.00148	0.0013
Formaldehyde	1-hour	9.25	0.35	0.35	3.8
Acetaldehyde	1-hour	1,125	0.0479	0.0479	0.0043
Acrolein	1-hour	5.75	0.0094	0.0094	0.16
Arsenic	1-hour	0.25	0.00256	0.00256	1.0
Beryllium	1-hour	0.05	0.00152	0.00152	3.0
Cadmium	1-hour	0.05	0.00668	0.00668	13
Chromium	1-hour	12.5	0.0407	0.0407	0.33
Manganese	1-hour	5.0	0.00851	0.00851	0.17
Mercury	1-hour	0.625	0.00183	0.00183	0.29
Nickel	1-hour	2.5	0.104	0.104	4.2

μg/m³ = micrograms per cubic meter.
PM_n = Particulate matter less than or equal to *n* micrometers.
[a] The more stringent of the Federal and state standards is presented for the averaging time. For toxic air pollutants, a value of 1/40 of the applicable threshold limit value is used for comparison.
[b] There is insufficient monitoring data to compare to the 8-hour standard for ozone.
Note: The National Ambient Air Quality Standards (40 CFR 50), other than those for particulate matter and those based on annual averages, are not to be exceeded more than once per year. The 1-hour ozone standard applies only to nonattainment areas. The 8-hour ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 157 μg/m³. The 24-hour particulate matter standard is attained when the expected number of days with a 24-hour average concentration above the standards is ≤1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. EPA recently revised the ambient air quality standards for particulate matter. The new standards were finalized on July 18, 1997. The current PM_{10} annual standard was retained and two $PM_{2.5}$ (particulate matter less than or equal to 2.5 micrometers) standards were added. These standards were set at 15 μg/m³ 3-year annual average arithmetic mean based on community-oriented monitors and 65 μg/m³ 3-year average of the 98th percentile of 24-hour concentrations at population-oriented monitors. The current 24-hour PM_{10} standard was revised to be based on the 99th percentile of 24-hour concentrations. The existing PM_{10} standards would continue to apply in the interim period (62 FR 38652).
Source: TVA 1997d, TVA 1998a.

The potential air pollutant emissions from the auxiliary boilers would exceed the emission level for applicability of the Prevention of Significant Deterioration permitting requirements, although the actual emissions from these sources would be well under these levels. The auxiliary boilers are currently permitted by the Alabama Department of Environmental Management. This department has stated that the boilers are not subject to the Prevention of Significant Deterioration regulations, so it has not issued a Prevention of Significant Deterioration Permit. The diesel generators are operating under a "synthetic minor" permit by the Alabama Department of Environmental Management, owing to their continued operation at less than 50 percent of the 91 metric tons per year (100 tons per year) emission threshold. Under the new operating permit program, permits could be required for other sources such as chlorine, ammonia, and hydrazine storage tanks; lubricating oil system vapor extraction vents; paint and welding shops; and oil storage tanks. Emissions from employee vehicles and trucks carrying materials and wastes would result in some emissions, as shown in Table 5–24.

The combustion of fossil fuels associated with this alternative would result in the emission of carbon dioxide, one of the atmospheric gases believed to influence global climate. Annual carbon dioxide emissions from this alternative would represent less than 0.0006 percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes (EPA 1997b). Operation of Bellefonte in lieu of fossil fuel-fired generation would significantly reduce future TVA carbon dioxide emissions.

The possible effects of the natural-draft cooling tower operation would include inadvertent localized atmospheric modifications such as the creation of plumes; cloud formation; changes in local rain, drizzle, fog, icing, and snowfall patterns; and the fallout of salts from cooling tower drift. Cooling tower drift is the dispersion and deposition of wet or dry aerosols emitted from cooling towers. Plans for normal operation of the Bellefonte cooling towers were based on the discharge of heated air carrying 62,800 liters per minute (16,600 gallons per minute) water as vapor and 170 liters per minute (45 gallons per minute) of water as drift from each of the towers (AEC 1974). Most of the drift that fell to the ground would do so within 300 meters (1,000 feet) of the towers. The remainder of the drift and residue would disperse and eventually be removed from the air and deposited on the ground by precipitation. Studies of natural-draft cooling towers in England indicate maximum rates of salt deposition on the order of 0.001 grams per square meter per hour (grams/m^2-hr). Solids deposition near the Bellefonte cooling towers is estimated to be less than 0.002 grams per square meter per hour (grams/m^2-hr). The major anions in the drift at Bellefonte would be sulphate and carbonate (AEC 1974).

Modeling of the occurrence of visible plumes was performed for the Bellefonte Environmental Statement (AEC 1974). Incidents of the plumes descending to the ground or causing localized surface fogging should be rare. However, the plumes would frequently cause surface fog on Sand Mountain Plateau, about 2.4 to 4.0 kilometers (1.5 to 2.5 miles) southeast from the site at an elevation 122 meters (400 feet) higher than the tops of the cooling towers. Fogging along roads in this area is predicted to occur about 80 hours per year. The plume modeling is expected to overpredict the occurrence of fog; however, the model does not account for the tendency of the plume to follow the terrain. For this reason, ground-level fog from operation of the cooling towers would likely occur only one to two days per year; icing in the Sand Mountain Plateau area would occur less frequently (AEC 1974).

Ozone is produced from corona discharge (ionization of the air) in the operation of transmission lines and substations, particularly at the higher voltages. TVA gives careful attention to the design and construction of its transmission facilities to minimize corona discharges (TVA 1974b). All but 20 miles of the transmission lines serving the Bellefonte Nuclear Plant site are currently energized, and no change in corona discharge from them is anticipated.

RADIOACTIVE GASEOUS EMISSIONS

No Action

Under the No Action Alternative, construction of Bellefonte 1 and 2 would not be completed. As described in Section 4.2.3.3, there would be no radioactive gaseous emissions at the Bellefonte site.

Tritium Production

Operation of Bellefonte 1 and 2 as nuclear reactor facilities would result in radioactive gaseous emissions. These would include operational emissions typical of nuclear reactor facilities, as well as a potential increase in tritium emissions due to tritium production. A design objective of the TPBARs is to retain as much tritium as possible within the TPBAR. The performance of the tritium "getter" is such that there is virtually no tritium available in a form that could permeate through the TPBAR cladding. However, for the purposes of this EIS it was conservatively assumed that an average of 1 Curie of tritium per TPBAR per year could permeate to the reactor coolant and 10 percent could be released to the environment as gaseous emission. **Table 5–26** shows the anticipated radioactive gaseous emissions at Bellefonte 1 from operations with 0; 1,000; and 3,400 TPBARs. The values presented for 0 TPBARs are based on the operational experience of Watts Bar 1. The calculation method and assumptions are described in Appendix C. Radiological exposures of the public and workers are presented in Section 5.2.3.9.

Table 5–26 Annual Radioactive Gaseous Emissions from Tritium Production at Bellefonte 1

		Tritium Production	
	0 TPBARs	***1,000 TPBARs***	***3,400 TPBARs***
Tritium release (Curies)	5.6	105.6	345.6
Other radioactive release (Curies)	283	283	283
Total release (Curies)	288.6	388.6	628.6

Note: For Bellefonte 1 and 2 operation, the emission values would be twice the values given.
Source: Based on Watts Bar 1 operation (see Table 5-1).

5.2.3.4 Water Resources

The availability and quality of water resources (surface water and groundwater) and the facility-related effects on those resources that could affect other users, are important factors in evaluating the acceptability of these facilities. The presence of floodplains is another important consideration. Legislation passed to protect water resources includes the Clean Water Act, especially Section 402, National Pollutant Discharge Elimination System, and 307(b), Pretreatment Standards, and the Safe Drinking Water Act. DOE regulation 10 CFR 1022, Compliance with Floodplains/Wetlands Environmental Review Requirements, implements Executive Orders 11988 and 11990 and requires evaluation of the potential effects of an action on floodplains and wetlands.

The issues related to water resources include: (1) whether there is sufficient water available for both the proposed use and local domestic consumption, (2) whether water quality would be degraded or further degraded, (3) whether the proposed use challenges legislative or regulatory compliance, and (4) whether the proposed action is threatened by flooding.

The State of Alabama implements the requirements of the Clean Water Act and Safe Drinking Water Act and NPDES regulations through its Department of Environmental Management's Water Quality Program.

Bellefonte operations are covered under the Alabama Department of Environmental Management's NPDES Permit, as described in Section 4.2.3.4.

SURFACE WATER

No Action

No surface water impacts are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Analyses of impacts to surface water are presented separately for construction and operations activities.

Construction

Water uses during construction would include water for employee use, demineralized water, and raw water for cleaning, systems testing, and cooling. A peak use of 3,330,000 liters per day (872,000 gallons per day) of water would be required during startup when plant flushing and cleanup are performed (TVA 1998e). Approximately 379,000 liters per day (100,000 gallons per day) of this peak usage would be potable water. Peak usage could occur over a period of several weeks. A peak use of 280,000 liters per day (74,000 gallons per day) would be required for completion of Unit 2. Potable water would continue to be obtained from the Hollywood water supply system (see Table 5–27). The quantities of water (raw and potable) obtained from the Guntersville Reservoir would have little effect on the availability of water for other uses.

Since construction completion would involve little or no new land disturbance or excavation, there would be little or no impact to surface water quality as a result of soil erosion of disturbed land or siltation of surface drainage channels. Stormwater runoff would continue to be collected and treated, if necessary, before discharge. An NPDES Permit was issued for the Bellefonte Nuclear Plant that covers existing site outfalls and stormwater monitoring during construction of the nuclear facility.

Sanitary wastewater would be treated at the Hollywood Waste Water Treatment Facility. This facility is a publicly owned treatment works designed to ensure compliance with the effluent limitations of the state. The city of Hollywood has agreed to add additional treatment facilities as needed to handle the sanitary wastewater from the Bellefonte Nuclear Plant. A small quantity of sanitary wastewater from the simulator building, training facility, and environmental data station is treated on site by sand filters and a septic system.

Operation

All water for operation of Bellefonte 1 or both Bellefonte 1 and 2 would be drawn from the Guntersville Reservoir, except for potable water, which is obtained from the Hollywood water supply system. Potable water requirements would average 95,000 liters per day (25,000 gallons per day) with two units operating (TVA 1998a). Average river flow rates at the Bellefonte Nuclear Plant are 65.9 million liters per minute (17.4 million gallons per minute); the 7-day, 10-year minimum flow, 21.9 million liters per minute (5.78 million gallons per minute). Operation of Bellefonte 1 and 2 would require 376 million liters per day (99.4 million gallons per day) for normal full operation. This represents about 0.4 percent of the average river flow and about 1.2 percent of the 7-day, 10-year minimum. In addition, about 24 million liters per year (6 million gallons per year) of water would be used for firefighter training and the testing and maintenance of fire protection systems. Other major water uses served by the Guntersville Reservoir include the 30 million liters per day (7.8 million gallons per day) of potable water demand of several municipalities in Alabama and Tennessee; the 4.9 billion liters per day (1.1 billion gallons per day) for the Widows Creek Fossil Plant; and various smaller, industrial uses. The water supply from Guntersville Reservoir appears to be adequate to meet the foreseeable requirements for the area (TVA 1997d, TVA 1997f). Water required from the Guntersville Reservoir for Bellefonte operation would be a small fraction of the river flow, and most of it would be returned to the reservoir after use.

Discharges from the Bellefonte plant include storm and process water outfalls, covered by the existing NPDES Permit, which would be treated and monitored before release. Water quality-based limitations include the following:

- Use classification of the upper stretch of the Tennessee River Basin as a public water supply and for swimming, fishing, and wildlife protection

- Select water quality criteria (e.g., temperature, dissolved oxygen, and toxics) for public water supply-designated segments

- Secondary treatment, or the equivalent, of all industrial, sanitary, and combined discharges for biologically degradable waste [Parameters of interest are biochemical/biological oxygen demand, total suspended solids, and acidity (pH) (TVA 1997f).]

Process water discharges would come mostly from cooling tower blowdown (about 247 million liters per day [65.2 million gallons per day]) and sump collection ponds (2.46 million liters per day [0.65 million gallons per day]) with both units operating. These discharges would be to the main river channel (Guntersville Reservoir). In addition to these discharges, approximately 2,720,000 liters per day (718,000 gallons per day) of water would be used for intake strainer and screen backwash (TVA 1997e).

Sanitary wastewater would be treated at the Hollywood Waste Water Treatment Facility, a publicly owned treatment works designed to ensure compliance with the effluent limitations of the State of Alabama. The city of Hollywood has agreed to add additional treatment facilities as needed to handle the wastewater from the Bellefonte plant. Discharges to the treatment facility would not include industrial wastes. The outfall from the Hollywood Waste Water Treatment Facility is covered under the NPDES Permit held by the city of Hollywood.

Discharges from the plant would be monitored to comply with the Bellefonte NPDES Permit limitations. Limitations of the existing NPDES Permit issued by the Alabama Department of Environmental Management are summarized in Section 4.2.3.4. **Table 5–27** presents changes to surface water resources attributable to the alternatives involving the Bellefonte plant.

Chemical discharges to the Guntersville Reservoir from various systems at the Bellefonte plant are summarized in **Tables 5–28** and **5–29**. The blowdown diffuser is designed to mix the blowdown with reservoir water. The average expected chemical concentrations in the reservoir after mixing have been calculated using CORMIX (Cornell 1996). Sources of chemical discharges would include cooling tower blowdown, cooling tower makeup and essential raw water systems, the water filtration plant, steam system makeup water demineralizers, alternative treatment of wastes from makeup and condensate demineralizers, component-cooling systems, the reactor coolant system, auxiliary steam generator blowdown, and yard drainage systems and various sumps (TVA 1974b). Even under adverse conditions, chemical discharges would be small. The change in average concentrations in the reservoir after mixing would represent a small increase over the observed background concentrations. Actual discharges and concentrations in the reservoir should meet the limitations of the NPDES Permit and Alabama Department of Environmental Management drinking water standards. Federal secondary drinking water standards and health advisories also would be met, except for those pertaining to constituents such as aluminum, iron, and molybdenum where the existing concentrations exceed those levels.

A portion of the circulated cooling water would be discharged to prevent the buildup of dissolved salts and minerals in the cooling system (blowdown), resulting in the discharge of heated water to the Guntersville Reservoir. The NPDES Permit for Bellefonte (ADEM 1992) limits in-stream temperatures to less than or equal to 30°C (86°F). Ambient upstream temperatures typically exceed this limit an average of 8.5 days per year in July and August, primarily as a result of natural heating of the lake. Monitoring data for 1975 to 1991 indicate that the ambient upstream temperature ranged from 1.7°C (35°F) to 32.2°C (90°F) (TVA 1997f).

Table 5–27 Potential Changes to Water Resources from Bellefonte 1 or Bellefonte 1 and 2

Affected Resource Indicator	*No Action*	*Tritium Production Bellefonte 1*	*Tritium Production Bellefonte 1 and Bellefonte 2*
Construction			
Water availability and use:			
Raw water source	Guntersville Reservoir	Guntersville Reservoir	Guntersville Reservoir
Site water use requirement (million liters per year)	None	1,260[a]	1,390[a]
Percent of river flow	None	0.0036	0.004
Water quality:			
Discharge to surface water (million liters per year)	None[b]	3,100[c]	3,430[c]
Discharge of sanitary waste to local treatment plant (million liters per year)	Not applicable	155[c]	155[c]
Operation			
Water availability and use:			
Water source	Guntersville Reservoir	Guntersville Reservoir	Guntersville Reservoir
Site raw water use requirement (million liters per year)	Not applicable[d]	68,700[e]	137,000
Percent of river flow	Not applicable	0.2	0.39
Potable water use requirement (million liters per year)	2.76	27.6	34.5
Water quality:			
Discharge to surface water (million liters per year)	None[b]	46,000[e]	91,100
Discharge of sanitary waste to local treatment plant (million liters per year)	2.76	27.6	34.5
Floodplain:			
Actions in 500-year floodplains	None	Intake	Intake

[a] Potable and raw water usage.
[b] Except stormwater runoff and a small quantity discharged from the simulator training facility sand filters.
[c] Discharges from construction activities and from runoff are discharged to the diffuser or to other discharge points.
[d] Current raw water use from Guntersville Reservoir is limited to fire protection and cooling water needs.
[e] Estimated assuming one cooling tower operation.
Source: TVA 1997f, TVA 1997d.

Table 5–28 Summary of "Added" Inorganic Chemical Discharges to Guntersville Reservoir from Operation of Bellefonte 1 and Bellefonte 1 and 2

Chemical	*Finished Drinking Water Standard (milligrams per liter)*	*Background Water Quality–Average Concentration (milligrams per liter)*	*Average Daily Discharge of Chemical for One Unit (kilograms)*	*Average Daily Contribution to Cooling Tower Blowdown[a] (milligrams per liter)*		*Average Blowdown Concentration (milligrams per liter)*		*Concentration in Reservoir after Mixing[b] (milligrams per liter)*	
				Unit 1	*Units 1 and 2*	*Unit 1*	*Units 1 and 2*	*Unit 1*	*Units 1 and 2*
Ammonia	30	0.03	0.0162	0.000087	0.000103	0.0601	0.0601	0.0336	0.0336
Chlorides	250	7.6	24.5	0.132	0.155	15.3	15.4	8.51	8.52
Copper	1.3	0.011	7.7	0.0416	0.0489	0.0636	0.0709	0.0148	0.0152
Nickel	0.1	0.0017	0.858	0.00463	0.00544	0.00803	0.00884	0.00218	0.00223
Sodium	20	6.83	419	2.26	2.66	15.9	16.3	7.77	7.8
Total dissolved solids	500	100	146	0.788	0.927	201	201	112	112
Sulfates	250	15.4	1210	6.55	7.72	37.4	38.5	17.6	17.7
Zinc	3	0.11	111	0.601	0.707	0.821	0.927	0.159	0.165

[a] Based on annual contributions in blowdown stream for a one-unit plant with a 67,650 liter per year blowdown rate and a two-unit plant with a 115,000 liter per year blowdown rate.
[b] Average concentration at the edge of the near-field mixing zone (6 meters downstream of the diffuser).
Source: Alabama 1998, ADEM 1998b, EPA 1996a, TVA 1997d, TVA 1997f.

Table 5–29 Summary of Observed Trace Metal Concentrations and Expected Trace Metal Concentrations in the Discharge Stream and at the Edge of the Mixing Zone from Operation of Bellefonte 1 and Bellefonte 1 and 2

Parameter (Dissolved)	*Finished Drinking Water Standard (milligrams per liter)*	*Background Water Quality–Average Concentration (milligrams per liter)*	*Average Blowdown Concentration (milligrams per liter)*		*Average Concentration in Reservoir After Mixing[a] (milligrams per liter)*	
			Unit 1	*Units 1 and 2*	*Unit 1*	*Units 1 and 2*
Aluminum	0.2	0.43	0.86	0.86	0.481	0.481
Arsenic	0.05	0.0002	0.0004	0.0004	0.000224	0.000224
Barium	2	0.05	0.1	0.1	0.0559	0.056
Beryllium	0.004	0.001	0.002	0.002	0.00112	0.00112
Boron	0.9	0.15	0.3	0.3	0.168	0.168
Cadmium	0.005	0.0005	0.001	0.001	0.000559	0.00056
Chromium	0.1	0.003	0.006	0.006	0.00336	0.00336
Iron	0.3	0.53	1.06	1.06	0.593	0.593
Lead	0.015	0.006	0.012	0.012	0.00671	0.00672
Mercury	0.002	0.0009	0.0018	0.0018	0.00101	0.00101
Molybdenum	0.01	0.02	0.04	0.04	0.0224	0.0224
Silver	0.2	0.01	0.02	0.02	0.00112	0.00112

[a] Average concentration at the edge of the near-field mixing zone (6 meters downstream of the diffuser).
Source: Alabama 1998, ADEM 1998b, EPA 1996a, TVA 1997d, TVA 1997f.

The combined discharges to the Guntersville Reservoir would be through the submerged diffuser to provide dilution with the stream flow. The temperature of the discharge would vary with the ambient wet-bulb temperature. Alabama water quality standards limit the maximum temperature rise (difference between upstream and downstream temperature) to no more than 2.8°C (5°F). The maximum temperature rise would occur when the river was cold and the discharge warm (TVA 1997f).

Results of temperature analyses for various discharges using CORMIX system indicate that the maximum water temperature 3 meters (10 feet) downstream from the diffuser would be 32.6°C (90.7°F) for a 2,720-megawatts-electric facility with multiple units (somewhat larger than the two-unit, 2,440-megawatts-electric nuclear option). At 800 meters (2,620 feet) downstream the predicted maximum temperature was 32.3°C (90.1°F). The maximum temperature rise would occur in January and February; it has been computed at 1.8°C (3.2°F) within 3 meters (10 feet) downstream, cooling (with dilution) to 0.4°C (0.7°F) at 16 kilometers (10 miles) downstream (TVA 1997f, TVA 1998a). The one-unit option would result in lower temperatures downstream due to the lower discharge rate.

An earlier analysis for two-unit operation indicated that the maximum discharge temperature at the diffusers would vary from 28.5°C (83.3°F) in January to 34.7°C (94.5°F) in July (TVA 1982). Given a minimum mixing ratio of 9 to 1, the maximum in-stream temperature at the edge of the mixing zone would vary from 16.8°C (62.2°F) in January to 32°C (90°F) in July for the two-unit nuclear option. In-stream temperatures for the one-unit option would be lower due to the lower discharge flow rate. The maximum predicted discharge temperature rise (downstream temperature minus upstream temperature) would be 1.6°C (2.9°F) in February (TVA 1982). Holdup of the blowdown could be necessary on occasion when the ambient temperature in the summer nears or exceeds the maximum temperature standards. A temperature variance to the NPDES Permit has been requested from the Alabama Department of Environmental Management. Although there would be a finite increase in reservoir water temperature due to the discharge from Bellefonte operation, both the increase in temperature and the maximum temperature would be limited such that impacts on aquatic species would meet the limitations of the NPDES Permit.

The Widows Creek Fossil Plant is about 24 kilometers (15 miles) upstream of the Bellefonte site. It discharges approximately 68 cubic meters per second (2,400 cubic feet per second) of water heated to 10°C (18°F) above ambient water temperature. Assuming that full mixing occurred before the water reached the Bellefonte site, the temperature increase would be 0.8°C (1.5°F) during the summer and 0.6°C (1.0°F) during the winter, excluding surface heat loss. Temperature measurements at Guntersville Dam and Nickajack Dam indicate that the water at the downstream dam is about 0.7°C (1.3°F) warmer on the average. One portion of this temperature increase could be due to the Widows Creek plant, and another portion to solar heating. The Bellefonte plant by comparison would increase the average water temperature flowing past the plant by about 0.05°C (0.1°F). Any combined thermal effect assignable to Bellefonte likely would be small (AEC 1974).

Since stormwater runoff would continue to be collected and treated (if necessary) before discharge, little or no impact on surface water would result from soil erosion or the siltation of surface drainage channels.

GROUNDWATER

Construction

Construction activities related to the completion of Bellefonte 1 or both Bellefonte 1 and 2 should have no effect on groundwater availability. There are no planned withdrawals of groundwater. The potential for groundwater contamination from fuels, oils, solvents, or other chemicals used in the operation and maintenance of equipment and other activities during construction would be minimized by careful handling and proper disposal of potential contaminants. TVA's Spill Prevention, Control, and Countermeasures Plan provides a method for mitigating releases of contamination into the groundwater at the site. Should a release occur, remediation methods would be employed to prevent impacts on water supplies (TVA 1997f).

Operations

Groundwater availability would not be affected by operation of Bellefonte 1 and 2. There are no planned withdrawals of groundwater. Any impacts on groundwater quality during operations most likely would be associated with the storage and handling of fuel oil and the storage, handling, and disposal of the wastes generated. The disposal of wastes is discussed in Section 5.2.3.11. No impacts on groundwater are expected. TVA's Spill Prevention, Control, and Countermeasures Plan provides a method for mitigating groundwater releases at the site. Should a release occur, remediation methods would be employed to prevent impacts on water supplies (TVA 1997f).

FLOODING

The Bellefonte facilities have been sited to provide a reasonable level of protection from flooding. The requirements of Executive Order 11988, "Floodplain Management," would be fulfilled. To the extent practicable, required actions would be conducted outside the limits of the 100-year floodplain unless there are no practicable alternatives. If possible, "critical action" facilities (i.e., those facilities whose inoperability would compel the curtailment or shutdown of power generation) would be located outside the 500-year floodplain or protected to the 500-year flood elevation. All safety-related structures, systems, and components have been designed to remain functional in the worst potential flood from any cause (TVA 1997f).

The maximum plant-site flood level from any cause would be elevation 190.4 meters (624.8 feet). Coincident wind waves would raise the reservoir to a maximum elevation of 191.3 meters (627.7 feet). The safety-related facilities, systems, and equipment in the reactor building have been protected against the maximum flood level and the maximum wind- or wave-induced levels. The intake pumping station has been designed for the static and dynamic forces resulting from such an event, and is protected from runup by a wall built around the top deck (TVA 1991).

The situation conducive to the maximum plant-site flood level has been determined to be a sequence of March storms producing maximum precipitation on the watershed above Chattanooga. The flood crest would be augmented by the failure of earth embankments at the Fort Loudoun-Tellico, Watts Bar, Chickamauga, and Nickajack Dams upstream (TVA 1991). While some support facilities and utilities (e.g., the railroad, water, and sewer pipelines) would be below the 500-year flood level, they too have been constructed to protect them from flood damage.

Radioactive Liquid Effluent

No Action

Under the No Action Alternative, construction of Bellefonte 1 and 2 would not be completed. As discussed in Section 4.2.3.4, there would be no radioactive liquid effluent at the Bellefonte site.

Tritium Production

Surface Water

Operation of Bellefonte 1 and 2 as nuclear reactor facilities should produce the liquid radioactive effluents typical of such operation, as well as those attributable exclusively to tritium production. An increase in the tritium release as a result of tritium production is based on the assumption that an average of 1 Curie of tritium per TPBAR per year could permeate through the TPBAR cladding to the reactor coolant, and that 90 percent of that amount could be released to the environment as liquid effluent. **Table 5–30** shows the expected radioactive liquid effluents from operation of Bellefonte 1 with 0, 1,000, and 3,400 TPBARs. The values presented for 0 TPBARs are based on the operational experience at Watts Bar 1. The calculation method and assumptions are described in Appendix C, Section C.3. Radiological exposures of the public and workers are presented in Section 5.2.3.9.

In accordance with the Safe Drinking Water Act requirements promulgated by the EPA in 40 CFR, 100-149, a tritium concentration of 20,000 picocuries per liter has been established as a limit for drinking water. In view of this regulatory limit, an analysis was performed to estimate tritium concentrations in the Tennessee River that could result from tritium production at Bellefonte 1 or Bellefonte 2. The average expected tritium concentrations in the river were calculated using CORMIX (Cornell 1996). **Table 5–31** presents the potential tritium concentrations from the incident-free irradiation of 1,000 and 3,400 TPBARs at two points: (1) the edge of the near-field, and (2) at the nearest drinking water intake. "Near-field" in CORMIX is the area surrounding the discharge point of the effluent, where initial mixing is taking place. The edge of the near-field typically extends to a few meters away from the point of discharge. Table 5–31 also presents potential tritium, concentrations in the unlikely event of 2 TPBAR failures during a given 18-month operating cycle. The results indicate that tritium concentrations would remain well below the 20,000 picocurie per liter limit, and at the drinking water intake, the tritium concentration would be below or close to the lower detection limit for tritium, which is approximately 300 picocuries per liter.

Table 5–30 Annual Radioactive Liquid Effluents from Tritium Production at Bellefonte 1

		Tritium Production [a]	
	0 TPBARs	*1,000 TPBARs*	*3,400 TPBARs*
Tritium release (Curies)	639	1,539	3,699
Other radioactive release (Curies)	1.3	1.3	1.3
Total release (Curies)	640.3	1,540.3	3,700.3

[a] For Bellefonte 1 and Bellefonte 2 operation the effluent values would be twice the values given.
Source: Based on Watts Bar 1 operation (see Table 5-2).

Table 5–31 Tritium Concentration in the Tennessee River from Tritium Production at Bellefonte 1 or Bellefonte 2

		Incident-Free Tritium Production		
	0 TPBARs (picocuries per liter)	*1,000 TPBARs (picocuries per liter)*	*3,400 TPBARs (picocuries per liter)*	*2 TPBAR Failures*[a] *(picocuries per liter)*
Edge of near-field	560	1,348	3,240	12,219
At nearest drinking water intake	36	88	211	796

[a] See Appendix C, Table C-8, for tritium release.

5.2.3.5 Geology and Soils

No Action

No impacts on geology and soils are anticipated at Bellefonte beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Construction

The limited construction activities required to complete Bellefonte 1 and 2 should have no effect on geology and soils.

Soil Amplification and Ground Deformation—Liquefaction of soils at Bellefonte due to earthquake ground motion is believed to be very unlikely. The effects of the amplification of ground motions through soil columns should be considered in the seismic design of structures not founded on rock.

Seismic Hazard Assessments—Bellefonte is in a Seismic Hazard Zone 2, or a zone of low seismic hazard. The use of existing building codes should adequately address the earthquake hazard to ordinary buildings at Bellefonte. Additional considerations might be needed for special structures that house hazardous processes or sensitive equipment. Underground or aboveground piping that transports hazardous substances could also require nonroutine design to address seismic hazards at the site.

Bedrock—No problems should be created within the consolidated bedrock (the Chickamauga Formation) beneath the main plant area footprint by activities such as excavation or dewatering. All of the unweathered rock at the site is capable of supporting intended loads.

Overburden—Soils beneath the footprint areas are variable in depth (0 to 7 meters [0 to 23 feet]) and are expected to consist primarily of stiff silty clays and clayey silts. Structural design would be based upon in-situ soil investigations at the proposed foundation location and appropriate safety factors for the proposed foundations of new facilities on soil.

Operation

No impacts on geologic stability are expected to occur. All structures would be designed and constructed according to sound engineering practices; no materials would be injected underground; and groundwater would not be required for tritium production. The normal operation of Bellefonte 1 and 2 would have no effect on soils and prime farmland at the site.

5.2.3.6 Ecological Resources

No Action

No impacts on land use, air quality, or water quality are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action. Therefore, no impacts on ecological resources are expected under this alternative.

Tritium Production

The evaluation of impacts on ecological resources was based on a review of previous studies for the Bellefonte plant and analysis of any changes associated with tritium production that might be relevant to previously disclosed impacts. Where relevant, these impacts were identified.

Construction

Evaluation of the ecological impacts of construction activities at the Bellefonte site encompassed terrestrial resources, aquatic resources, wetlands, and threatened and endangered species. Specific sources of construction impacts include increases in air emissions, runoff and sedimentation, human activity, and noise.

Terrestrial Resources

Construction activities required to complete Bellefonte 1 or both Bellefonte 1 and 2 would include the installation of additional equipment, the construction of new support buildings, and minor activities associated with making the intake water structure operational (TVA 1998a) (see the description in Section 3.2.5.3). Most major facilities at Bellefonte have already been completed (TVA 1993). The area of the site that was cleared during initial construction should be adequate for the construction of the new support buildings and for the remaining construction-related activities. Therefore, no additional land would be cleared, and there would be no impacts from disturbance or destruction of vegetation or wildlife habitat in currently undisturbed areas of the site. The transient emissions of gaseous and particulate air pollutants from construction operations would have little or no adverse effect on terrestrial ecological resources (TVA 1974b). During construction, no radioactive materials would be handled. Thus, there should be no radiological impacts on terrestrial resources. Although there would be increased activity at the site and increases in sound levels from construction activities and from traffic along the access road, these changes should have little effect on wildlife on the site (TVA 1974b).

Aquatic Resources

Impacts to aquatic resources from increased surface runoff and sediment loading should be temporary and limited. Land disturbance would be limited to that required for the new support buildings, and there would be no physical disturbance of the Guntersville Reservoir shoreline or adjacent riparian habitat in the vicinity of the Bellefonte site. Standard erosion control and sedimentation mitigation techniques would be used as appropriate in any construction areas. Runoff from construction activities would be collected and processed before release to surface waters. Monitoring investigations from 1974 to 1979 during the major construction activities at Bellefonte indicated that these activities did not adversely impact the Guntersville Reservoir or Town Creek Embayment (TVA 1980).

Wetlands

Construction activities required to complete Bellefonte 1 or both Bellefonte 1 and 2 should disturb no additional wetlands beyond those disturbed during initial construction of the Bellefonte plant. Activities required to make the intake structure operational would involve desilting of the existing pumps. This would not disturb any wetlands. As discussed previously for aquatic resources, impacts to wetlands from increased surface runoff and sedimentation would be both temporary and limited.

Threatened and Endangered Species

Construction activities at the Bellefonte site would not adversely affect any Federally or state-listed threatened or endangered terrestrial species. There should be no impacts on threatened or endangered aquatic animals or plants from construction activities, because no such species have been reported around the Guntersville Reservoir in the vicinity of Bellefonte in recent years.

The gray bat and Indiana bat, both Federally listed as endangered, are known to forage along the Guntersville Reservoir shoreline. Indiana bats also roost in heavily wooded areas on the hillsides and bluff areas along the Tennessee River. The bald eagle, Federally listed as threatened, has been seen along the wooded shoreline on the eastern side of the Bellefonte site and along the intake canal during the winter. Activities associated with completion of Bellefonte 1 and 2 would not reduce foraging areas and roosting sites for the gray bat, Indiana bat, or the bald eagle. Noise and human disturbance associated with construction should have only minor, short-term effects on these species (TVA 1993, TVA 1997f).

TVA has notified the U.S. Fish and Wildlife Service of DOE's proposed action and will provide the States of Tennessee, Alabama, and South Carolina and the U.S. Fish and Wildlife Service with copies of the CLWR Draft and Final EISs. TVA and DOE will continue to comply with the requirements of the Endangered Species Act and interact with the U.S. Fish and Wildlife Service, as appropriate.

Operation

Evaluation of the ecological impacts of the operation of Bellefonte 1 or both Bellefonte 1 and 2 encompassed terrestrial resources, aquatic resources, wetlands, and threatened and endangered species. Specific sources of operational impacts would include increases in emissions of air pollutants, effluent releases to surface waters, human activity, and noise levels.

<u>Terrestrial Resources</u>

Wildlife on the Bellefonte site would be exposed to increased noise levels from operational sources and from traffic during peak traffic hours. Short-term noises above a level of about 75 dBA could startle wildlife (TVA 1997f). Noises from site activities above this level likely would not be experienced by wildlife in the undeveloped areas of the site. The increased operational noise levels should cause little or no disturbance of wildlife on the site; therefore, no changes in local wildlife populations should occur. Testing of the emergency sirens could elicit a “startle” response in nearby wildlife, but these infrequent tests should cause no changes in wildlife populations in these areas.

Emissions of gaseous and particulate air pollutants from combustion sources would result in small increases in air pollutant concentrations (see Section 5.2.3.3). However, the resulting concentrations of hazardous and toxic pollutants in the vicinity of the site should continue to meet the ambient standards and guidelines and have no adverse effect on terrestrial resources.

Surface deposition or root uptake of concentrated salts could cause stress on vegetation. Effects on vegetation would vary with the plant species and the salts being deposited. Most of the drift that fell to the ground would do so within 300 meters (1,000 feet) of the towers (AEC 1974). The remainder would disperse and eventually be removed from the air and deposited on the ground by precipitation. The estimated salt deposition rate for the cooling towers is 10^{-3} grams per square meters per hour (grams per m^2-hr). The analysis of cooling tower drift for Bellefonte 1 and 2 indicates that gross impacts on terrestrial biota as a result of salt deposition from the cooling towers would be unlikely, but sensitive species could be adversely affected (AEC 1974).

Changes in incoming radiation (due to shadows from the cooling tower plume) and moisture could affect biota in the vicinity of the cooling towers. However, these changes likely would be indistinguishable from natural variations. Impacts should not be adverse—they might not even be measurable—but over the lifetime of the station, subtle effects could appear (AEC 1974). There should be no operations-related changes in bird mortalities from collision with the cooling towers.

Operation of Bellefonte 1 or both Bellefonte 1 and 2 for tritium production would release radioactive gaseous emissions and radioactive liquid effluents to the Guntersville Reservoir, as discussed in Sections 5.2.3.3 and 5.2.3.4. When tritium is inhaled or ingested by an organism, incorporation into bodily fluids is very efficient. However, long-term accumulation in the organism is limited by tritium’s rapid elimination by exhalation, excretion in body water, and its short half-life. The biological properties of tritium are discussed in Appendix C.

Doses to the public and workers have been estimated and are presented in Section 5.2.3.9. Various studies on exposure of vegetation, wildlife, and aquatic species indicate that radiological effects on the human species are a reasonable indicator of the effects on other organisms. In the Bellefonte Final Environmental Statement (TVA 1974b), maximum radiological doses to terrestrial vertebrates (excluding doses from tritium production) from liquid effluent releases under normal operating conditions were estimated at 160 millirad per year. Particularly instructive in this connection is the IAEA's 100-millirad per day benchmark of a chronic dose rate that appears unlikely to cause observable changes in terrestrial animal populations (IAEA 1992). It has been concluded that, since the exposure estimates are small relative to that benchmark and the incremental doses due to tritium production (see the analysis for the public and workers in Section 5.2.3.9) also would be small, the impact of radiological releases on terrestrial species would be minor.

<u>Aquatic Resources</u>

Possible major environmental impacts on the aquatic ecosystem of the Guntersville Reservoir due to the operation of Bellefonte 1 or both Bellefonte 1 and 2 include fish losses at the cooling water intake screens; almost total loss of entrained, unscreened organisms; and thermal and chemical discharges.

Fish Impingement—Since the water velocity in the intake channel would be low, fish would enter the channel in the normal course of their activities. The recessed embayment location of the intake would be conducive to fish congregation. If congregated fish swam until they were fatigued, they could eventually be impinged on the traveling screens. Since the overbank area has a high density of young-of-the-year fish, impingement should be high for this age group (AEC 1974).

Entrainment—Because of closed-cycle cooling, it can be assumed that all free-floating organisms that pass through the vertical traveling intake screens would be destroyed. These would include phyto- and zooplankton, fish eggs and larvae (ichthyoplankton), and small fish. An evaluation of plankton population densities and stream flow data indicates that there would be no discernible effect on the plankton populations in the Guntersville Reservoir. This is due largely to the small volume of water (less than 1 percent of the Tennessee River flow) that would be used by Bellefonte 1 or both units relative to the volume in the river (TVA 1991). Similarly, no adverse effect on fish populations in the reservoir would be expected from fish egg and larvae mortalities, since the withdrawal requirements for the closed-cycle cooling system would be small relative to the volume of the river (TVA 1974b).

Entrainment effects on aquatic macrophytes would mean the probable destruction of submerged floating plants and plant fragments. However, these losses would not constitute a significant reduction in the aquatic macroflora (TVA 1991).

Thermal Effects—Fish are normally attracted to the outfalls of power plants, especially when the ambient river temperatures are lower than the preferred temperature of a given species. In some cases, fish captured in the discharge region for a power plant are in poorer condition than those from unheated regions. Although the condition of some fish could be adversely affected, there should be no major effect on the abundance of fish species in the Guntersville Reservoir (AEC 1974).

The impact from thermal effects on the population of plankton in the Guntersville Reservoir should be small, given the limited diffuser mixing zone, which would limit the time of plankton entrainment in the plume, and the 10-fold dilution that would occur in the mixing zone. Some localized changes of backwater plankton assemblages (e.g., upstream and downstream of Jones Creek [Tennessee River Mile 388]) could result from plume dispersion along the left shore, beginning within 1.6 kilometers (1 mile) of the diffuser. Because of the small amounts of heat involved, these changes should be small (TVA 1991).

A major benthic community has been identified along the near shore (right side) overbank area extending downstream of the Bellefonte Nuclear Plant site (see Section 4.2.3.6). The impact of the thermal plume to the macrobenthos should be small. The benthos in the main channel is very limited in diversity, being composed primarily of the Asiatic clam, *Corbicula fluminea*. No thermal impacts would be expected on mainstream benthic populations. The impact of the thermal plume on emersed, floating-leaved, and submerged aquatic macrophyte species should be limited due to the small temperature change predicted. Some localized enhancement of macrophyte growth could occur along portions of the mainstream left bank and the adjacent shallow overbank area.

During startup and shutdown operations, blowdown discharges would continue. Therefore, changes in the mixed temperature at the edge of the diffuser mixing zone would not be rapid and would be expected to occur primarily from routine changes in plant operation. These changes would be smaller than the maximum changes of -0.4°C (-0.7°F) and 2.0°C (3.6°F). Therefore, impacts on the rate of temperature change (e.g. fish kills due to cold shock) should be small (AEC 1974, TVA 1991).

Chemical Effects—Analyses of chemical releases to surface waters from operations indicate that releases should comply with NPDES Permit limitations; therefore, the potential impacts of these releases should be minor (TVA 1993). The potential impacts on aquatic organisms from the use of biocides such as chlorine in the treatment of cooling tower makeup water and raw cooling water systems and the use of tolytriazole and potassium hydroxide for pH and corrosion control in the cooling system also should be minor, as the release of these compounds to surface waters is controlled by provisions of the NPDES Permit. Runoff would be treated before release to receiving surface water bodies in accordance with applicable NPDES Permit requirements (TVA 1993).

Radiological Effects—When tritium is ingested by an aquatic organism, incorporation into bodily fluids is very efficient. However, long-term accumulation in the organism is limited by tritium's elimination in body water and its short half-life. The biological properties of tritium are discussed in Appendix C.

TVA has estimated maximum annual doses to aquatic organisms from liquid effluent releases from Bellefonte as originally designed (i.e., without tritium production) at 8.5 millirads for plants, 3.5 millirads for suspended invertebrates, 120 millirads for benthic invertebrates, and 0.4 millirads for fish (TVA 1974b). Instructive in this connection is the benchmark dose of 1 rad per day (1,000 millirads per day) established by the National Council on Radiation Protection and Measurements and IAEA as a level that appears unlikely to cause observable changes in aquatic populations (NCRP 1991, IAEA 1992). It has been concluded that, since the exposure estimates would be small relative to that benchmark and the incremental doses due to tritium production (see the analysis for the public and workers in Section 5.2.3.9) also would be small, the impact of radiological releases on aquatic species would be small, as defined by 10 CFR 51 (see Glossary term "qualitative environmental impacts").

Wetlands

Wetlands likely would not be impacted from runoff or sedimentation during tritium production.

Threatened and Endangered Species

Operational impacts on threatened or endangered species could occur through the release of thermal, chemical, or radioactive discharges to the atmosphere or river. These releases could affect listed species in the vicinity of the site and in the reservoir downstream of the site, either directly or indirectly, through the food chain. Listed species occurring on or in the immediate vicinity of the Bellefonte site also could be affected by the increased human presence or noise during plant operations.

Impacts on threatened or endangered plants from operational activities would not occur, as no Federally or state-listed plant species occur on or in the immediate vicinity of the Bellefonte site. The periodic presence of plant workers at the intake canal and the increased noise levels could cause foraging eagles to move from this area; however, this disruption would be temporary and unlikely to affect the eagles negatively. There should be no other operational impacts on wooded areas used by eagles, gray bats, or Indiana bats.

Potential thermal and chemical effects on aquatic biota are described above. No aquatic listed species occur in the immediate vicinity of the Bellefonte site, and no thermal or chemical impacts to the endangered pink musket and orange-footed pearly mussels that reside in the Guntersville Dam tailwater would be expected. Thermal and chemical effects on the potential prey of bald eagles and gray bats should be small and localized. Thus, thermal or chemical effects on listed threatened or endangered species would be unlikely.

As discussed previously for terrestrial and aquatic species, the impact of radiological releases should not adversely affect the listed threatened and endangered species.

TVA has notified the U.S. Fish and Wildlife Service of DOE's proposed action at Bellefonte and has provided the States of Alabama and South Carolina and the U.S. Fish and Wildlife Service with copies of the CLWR Draft EIS. Copies of the CLWR Final EIS also will be provided to these agencies. The U.S. Fish and Wildlife Service was consulted initially concerning the identification of threatened or endangered species that should be evaluated in the EIS (DOI 1998c). In its response to the CLWR Draft EIS, the U.S. Fish and Wildlife Service concluded that adverse effects to listed species potentially occurring at the site from the proposed action are not anticipated (DOI 1998d). TVA and DOE will continue to comply with the requirements of the Endangered Species Act and will interact with the U.S. Fish and Wildlife Service, as appropriate. TVA is committed to conducting an environmental monitoring program during tritium production operations. Should the monitoring program indicate any adverse impacts to listed species, consultation with the U.S. Fish and Wildlife Service would be initiated immediately to address those impacts.

Environmental Monitoring

Before and during the construction of Bellefonte 1 and 2, TVA conducted an extensive environmental monitoring program. It has continued environmental monitoring for various parameters during the period of construction deferment, especially as required to comply with various permits (e.g., the NPDES Permit). TVA also has committed to an extensive environmental monitoring program to be conducted during operations, the aim being to confirm that operation of the plant does not have a significant adverse impact on the environment, including threatened and endangered species (TVA 1993).

5.2.3.7 Archaeological and Historic Resources

No Action

No impacts on land use are anticipated at the Bellefonte site beyond the effects of existing and future activities that are independent of the proposed action. As a result, no impacts on archaeological or historic resources are expected.

Tritium Production

Analyses of impacts on archaeological and historic resources are presented separately for construction and operations activities.

Construction

There are no known archaeological sites within the previously disturbed areas of the Bellefonte site. Historic resources would be unaffected, as all structures associated with the original Bellefonte town site have been removed since 1974, when it was determined that the site was eligible for placement on the National Register of Historic Places. The town site was not on TVA property, and the buildings were removed by non-TVA land owners. Before construction of the existing facilities at Bellefonte, the Alabama State Historic Preservation Office approved the design and indicated that no mitigation would be required (TVA 1997f).

Operation

No impacts to historic or archaeological resources would occur from tritium production activities at the Bellefonte site.

5.2.3.8 Socioeconomics

The socioeconomic impacts resulting from the completion and operation of the Bellefonte units are presented for Unit 1 and then for both units combined. Completion and operation of Bellefonte 2 without Bellefonte 1 is not considered a Reasonable Alternative (see Section 3.2.3).

5.2.3.8.1 Bellefonte 1

No Action

The No Action Alternative requires the continuation of the deferred status of Bellefonte 1. Therefore, no socioeconomic impacts are expected. Approximately 80 employees maintain the partially completed plant in its layup condition.

Tritium Production

Estimates of the staffing requirements needed to complete and operate Bellefonte 1 as a nuclear power plant for the production of tritium are presented as **Table 5–32**. About 12,800 person-years will be needed through the five-year construction phase and 800 per year for plant operations. [The estimate of 12,800 person-years takes into account the tendency to variation in employment throughout the construction period, especially in years one and five, and does not reflect the total construction employment figure given in the table.] A comparison of peak staffing levels by year for the No Action Alternative and for the completion of Bellefonte 1 is provided as **Figure 5–1**.

Table 5–32 Staffing for Completion and Operation of Bellefonte 1

Construction Year	*Staffing (Peak)*
1	1,500
2	2,700
3	4,100
4	4,500
5	2,600
6	800+ (operations begin)
7	800
8	800
9	800
10 to 40+	800

Sources: TVA 1998a, TVA 1997e.

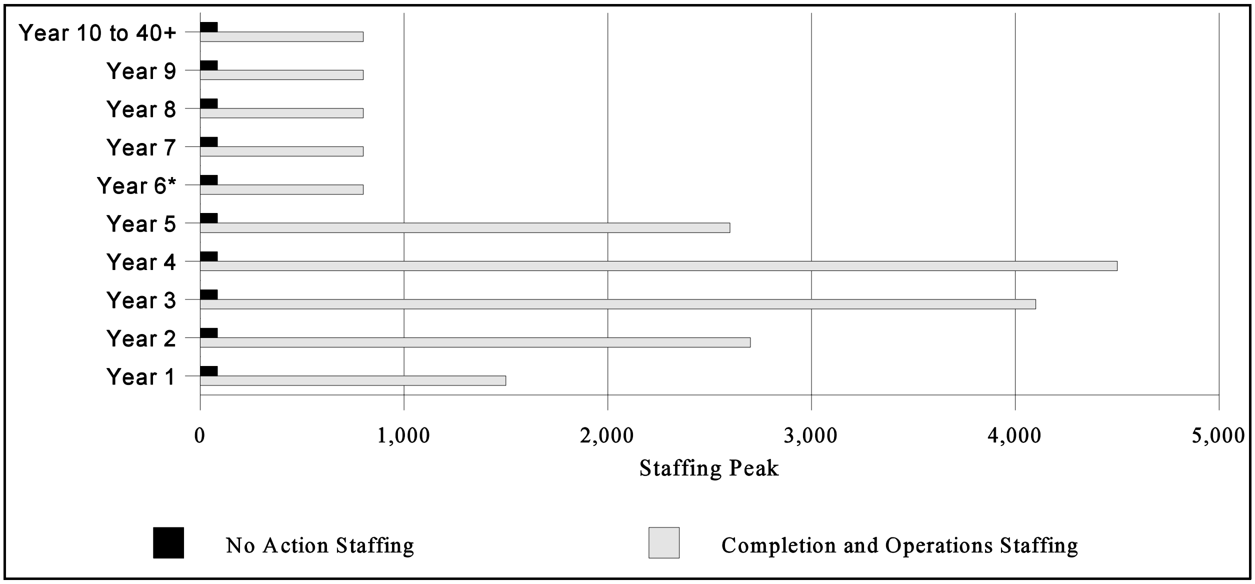

Figure 5–1 Staffing for Completion and Operation of Bellefonte 1, Compared to No Action from First Year of Construction

* Operations begin.
Source: TVA 1998a, TVA 1997e.

Income estimates for construction and operations staff are based on local earnings of about $65,000 per person-year, an estimate that is 30 percent higher than the estimated labor cost to complete and operate the facility as a nonnuclear plant. Such high compensation reflects the requirements levels for many categories of nuclear construction and operations and would provide increased revenues to the local economy.

Another potentially important socioeconomic benefit is the direct and indirect income associated with the procurement of equipment and supplies for completion of the plant. Millions of dollars would be added to the local economy during the construction and operations periods.

The largest impacts would be experienced in the Scottsboro-Hollywood area of Jackson County. A larger region of influence encompassing the commuting area would have a lesser effect. The reasons for the concentration of socioeconomic impacts within Jackson County and Scottsboro-Hollywood are several. First, Scottsboro-Hollywood—population approximately 15,000 (DOC 1998c),—is the only densely populated area within Jackson County. Second, due to the sparseness of the plant environs, local spending and indirect income generation from that spending are concentrated in the Scottsboro-Hollywood area. Third, procurement of goods and services by the plant and TVA outside Jackson County would be modest. Major impacts such as those relating to schools and taxes would be felt within the county, but not within the region of influence outside the county.

Population and Housing

The completion of Bellefonte 1 would result in a temporary increase in population and income in the region of influence as a direct and indirect result of increased employment at the site. An estimated 33 percent of the construction workers and 50 percent of the operations workers would be expected to move into the area. This is consistent with the values in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997f).

About 75 percent of the construction workers and 90 percent of the operations workers would be expected to live in Jackson County. About 70 percent could be expected to live in the Scottsboro-Hollywood area, assuming housing were available. About 20 percent likely would be located along Routes 79 and 72 in the valley between Guntersville and Bridgeport, with the remainder scattered throughout the county.

The influx of construction and plant operations personnel, plus families, would increase the population of Jackson County by about 3,200, or more than 6 percent. This influx within a period of four years would be about 70 percent greater than local growth in the seven years from 1990 through 1997. Within the Scottsboro-Hollywood area, the estimated peak population influx of about 2,200 workers and family members would represent a 14 percent overall population increase. Adding indirect employees and their families, the population influx into the Scottsboro-Hollywood area could exceed 25 percent at the peak. Peak population growth in Jackson County, including indirect employees and their families, would probably be no more than about 10 percent. Population impacts outside Jackson County would be negligible.

Most construction workers prefer not to buy permanent housing. Their housing needs would include rental homes and apartments, mobile homes, and camper-trailers. Operations workers generally purchase permanent single-family housing. Up to 70 percent of all incoming construction workers and 90 percent of all operations workers would be expected to bring their families. That number could be appreciably lower than 70 percent, depending on the availability of rentals and trailer parks for camper-trailers. Currently, trailer parks near the Bellefonte site are close to capacity. A trailer park with an estimated capacity of 250 campers/trailers is planned for operation near the site in the fall of 1998. Additional trailer parks could be built in three to four months if construction activity at the plant increased rapidly. DOE is estimating maximum housing and, more importantly, school system impacts, based on the expectation that up to 70 percent of construction workers moving into the area would bring their families.

Demand for housing by construction and operations workers in the vicinity of Bellefonte would increase during the completion and operation of the plant. Data indicate that vacant permanent housing for sale and rent in the vicinity of the Bellefonte plant is insufficient to meet this demand. It is anticipated, however, that the completion and operation of Bellefonte will stimulate the construction of additional permanent housing, the opening of new trailer parks, and the expansion of existing parks to meet this demand, thereby producing a positive effect on the regional economy. It is expected that these new units also would meet permanent housing requirements for plant operations workers and their families.

Employment and Income

Peak employment during construction has been estimated at 4,500. Average employment for construction workers during the four years of the construction phase would be about 2,400 per year. Operations workers would average 800 per year over the operational life of the plant. Indirect employment (e.g., food, retail, banking) could reach an average at least equal to the number of operations workers. During the construction phase, indirect employment would be considerably higher. The effect of this change in employment at the county level would be high. Unemployment in 1997 averaged 8.2 percent. This could decline by very roughly half over the first few years of construction, and then unemployment likely would stabilize at least two points below the average. The unemployment rate would not drop by as much as the employment requirements would suggest. As the construction project escalated and the labor market tightened, the labor pool would expand from the influx of immigrating workers.

Total person-years of employment during construction, including operations staff, have been estimated at about 12,800 over the five-year construction phase. This level of employment should generate about $835 million in direct labor earnings to the region of influence (i.e., wages and benefits). A large fraction of the locally generated income would be spent locally, and indirect economic impacts would be expected. By means of an income multiplier of 1.7, total earnings during the period would exceed approximately $1.4 billion. This multiplier compares to the roughly 1.8 to 2.5 multipliers TVA used to estimate the impact of conversion of Bellefonte 1 to a nonnuclear plant (TVA 1997f).

Regional earnings during the period of plant operation have been estimated at a minimum of $100 million per year. This estimate was developed using a multiplier of 1.8. The higher multiplier reflects the longer-term, more level injection of income into the region during operations than during construction. It is consistent with the multipliers used by TVA for the largest conversion scenario at Bellefonte.

Public Finance and Schools

Construction and operation of Bellefonte 1 as a nuclear unit would generate about $5.5 million per year in tax-equivalent payments (payments in-lieu-of-taxes) for Alabama. Tax revenues to the region of influence and Jackson County and, in part, to the Scottsboro-Hollywood area are derived from real estate taxes, motor vehicle taxes, and motor vehicle and mobile home sales taxes. Income and sales taxes are collected at the state level. Jackson County collected approximately $9.4 million (roughly $200 per capita) in taxes in 1997.

Completion of the plant would affect the school systems of Jackson County and Scottsboro City. The county school system has approximately 6,500 students; the city system, approximately 3,000. Roughly two-thirds of the students (about 6,300) are in the Scottsboro-Hollywood area and the Guntersville-to-Bridgeport corridor, the major impact areas within the county and the region of influence. School facilities within the Scottsboro-Hollywood area and the Guntersville-Bridgeport corridor have the capacity to accommodate about 7,850 students. The peak influx of schoolchildren associated with in-migrating construction and operations workers in the fourth year of construction would be an estimated 970 for the whole of Jackson County, consisting of about 640 in the Scottsboro-Hollywood area, 220 in the Guntersville-Bridgeport corridor, and the remainder in other parts of the county. DOE believes these estimates to be conservative. As discussed in the section on housing, more construction workers than expected could choose to live without their families in camper-trailers rather than with their families in apartments, mobile homes, or single-family homes. As a result, the increase in the number of schoolchildren associated with construction and operations workers would be lower than expected. The number of schoolchildren from the families of in-migrating operations workers would decline to about 325 from the sixth year onward. The impacts of schoolchildren from in-migrating families not directly associated with Bellefonte would be additional.

The Scottsboro school transportation system (excluding Hollywood) operates 26 buses on a dual-route system and 8 on a single-route system (for a maximum of 3,600 students). The actual number of students transported is less than 3,000, leaving a surplus of more than 600. The conversion of some of the 8 single-route buses to a dual-route system could accommodate the peak influx of about 600 students in the Scottsboro system (excluding about 40 students in Hollywood) from families of in-migrating construction and operation workers.

The Jackson County school transportation system would experience an impact similar to the Scottsboro school transportation system. By increasing the number of dual-route operations, the additional number of schoolchildren associated with construction and operation workers could be accommodated.

The combined Jackson County and Scottsboro Boards of Education receive about 40 percent of TVA's payment in-lieu-of-taxes. Completion of Bellefonte 1 would increase TVA's payment to about $5.5 million. Assuming that the 40 percent share were maintained, this would translate into a payment to the Jackson County and Scottsboro boards of about $2.2 million. Over the long term, a payment of $2.2 million would exceed the increase in school costs attributable to students whose families directly support the operation of Bellefonte 1.

In the short term, however, construction of Bellefonte 1 would impose costs averaging almost twice Jackson County's likely long-term receipts from the TVA payment. The TVA payment would not reach the $5.5 million level until plant operations began. Educational costs in the Scottsboro school system could increase by an estimated average of $3 million per year (1997$) for the three busiest years of the construction phase. This estimate includes the cost of hiring 37 additional teachers for the estimated 530 new students averaged over the three peak years of construction to maintain the current student-teacher ratio of about 14:1. The peak year of construction could require an additional 5 teachers over the three-year average of 37 to maintain the current student-teacher ratio. Average educational costs could rise to an estimated $5,432 per student (1997$), based on actual costs of $5,120 per student for the 1995-96 school year plus inflation.

For the Jackson County school system (excluding Scottsboro but including Hollywood), educational costs could increase by an average of less than $1.8 million per year (1997$) for the three busiest years of the construction phase. This estimate includes the cost of hiring 23 additional teachers for the estimated 305 new students averaged over the three peak years to maintain the current student-teacher ratio of about 14:1. The peak year of construction could require an additional 4 teachers over the three-year average of 23 to maintain the current student-teacher ratio. Average educational costs could rise to an estimated at $5,716 per student (1997$), based on actual costs for the 1997-98 school year.

Assuming inflation-related increases of 3 percent per year in costs per student from the amounts reported above, average annual costs for the three-year period beginning with the 2001-2002 school year could rise to an estimated $3.4 million per year for Scottsboro and $1.9 million for the rest of Jackson County. These amounts are in the range of 18 percent and 4 percent of the current school system budgets for Scottsboro and Jackson County, respectively. The costs per student from in-migrating families not directly associated with Bellefonte would be additional.

Costs for the first two years would be well below the three-year construction period average and would allow a gradual phase-in of revenues and expenses to meet the costs associated with the increased student population. **Figures 5-2** and **5-3** reflect the projected budget requirements for the first four years of construction versus the No Action Alternative for the Scottsboro and Jackson County school boards. To meet its expenses, the Scottsboro Board of Education could request additional funding from the State of Alabama.

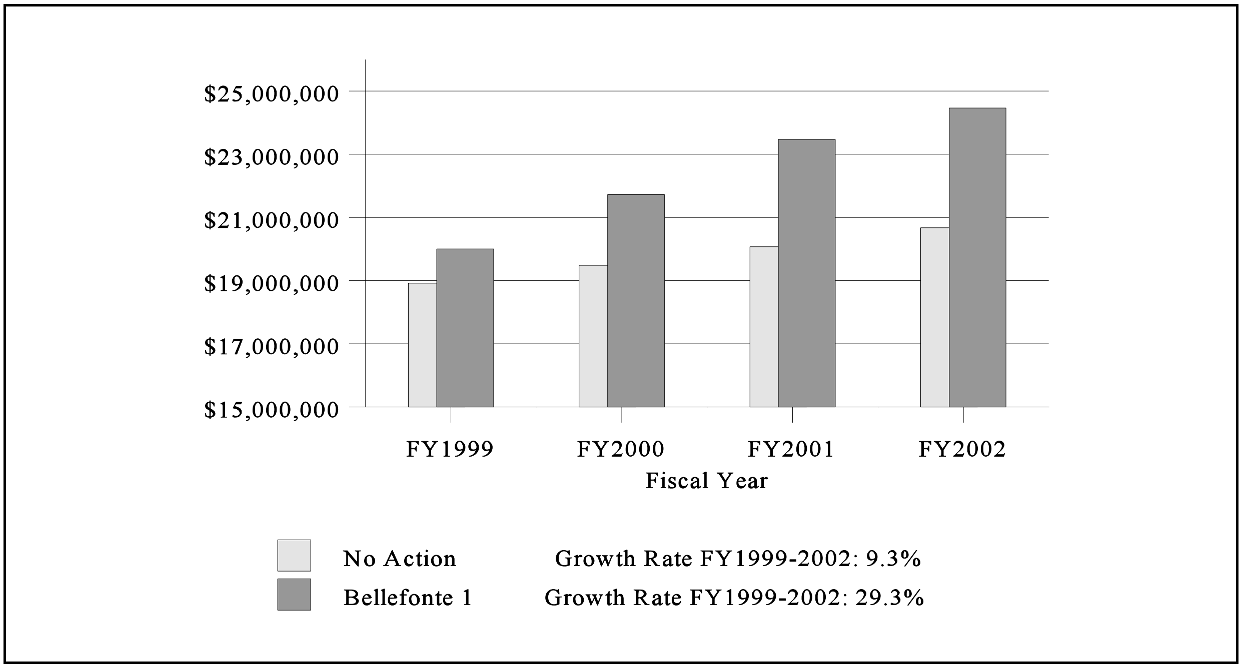

Figure 5-2 Scottsboro School Board Projected Budget, Completion of Bellefonte 1 Versus the No Action Alternative (FY 1999-2002)

Source: Scottsboro 1998.

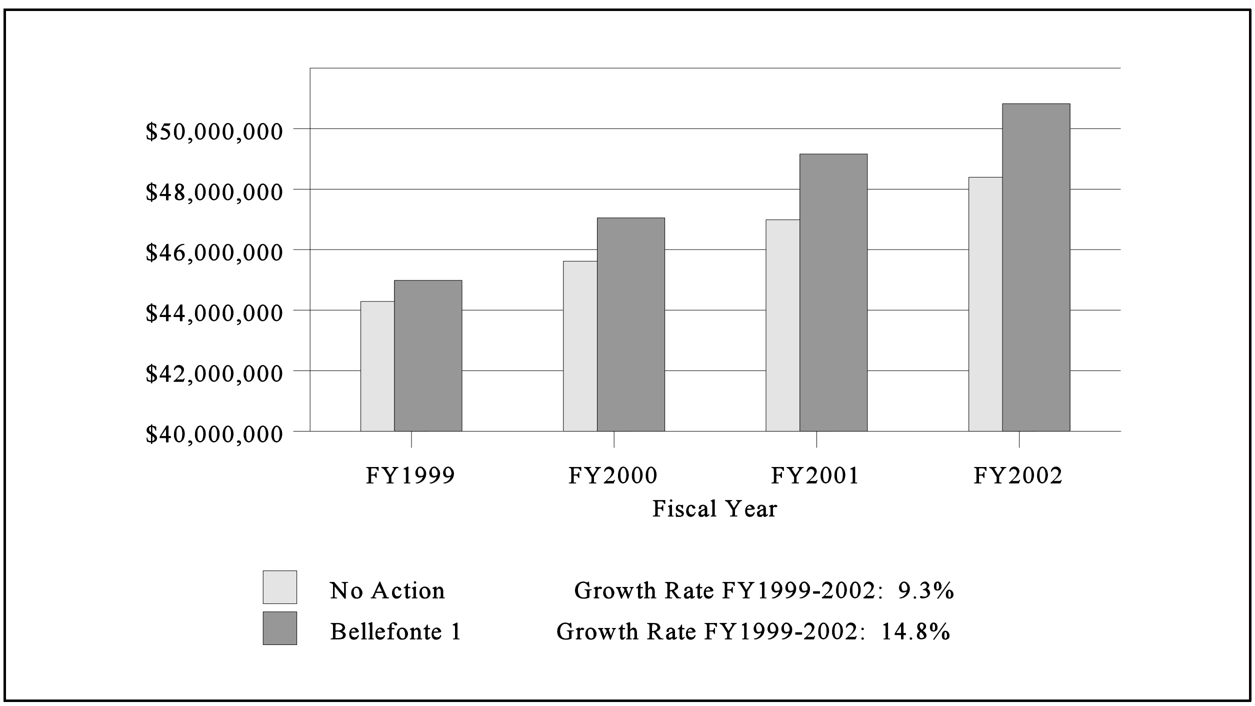

Figure 5-3 Jackson County School Board Projected Budget, Completion of Bellefonte 1 Versus the No Action Alternative (FY 1999-2002)

Source: Scottsboro 1998.

Additional tax revenues also would be generated by the increased economic activity involving the plant and plant workers. Such revenues (e.g., property taxes, income taxes, real estate transfer fees, sales taxes, motor vehicle taxes) are collected by or on behalf of the state government and then distributed to the jurisdictions.

The effect of an influx of families on other areas of public finance (e.g., fire, police, ambulance, hospitals) should be minimal. Additional and new equipment would be required for the police and fire departments, but these items could probably be accommodated within the overall expanding budgets arising from additional tax revenues and payments in-lieu-of-taxes.

Local Transportation

Traffic generated by construction activities associated with the completion of Bellefonte 1 could strain the capacity of the local road network. Traffic impacts during construction would be temporary and similar to the impacts described for the Bellefonte conversion project (TVA 1997f). During peak construction periods, U.S. Highway 72 could experience a 46 percent increase in traffic volume during morning and evening rush hours to the north, and a 48 percent increase in traffic volume to the south. Access roads to the Bellefonte site could experience more than an 80 percent increase in traffic volumes during these hours.

Increased traffic volumes during plant operations, attributable both to the commuting of 800 additional plant employees and to truck transport requirements, would decrease the available capacity of site access roads during morning and evening rush hours. The impacts would be lower than those experienced during peak construction. During plant operations, U.S. Highway 72 could experience a 13 percent increase in traffic volume during morning and evening rush hours to the north, and a 14 percent increase in traffic volume to the south. Access roads to the Bellefonte site could experience a 43 to 59 percent increase in traffic volumes during these hours. Additional truck traffic during plant operations would include a total of 16 shipments of TPBARs to and from the plant per year.

Possible measures that could be used to mitigate traffic volume impacts are physical improvements to the local roads or road network to increase capacity, including construction of additional vehicle lanes throughout road segments, construction of passing lanes in certain locations, or realignment to eliminate some of the no-passing zones. Employee programs that provide flexible hours also could reduce road travel during peak hours, and restrictions for trucks traveling during the peak hours could be made. Also, establishing employee programs and incentives for ride-sharing could be encouraged, and bus and/or vanpool programs could be initiated.

5.2.3.8.2 Bellefonte 1 and 2

No Action

The No Action Alternative requires continuation of the deferred status of Bellefonte 1 and 2. Therefore, no socioeconomic impacts are expected. Approximately 80 employees maintain the partially completed plant in its lay-up condition.

Tritium Production

Estimates of the staffing requirements needed to complete and operate Bellefonte 1 and 2 as a nuclear power plant are presented as **Table 5–33**. About 15,600 person-years will be needed through the six-year construction phase and 1,000 persons per year will be needed for plant operations. In terms of construction workers, completion of Bellefonte 1 and 2 is estimated to require about 10 percent more labor hours than completion of Bellefonte 1 alone, because all the common facilities were completed as part of Bellefonte 1. Peak employment would be about the same in either case; the additional Bellefonte 2–related employment would occur mainly in the fifth and sixth years of the construction program. A comparison of the peak staffing levels by year for the No Action Alternative and for the completion of Bellefonte 1 and 2 is provided in **Figure 5–4**.

Table 5–33 Staffing For Completion And Operation of Bellefonte 1 and 2

Construction Year	*Staffing (Peak)*
1	1,400
2	3,000
3	4,000
4	4,500
5	3,900 (Bellefonte 1 operates)
6	2,000 (Bellefonte 2 operates)
7	1,000
8	1,000
9	1,000
10 to 40+	1,000

Source: TVA 1998a.

Figure 5–4 Staffing for Completion and Operation of Bellefonte 1 and 2, Compared to No Action from First Year of Construction

*Operations at Bellefonte 1 begin.
**Operations at Bellefonte 2 begin.
Sources: TVA 1998a, TVA 1997e.

Income estimates for construction and operations staff are based on local earnings of about $65,000 per person-year, an estimate that is 30 percent higher than the estimated labor cost to complete and operate the facility as a nonnuclear plant. Such high compensation reflects the requirements levels for many categories of nuclear construction and operations and would provide increased revenues to the local economy.

Another potentially important socioeconomic benefit is the direct and indirect income associated with the procurement of equipment and supplies for completion of the plant. Millions of dollars would continue to be added to the local economy during the construction and operations period.

The largest impacts would be experienced in the Scottsboro-Hollywood area of Jackson County. A larger region of influence encompassing the commuting area would have a lesser effect. The reasons for the concentration of socioeconomic impacts within Jackson County and Scottsboro-Hollywood are several. First, Scottsboro-Hollywood—population approximately 15,000 (DOC 1998c)—is the only densely populated area within Jackson County. Second, due to the sparseness of the plant environs, local spending and indirect income generation from that spending are concentrated in the Scottsboro-Hollywood area. Third, procurement of goods and services by the plant and TVA outside Jackson County would be modest. Major impacts such as those relating to schools and taxes would be felt within the county, but not within the region of influence outside the county.

Population and Housing

The completion of Bellefonte 1 and 2 would result in a temporary increase in population and income in the region of influence as a direct and indirect result of increased employment at the site. An estimated 33 percent of the construction workers and 50 percent of the operations workers would be expected to move into the area. This is consistent with the values in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997f).

About 75 percent of the construction workers and 90 percent of the operations workers who moved would be expected to live in Jackson County. About 70 percent could be expected to live in the Scottsboro-Hollywood area, assuming housing were available. About 20 percent likely would be located along Route 79 and Route 72 in the valley between Guntersville and Bridgeport, with the remainder scattered throughout the county.

The influx of construction and plant operations personnel, plus families, would increase the population of Jackson County by about 3,500, or more than 7 percent. This influx within a period of four years would be about 80 percent greater than local growth in the seven years from 1990 through 1997. Within the Scottsboro-Hollywood area, the estimated peak population influx of about 2,300 workers and family members would represent a 15 percent overall population increase. Adding indirect employees and their families, the population influx into the Scottsboro-Hollywood area could exceed 25 percent at the peak. Peak population growth in Jackson County, including indirect employees and their families, would probably be no more than about 12 percent. Population impacts outside Jackson County would be small.

Most construction workers prefer not to buy permanent housing. Their housing needs would include rental homes and apartments, mobile homes, and camper-trailers. Operations workers generally purchase permanent single-family housing. Up to 70 percent of all incoming construction workers and 90 percent of all operations workers would be expected to bring their families. That number could be appreciably lower than 70 percent, depending on the availability of rentals and trailer parks for camper-trailers. Currently, trailer parks near the Bellefonte site are close to capacity. A trailer park with an estimated capacity of 250 campers/trailers is planned for operation near the site in the fall of 1998. Additional trailer parks could be built in three to four months if construction activity at the plant increased rapidly. DOE is estimating maximum housing and, more importantly, school system impacts, based on the expectation that up to 70 percent of construction workers moving into the area would bring their families.

Demand for housing by construction and operations workers in the vicinity of Bellefonte would increase during the completion and operation of the plant. Data indicate that vacant permanent housing for sale and rent in the vicinity of the Bellefonte plant is insufficient to meet this demand. It is anticipated, however, that the completion and operation of Bellefonte would stimulate the construction of additional permanent housing, the opening of new trailer parks, and the expansion of existing parks to meet this demand, thereby producing a positive effect on the regional economy. It is expected that these new units also would meet permanent housing requirements for plant operations workers and their families.

Employment and Income

Peak employment during construction has been estimated at 4,500. Average employment during the middle four years of the construction phase would be about 3,650 per year. Operations workers would average 1,000 per year over the operational life of the plant. Indirect employment (e.g., food, retail, banking) could reach an average at least equal to the number of operations workers. During the construction phase, indirect employment would be considerably higher. The effect of this change in employment in Jackson County would be high. Unemployment in 1997 averaged 8.2 percent. This would be expected to decline to perhaps 3 percent over the first few years of construction, and then likely would stabilize at least two points below the average. The unemployment rate would not drop by as much as the employment requirements would suggest. As the construction project escalated and the labor market tightened, the labor pool would expand from the influx of immigrating workers.

Total person-years of employment during construction, including operations staff, have been estimated at about 15,600 over the six-year construction phase. This level of employment should generate about $1 billion in direct labor earnings to the region of influence (i.e., wages and benefits). A large fraction of the locally generated income would be spent locally, and indirect economic impacts would be expected. By means of an income multiplier of 1.7, total earnings during the period have been estimated at more than $1.7 billion. This multiplier compares to the roughly 1.8 to 2.5 multipliers TVA used to estimated the impact of conversion of the Bellefonte Nuclear Plant to a nonnuclear plant (TVA 1997e).

Regional earnings during the period of plant operation have been estimated at a minimum of $115 million per year. This estimate was developed using a multiplier of 1.8. The higher multiplier reflects the longer-term, more level injection of income into the region during operations than during construction. It is consistent with the multipliers used by TVA for the largest conversion scenario at Bellefonte.

Public Finance and Schools

Construction and operation of Bellefonte 1 and 2 as a nuclear plant would generate more than $8 million per year in tax-equivalent payments (payments in-lieu-of-taxes) for Alabama. Tax revenues to the region of influence and Jackson County and, in part, to the Scottsboro-Hollywood area are derived from real estate taxes, motor vehicle taxes, and motor vehicle and mobile home sales taxes. Income and sales taxes are collected at the state level. Jackson County collected approximately $9.4 million (roughly $200 per capita) in taxes in 1997.

Completion of the plant would affect the school systems of Jackson County and Scottsboro City. The Jackson County school system has approximately 6,500 students; the city system, approximately 3,000. Roughly two-thirds of the students (about 6,300) are in the Scottsboro-Hollywood area and the Guntersville-to-Bridgeport corridor, the major impact areas within the county and the region of influence. School facilities within the Scottsboro-Hollywood area and Guntersville-Bridgeport corridor have the capacity to accommodate about 7,850 students. The peak influx of schoolchildren associated with in-migrating construction and operations workers in the fourth year of construction would be an estimated 1,055 for the whole of Jackson County, consisting of about 700 in the Scottsboro-Hollywood area, 235 in the Guntersville-Bridgeport corridor, and the remainder in other parts of the county. DOE believes these estimates to be conservative. As discussed in the section on housing, more construction workers than expected could choose to live without their families in camper-trailers rather than with their families in apartments, mobile homes, or single-family homes. As a result, the increase in the number of schoolchildren associated with construction and operations workers would be lower than expected. The number of schoolchildren from the families of in-migrating operations workers would decline to about 400 from the seventh year onward. The impacts of schoolchildren from in-migrating families not directly associated with Bellefonte would be additional.

The Scottsboro school transportation system (excluding Hollywood) operates 26 buses on a dual-route system and 8 on a single-route system (for a maximum of 3,600 students). The actual number of students transported is less than 3,000, leaving a surplus of more than 600. The conversion of some of the 8 single-route buses to a dual-route system could accommodate the peak influx of about 655 students in the Scottsboro system (excluding about 45 students in Hollywood) from families of in-migrating construction and operation workers.

The Jackson County school transportation system would experience an impact similar to the Scottsboro school transportation system. By increasing the number of dual-route operations, the additional number of schoolchildren associated with construction and operation workers could be accommodated.

The combined Jackson County and Scottsboro Boards of Education receive about 40 percent of TVA's payment in-lieu-of-taxes. Completion of Bellefonte 1 and 2 would increase TVA's payment to about $8 million. Assuming that the 40 percent share were maintained, this would translate into a payment to the Jackson County and Scottsboro boards of about $3.2 million. Over the long term, a payment of $3.2 million would exceed the increase in school costs attributable to students whose families directly support the operation of Bellefonte 1 and 2.

In the short term, however, construction of Bellefonte 1 and 2 would impose costs averaging almost twice Jackson County's likely long-term receipts from the TVA payment. The TVA payment would not reach the $8 million level until plant operations began. Educational costs in the Scottsboro school system could increase by an estimated average of $3.5 million per year (1997$) for the three busiest years of the construction phase. This estimate includes the cost of hiring 43 additional teachers for the estimated 615 new students averaged over the three peak years of construction to maintain the current student-teacher ratio of about 14:1. The peak year of construction could require an additional 3 teachers over the three-year average of 43 to maintain the current student-teacher ratio. Average educational costs could rise to an estimated $5,432 per student (1997$), based on actual costs of $5,120 per student for the 1995-96 school year plus inflation.

For the Jackson County school system (excluding Scottsboro but including Hollywood), educational costs could increase by an average of less than $2.1 million per year (1997$) for the three busiest years of the construction phase. This estimate includes the cost of hiring 23 additional teachers for the estimated 355 new students averaged over the three peak years to maintain the current student-teacher ratio of about 14:1. The peak year of construction could require an additional 6 teachers over the three-year average of 23 to maintain the current student-teacher ratio. Average educational costs could rise to an estimated $5,716 per student (1997$), based on actual costs for the 1997-98 school year.

Assuming inflation-related increases of 3 percent per year in costs per student from the amounts reported above, average annual costs for the three-year period beginning with the 2001-2002 school year could rise to an estimated $3.9 million per year for Scottsboro and $2.3 million for the rest of Jackson County. These amounts are in the range of 20 percent and 4 percent of the current school system budgets for Scottsboro and Jackson County, respectively. The costs per student from in-migrating families not directly associated with Bellefonte would be additional.

Costs for the first two years would be well below the three-year construction period average and would allow a gradual phase-in of revenues and expenses to meet the costs associated with the increased student population. **Figures 5–5** and **5–6** reflect the projected budget requirements for the first four years of construction versus the No Action Alternative for the Scottsboro and Jackson County School Boards. These growth rates are similar to those for the case in which only Bellefonte Unit 1 is completed, as the differential impacts of

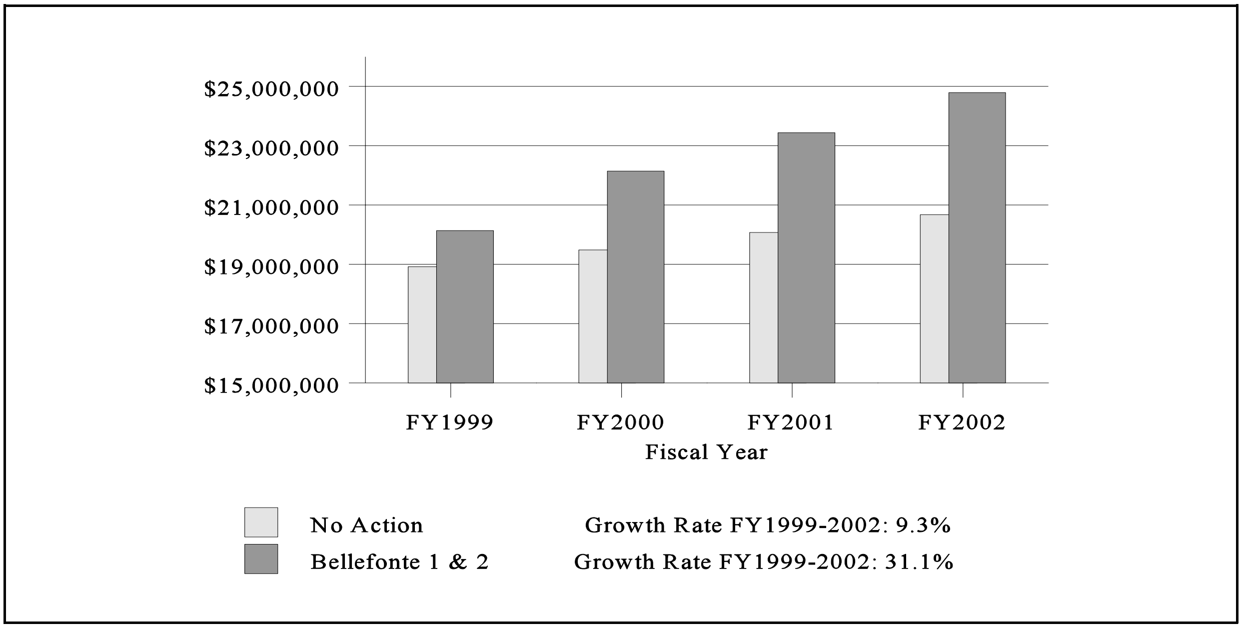

Figure 5-5 Scottsboro School Board Projected Budget, Completion of Bellefonte 1 and 2 Versus the No Action Alternative (FY 1999-2002)

completing Unit 2 become greater in the fifth year of construction. To meet its expenses, the Scottsboro Board of Education could request additional funding from the State of Alabama.

Source: Scottsboro 1998.

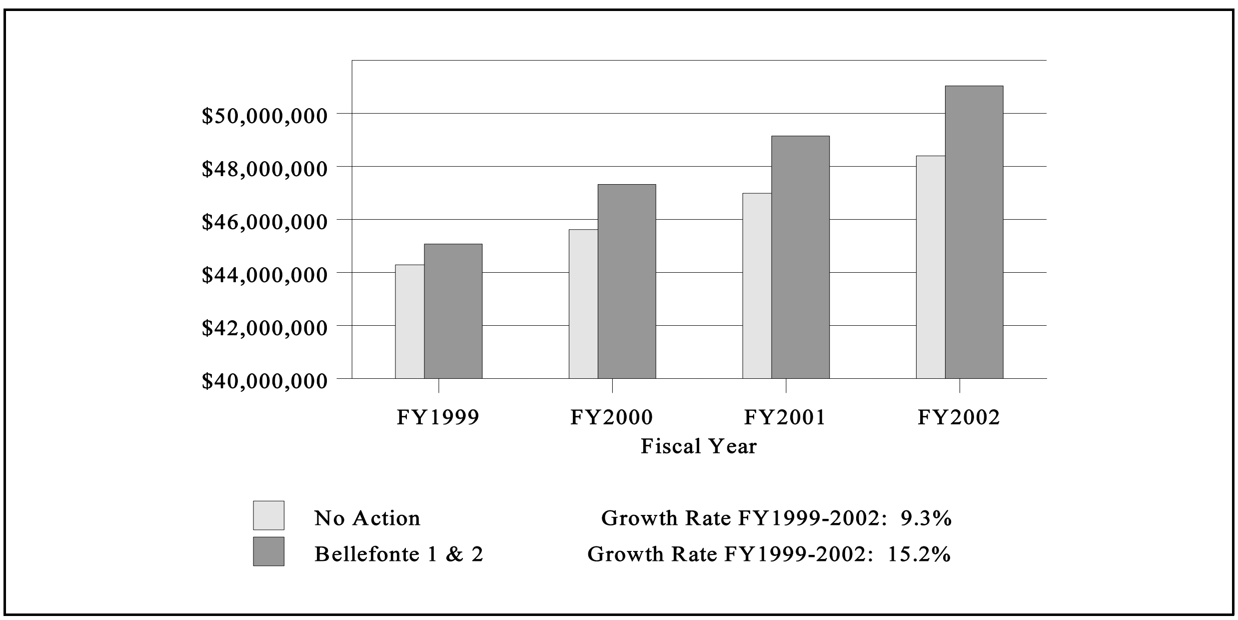

Figure 5-6 Jackson County School Board Projected Budget, Completion of Bellefonte 1 and 2 Versus the No Action Alternative (FY 1999-2002)

Source: Scottsboro 1998.

Additional tax revenues also would be generated by the increased economic activity involving the plant and plant workers. Such revenues (e.g., property taxes, income taxes, real estate transfer fees, sales taxes, motor vehicle taxes) are collected by or on behalf of the state government and then distributed to the jurisdictions. The effect of an influx of families on other areas of public finance (e.g., fire, police, ambulance, hospitals) should be minimal. Additional and new equipment would be required for the police and fire departments, but these items could probably be accommodated within the overall expanding budgets arising from additional tax revenues and payments in-lieu-of-taxes.

Local Transportation

Traffic generated by construction activities associated with the completion of Bellefonte 1 and 2 could strain the capacity of the local road network. Traffic impacts during construction would be temporary and similar to the impacts described for the Bellefonte conversion project (TVA 1997f). During peak construction periods, U.S. Highway 72 could experience a 46 percent increase in traffic volume during morning and evening rush hours to the north, and a 48 percent increase in traffic volume to the south. Access roads to the Bellefonte site could experience more than an 80 percent increase in traffic volumes during these hours.

Increased traffic volumes during plant operations, attributable both to the commuting of 1,000 additional plant employees and to truck transport requirements, would decrease the available capacity of site access roads during morning and evening rush hours. The impacts would be lower than those experienced during peak construction. During plant operations, U.S. Highway 72 could experience a 16 percent increase in traffic volume during morning and evening rush hours to the north and a 17 percent increase in traffic volume to the south. Access roads to the Bellefonte site could experience a 48 to 64 percent increase in traffic volumes during these hours. Additional truck traffic during plant operations would include a total of 16 shipments of TPBARs to and from the plant per year.

Possible measures that could be used to mitigate traffic volume impacts are physical improvements to the local roads or road network to increase capacity, including construction of additional vehicle lanes throughout road segments, construction of passing lanes in certain locations, or realignment to eliminate some of the no-passing zones. employee programs that provide flexible hours also could reduce road travel during peak hours, and restrictions for trucks traveling during the peak hours could be made. Also, establishing employee programs and incentives for ride-sharing could be encouraged, and bus and/or vanpool programs could be initiated.

5.2.3.9 Public and Occupational Health and Safety

This section describes the impacts of radiological and hazardous chemical releases resulting from the construction activities required to complete the units, as well as the normal operation, abnormal conditions, or accidents due to tritium production at Bellefonte 1 or both Bellefonte 1 and 2.

5.2.3.9.1 Normal Operation

RADIOLOGICAL IMPACTS

The annual gaseous radioactive emissions and liquid radioactive effluents from the production of tritium at Bellefonte 1 are presented in Sections 5.2.3.3 and 5.2.3.4, respectively. Presented in **Table 5–34** are the radiological impacts of both gaseous and liquid radioactive releases on the maximally exposed offsite individual and on the general public living within 80 kilometers (50 miles) of Bellefonte 1 in the year 2025. **Table 5–35** provides the radiological impacts on the facility workers. A facility worker is defined as any "monitored" reactor plant employee. Doses to these workers would be kept to minimal levels through programs to keep worker doses as low as reasonably achievable. The tables include the impacts of the No

Action Alternative and, for comparison purposes, the estimated radiological impacts of operation of Bellefonte 1 and 2 without tritium production (0 TPBARs). These values are based on the Bellefonte Final

Table 5–34 Annual Radiological Impacts from Incident-Free Tritium Production Operations at Bellefonte 1

Tritium Production	*Release Media*	*Maximally Exposed Offsite Individual*		*Population Within 80 kilometers (50 miles) for the Year 2025*	
		Dose (millirem)	*Latent Fatal Cancer Risk*	*Dose (person-rem)*	*Latent Fatal Cancers*
No Action (not operating)	Air	0	0	0	0
	Liquid	0	0	0	0
	Total	0	0	0	0
0 TPBARs [a] (operation without tritium production)	Air	0.25	1.3×10^{-7}	0.27	0.00014
	Liquid	0.012	6.0×10^{-9}	1.1	0.00055
	Total	0.26	1.4×10^{-7}	1.4	0.00069
Incremental dose for 1,000 TPBARs	Air	0.0020	1.0×10^{-9}	0.13	0.000065
	Liquid	0.0012	6.0×10^{-10}	0.14	0.000070
Total dose for 1,000 TPBARs [b]	Air	0.25	1.3×10^{-7}	0.40	0.00020
	Liquid	0.013	6.5×10^{-9}	1.2	0.00060
	Total	0.26	1.3×10^{-7}	1.6	0.00080
Incremental dose for 3,400 TPBARs	Air	0.0065	3.3×10^{-9}	0.44	0.00022
	Liquid	0.0042	2.1×10^{-9}	0.47	0.00024
Total dose for 3,400 TPBARs[b]	Air	0.26	1.3×10^{-7}	0.71	0.00036
	Liquid	0.016	8.0×10^{-9}	1.6	0.00080
	Total	0.28	1.4×10^{-7}	2.3	0.0012

[a] AEC 1974.
[b] The total values are a summation of incremental impacts attributable to tritium production and estimated Bellefonte 1 operational impacts.
Note: The impacts from Bellefonte 1 and 2 operation would be twice those for Bellefonte 1.

Environmental Statement (AEC 1974). Based on actual experience at Watts Bar 1 and Sequoyah 1 and 2 (see Tables 5–4 and 5–14), the actual values are expected to be lower.

Background information on the effects of radiation to human health and safety is included in Appendix C. The calculation method and assumptions are presented in Appendix C, Section C.3.

Table 5–35 Annual Radiological Impacts to Workers from Incident-Free Tritium Production Operations at Bellefonte 1

Impact	*No Action*[a]	*0 TPBARs*[b]	*1,000 TPBARs*	*Total With 1,000 TPBARs*[c]	*3,400 TPBARs*	*Total With 3,400 TPBARs*[c]
Average worker dose (millirem)[d]	0	104	0.33	104.33	1.1	105.1
Latent fatal cancer risk	0	4.2×10^{-5}	1.6×10^{-7}	4.2×10^{-5}	4.5×10^{-7}	4.2×10^{-5}
Total worker dose (person-rem)	0	112	0.35	112.35	1.2	113.2
Latent fatal cancers	0	0.045	0.00014	0.045	0.00048	0.045

[a] These no action values represent the absence of impacts associated with the nonoperational status of Bellefonte.
[b] The 0 TPBARs entry is included for consistency with the Watts Bar and Sequoyah analyses.
[c] These values are a summation of incremental impacts and estimated single Bellefonte unit operational (baseline) impacts. "Baseline" impacts are defined as those impacts that result from normal plant (design specification) operation (i.e., operations without tritium production activities).
[d] Based on 1,073 badged workers.
Note: The impacts from Bellefonte 1 and 2 are twice those for Bellefonte 1.
Sources: TVA 1998d, TVA 1998e.

No Action

Under the No Action Alternative, the health and safety risk of members of the public and facility workers at Bellefonte 1 would remain at the level associated with the natural background radiation.

Tritium Production

Construction

During construction, no radioactive materials would be handled. Therefore, there would be no radiological impacts on the workers and the general population.

Operation

During tritium production, the health and safety risk of the public and facility workers would increase as a function of Bellefonte's normal operation as a nuclear reactor facility and the estimated releases of tritium in gaseous emissions and liquid effluents. As shown in Tables 5–34 and 5–35, for 3,400 TPBARs in the reactor core:

- The annual dose to the maximally exposed offsite individual would be 0.28 millirem per year, with an associated 1.4×10^{-7} latent cancer fatality per year of operation. This dose is 1.1 percent of the annual total dose limit of 25 millirem set by regulations in 40 CFR 190.

- The collective dose to the population within 50 miles of Bellefonte 1 would be 2.3 person-rem per year, with an associated 0.0012 latent cancer fatality per year of operation.

- The collective dose to the facility workers would be 113.2 person-rem per year, with an associated 0.045 latent cancer fatality per year of operation.

In addition to the assumed normal operation release of tritium through permeation, an additional potential release scenario considered in this EIS is the failure of 1 or more TPBARs such that the inventory of the TPBARs is released to the primary coolant. The occurrence of TPBAR failure is considered to be beyond that associated with normal operating conditions and, as discussed in Section 1.9, such an assumption is extremely conservative. The radiological consequences to the public and workers resulting from the assumption of 2 TPBAR failures in a given core load of 3,400 TPBARs at Bellefonte 1 are presented in **Tables 5–36** and **5–37**. Releases, doses, and cancer risk associated with 1 TPBAR failure can be determined by dividing the values in Tables 5–36 and 5–37 by two.

Table 5–36 Radiological Impacts to the Public from the Failure of 2 TPBARs at Bellefonte 1

Release Pathway	*Release Quantity (Curies)*	*Dose to Maximally Exposed Individual (millirem)*	*Latent Fatal Cancer Risk*	*Dose to Population Within 80 kilometers (50 miles) (person-rem)*	*Latent Fatal Cancers*
Air	2,315	0.045	2.3×10^{-8}	3.0	0.0015
Liquid	20,835	0.028	1.4×10^{-8}	3.2	0.0016

Table 5–37 Radiological Impacts to Workers from the Failure of 2 TPBARs at Bellefonte 1

Impact Type	*Impact Quantity*
Average Worker Dose (millirem)[a]	7.7
Latent Fatal Cancer Risk	3.1×10^{-6}
Total Worker Dose (person-rem)	8.2
Latent Fatal Cancers	0.0033

[a] Based on 1,073 badged workers.
Note: The impacts from Bellefonte 1 and Bellefonte 2 are twice that for Bellefonte 1.
Source: TVA 1998d, TVA 1998e.

HAZARDOUS CHEMICAL IMPACTS

No Action

Under the No Action Alternative, no additional impacts on public and occupational health and safety from exposure to hazardous chemicals are anticipated at Bellefonte 1 and 2 beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Analyses of impacts on public and occupational health and safety from exposure to hazardous chemicals are presented separately for construction and operations activities.

Construction

Construction activities at the Bellefonte plant could release a number of hazardous chemicals to the atmosphere, as discussed in Section 5.2.3.3 and presented in Table 5–22. The estimated annual and daily airborne concentrations of these chemicals at the location of the maximally exposed offsite individual during construction of both Bellefonte 1 and 2 are presented in **Table 5–38.** Airborne concentrations were estimated using the method described in Section 5.2.3.3 and Appendix C, Section C.4. Table 5–38 also presents the

EPA Inhalation Cancer Unit Risk Factor values for the carcinogenic chemicals (e.g., formaldehyde, arsenic, beryllium, cadmium, chromium, and nickel) and the Reference Concentration values for the noncarcinogenic chemicals (e.g., beryllium, manganese, and mercury). Application of the estimated airborne concentrations to the chemical-specific inhalation cancer unit risk factor and Reference Concentration values, as described in Section C.4, enables estimation of the potential adverse health effects for the maximally exposed offsite individual. For the noncarcinogens, these estimates are chemical-specific Hazard Quotient values; for the carcinogens, they are probabilities of excess latent cancer incidence. Both types of estimates are also presented in Table 5–38.

Table 5–38 Cancer and Noncancer Adverse Health Impacts from Exposure to Hazardous Chemicals at Bellefonte 1 and 2 During Construction

Chemical	*Estimated Annual Airborne Concentration[a] (μg/m3)*	*Estimated Daily Airborne Concentration [a](μg/m^3)*	*Reference Concentration[b] (μg/m^3)*	*Cancer Inhalation Unit Risk Factor[c] (cancers/(μg/m^3)*	*Hazard Quotient[d]*	*MEI Cancer Incidence Probability[e]*
Formaldehyde	8.5×10^{-5}	0.031	Not applicable	0.000013	Not applicable	1×10^{-9}
Arsenic	9×10^{-7}	0.0003	Not applicable	0.0043	Not applicable	4×10^{-9}
Beryllium	5×10^{-7}	0.0002	0.02	0.0024	0.01	1×10^{-9}
Cadmium	2.3×10^{-6}	0.00083	Not applicable	0.0018	Not applicable	4×10^{-9}
Chromium	1.4×10^{-5}	0.005	Not applicable	0.012	Not applicable	2×10^{-7}
Manganese	2.9×10^{-6}	0.001	0.05	Not applicable	0.02	Not applicable
Mercury	6×10^{-7}	0.0002	0.3	Not applicable	0.0007	Not applicable
Nickel	3.6×10^{-5}	0.013	Not applicable	0.00048	Not applicable	2×10^{-8}

MEI = maximally exposed individual
μg/m^3 = micrograms per cubic meter
[a] Estimates of annual and daily airborne concentrations developed by using the ISC3 air dispersion model. See Appendix C, Section C.4, for additional information.
[b] Reference Concentration values are estimates, with uncertainties spanning perhaps an order of magnitude, of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime. Values are developed by the EPA (EPA 1997a , EPA 1998).
[c] Cancer Inhalation Unit Risk Factors are estimates of the cancer potency of carcinogens by the inhalation pathway. Values are developed by the EPA (EPA 1997a, EPA 1998).
[d] Hazard Quotient estimates are developed by dividing the estimated daily airborne concentration by the Reference Concentration. Hazard Quotient estimates are chemical-specific measures of potential noncancer health effects. The Hazard Index is the sum of the Hazard Quotient values. Hazard Index values of less than one suggest low concern for noncancer effects as a result of the exposure, whereas Hazard Index values of greater than one suggest a potential for noncancer effects.
[e] The offsite population maximally exposed individual cancer incidence probability is estimated by multiplying the estimated annual airborne concentration by the Cancer Inhalation Unit Risk Factor. See Appendix C, Section C.4 for additional information.

For the noncarcinogenic chemicals, the chemical-specific Hazard Quotient values are summed to generate a Hazard Index value. Hazard Index values lower than 1 suggest that the offsite receptor likely would not experience adverse noncancer health effects as a result of the exposure. The Hazard Index value for the noncarcinogenic chemicals presented in Table 5–38 is 0.03.

The highest probability estimate for excess latent cancer incidence presented in Table 5–38 (2×10^{-7} for chromium) is lower than the 1 in 1 million established by the EPA as the lower bound of concern. This value suggests that exposure to chromium released from construction activity would result in 2 in 10 million additional chances of cancer incidence for the maximally exposed offsite individual. This estimate is actually higher than would be expected, because all of the released chromium was conservatively assumed to be in the form of chromium VI, which is carcinogenic. Actual releases of chromium also would include some amount of chromium III, which is not carcinogenic.

Operation

During normal operation, the Bellefonte Nuclear Plant could release a number of toxic chemicals to the atmosphere. These chemicals, discussed in Section 5.2.3.3 (Table 5–24), include carcinogenic (e.g., benzene, acetaldehyde, formaldehyde, arsenic, cadmium, chromium VI, and nickel) and noncarcinogenic (e.g., toluene, acetaldehyde, acrolein, manganese, and mercury) substances. The annual and daily airborne concentrations of these chemicals were estimated at the location of the maximally exposed offsite individual using the method described in Section 5.2.3.3 and Appendix C, Section C.4. The concentrations from the operation of both Bellefonte 1 and 2 are presented in **Table 5–39**. The table presents the EPA's Inhalation Cancer Unit Risk Factor values for the carcinogens and the Reference Concentration values for the noncarcinogens. Also presented are the chemical-specific Hazard Quotient estimates for noncarcinogens and the probability estimates for excess latent cancer incidence for carcinogens.

Table 5–39 Cancer and Noncancer Adverse Health Impacts from Exposure to Hazardous Chemicals at Bellefonte 1 and 2 During Normal Operation

Chemical	*Estimated Annual Airborne Concentration[a] (μg/m³)*	*Estimated Daily Airborne Concentration[a] (μg/m³)*	*Reference Concentration[b] (μg/m³)*	*Cancer Inhalation Unit Risk Factor[c] (cancers/(μg/m³))*	*Hazard Quotient[d]*	*MEI Cancer Incidence Probability[e]*
Benzene	0.0002	0.15	Not applicable	8.3×10^{-6}	Not applicable	2×10^{-9}
Toluene	0.00008	0.06	400	Not applicable	0.0002	Not applicable
Formaldehyde	0.0015	0.085	Not applicable	0.000013	Not applicable	2×10^{-8}
Acetaldehyde	9×10^{-6}	0.012	9	2.2×10^{-6}	0.0013	2×10^{-11}
Acrolein	2.5×10^{-6}	0.002	0.02	Not applicable	0.1	Not applicable
Arsenic	0.000015	0.00062	Not applicable	0.0043	Not applicable	6×10^{-8}
Cadmium	0.000039	0.0016	Not applicable	0.0018	Not applicable	7×10^{-8}
Chromium VI	0.00024	0.0098	Not applicable	0.012	Not applicable	3×10^{-6}
Manganese	0.00005	0.002	0.05	Not applicable	0.04	Not applicable
Mercury	0.000011	0.00044	0.3	Not applicable	0.001	Not applicable
Nickel	0.0006	0.025	Not applicable	0.00048	Not applicable	3×10^{-7}

MEI = maximally exposed individual
μg/m³ = micrograms per cubic meter
[a] Estimates of annual and daily airborne concentrations were developed by using the ISC3 air dispersion model. See Appendix C, Section C.4, for additional information. Note that 24-hour maximum daily concentrations were used to calculate Hazard Quotient values in order to be conservative.
[b] Reference Concentration values are estimates, with uncertainties spanning perhaps an order of magnitude, of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime. Values are developed by the EPA (EPA 1997a).
[c] Cancer Inhalation Unit Risk Factors are estimates of the cancer potency of carcinogens by the inhalation pathway. Values are developed by the EPA (EPA 1997a).
[d] Hazard Quotient estimates are developed by dividing the estimated daily airborne concentration by the Reference Concentration. Hazard Quotient estimates are chemical-specific measures of potential noncancer health effects. The Hazard Index is the sum of the Hazard Quotient values. Hazard Index values of less than one suggest low concern for noncancer effects as a result of the exposure, whereas, Hazard Index values of greater than one suggest a potential for noncancer effects.
[e] The offsite population maximally exposed individual cancer incidence probability is estimated by multiplying the estimated annual airborne concentration by the Cancer Inhalation Unit Risk Factor. See Appendix C, Section C.4, for additional information.

The sum of all of the Hazard Quotient estimates is called the Hazard Index. Hazard Index values lower than 1 suggest that the offsite receptor likely would not experience adverse noncancer health effects as a result of the exposure. The Hazard Index value for the noncarcinogenic chemicals presented in Table 5–39 is 0.1, which is considerably lower than 1.

The only probability of excess latent cancer incidence greater than 1 in 1 million (the lower EPA bound for concern) is the probability attributed to chromium VI: 3 in 1 million (3×10^{-6}). However, all the chromium was conservatively assumed to be in the form of chromium VI, which is carcinogenic. Actual releases of chromium also would include some amount of chromium III, which is not carcinogenic.

The health risk estimates presented in Table 5–39 assume that the airborne pathway would be the exposure route of most importance because aqueous waste streams would be treated before release to potable water sources. The hazardous trace chemicals in Table 5-39 would be generated by operating the support and backup systems identified in the footnote to Table 5-24. These are primarily internal combustion systems with engineering controls that emit combustion byproducts considered to be point sources and, therefore, are emitted through exhaust stacks above the level where they would affect workers in the immediate vicinity of the emission source. The backup systems are run on periodic schedules for testing. Because of their infrequent operation, engineering controls, and external emissions, the hazardous trace chemicals generated by these systems pose no hazard to plant workers during operations.

Other potential occupational health risks for facility workers were not estimated because their exposures to additional hazardous chemicals would be adequately controlled by procedural, engineering, and personal protective methods. Historically, facility worker exposures have been well under the permissible exposure levels of the Occupational Safety and Health Administration and the threshold limits values of the American Conference of Governmental Industrial Hygienists.

ENERGIZING TRANSMISSION LINES FROM BELLEFONTE 1 AND 2

No Action

Under the No Action Alterative, construction of Bellefonte 1 and 2 would not be completed. Unenergized transmission lines from the plant switchyard would remain unenergized; therefore, no impacts would be expected.

Tritium Production

Operation of the Bellefonte Nuclear Plant would result in energizing approximately 20 miles of 500-kilovolt line leading from the Bellefonte switchyard to the 500-kilovolt line connecting the Widows Creek and Huntsville substations. All other transmission lines in the vicinity of Bellefonte are currently in use. The Bellefonte Final Environmental Statement (AEC 1974) addressed the environmental impacts of transmission lines. Issues associated with their activation include ozone from corona effects, compatibility with communications equipment, and electromagnetic field effects.

Ozone can be produced from corona discharges (ionization of the air) in the operation of transmission lines and substations, particularly at the higher voltages. It can be harmful if breathed in sufficient concentrations over prolonged periods. However, it is not considered to be injurious to vegetation, animals, and humans unless concentrations exceed 0.05 parts per million. According to the Bellefonte Final Environmental Statement, any levels of ozone that could reasonably be expected to be generated by Bellefonte's transmission lines would be environmentally inconsequential.

High-voltage power lines operating close to telephone and signaling equipment can produce undesirable effects on the communication circuit through inductive coupling. However, it is TVA's normal practice to send transmission line vicinity maps to railroad and telephone companies having tracks or communication lines in the general area of proposed power lines for the purpose of making inductive coordination studies. If corrective action is indicated, the problem is jointly studied and any required changes are mutually resolved (AEC 1974).

During the past two decades, the potential role of electromagnetic fields in causing or promoting cancer or other adverse health effects has been the subject of scientific investigation and public concern. If Bellefonte 1 or both Bellefonte 1 and 2 were selected for production of tritium, electric power lines to the plant would be activated. Like all such lines, the power lines to Bellefonte would act as a source of weak, extremely low frequency electrical and magnetic fields. While research in electromagnetic field health effects is continuing, there is no conclusive scientific evidence of a "significant" link between cancer and power line fields. In 1995, the American Physical Society (APS 1995) concluded that: "While it is impossible to prove that no deleterious health effects occur from exposure to any environmental factor, it is necessary to demonstrate a consistent, significant, and causal relationship before one can conclude that such effects do occur. From this standpoint, the conjectures relating cancer to power line fields have not been scientifically substantiated." In response to a Congressional request to review the literature concerning potential electromagnetic field health effects, the National Academy of Sciences (NAS 1996) observed: "Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard." While TVA recognizes that continuing research may establish a credible link between adverse health effects and exposure to power line fields, it has concluded that no mitigation of potential electromagnetic field health effects would be implemented at the Bellefonte site until such a link is conclusively established through scientific investigation.

5.2.3.9.2 Facility Accidents

RADIOLOGICAL IMPACTS

The accident set selected for evaluation of impacts of the No Action Alternative and tritium production are described in Section 5.1 and discussed in detail in Appendix D, Section D.1. The consequences of the reactor and nonreactor design-basis accidents at Bellefonte 1 for the no-tritium-production case (0 TPBARs) and for the maximum tritium production case (3,400 TPBARs) were estimated using the NRC-based deterministic approach presented in the *Bellefonte Nuclear Plant Final Safety Analysis Report* (TVA 1991), the receptors being an individual at the reactor site exclusion area boundary and an individual located at the reactor site low-population zone. The margin of safety for site dose criteria associated with the same accidents and the same receptors are presented in **Table 5–40.** Data presented for the no-tritium-production case were extracted directly from the *Bellefonte Nuclear Plant Final Safety Analysis Report*. As indicated in **Table 5–41,** the irradiation of TPBARs at Bellefonte 1 would result in a very small increase in design-basis accident consequences and a reduction in the consequence margin. The accident consequences would be dominated by the effects of the same nuclide releases inherent to operation without tritium production. If constructed, Bellefonte 2 accident consequences would be the same as those for Bellefonte 1.

Table 5–40 Design-Basis Accident Consequence Margin to Site Dose Criteria at Bellefonte 1

Accident	Tritium Production	Dose Description [a]	Site Dose Criteria (rem) [b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%) [c]	Dose (rem)	Margin (%) [c]
Reactor design-basis accident	0 TPBARs [d]	Thyroid inhalation dose	300	5.8	98.1	2.7	99.1
		Beta + gamma whole body dose	25	0.031	99.9	0.18	99.3
	3,400 TPBARs	Thyroid inhalation dose	300	5.9	98.0	2.7	99.1
		Beta + gamma whole body dose	25	0.032	99.9	0.18	99.3
Nonreactor design-basis accident	0 TPBARs [d]	Thyroid inhalation dose	300	0.0067	99.998	0.0019	99.999
		Beta + gamma whole body dose	25	0.71	97.2	0.14	99.4
	3,400 TPBARs	Thyroid inhalation dose	300	0.029	99.99	0.0064	99.998
		Beta + gamma whole body dose	25	0.71	97.2	0.14	99.4

[a] Dose is the total dose from the reactor plus the contribution from the TPBARs.
[b] 10 CFR 100.11.
[c] Margin below the site dose criteria.
[d] TVA 1991.

Table 5–41 presents the total risks of the postulated set of design-basis, handling, and beyond design-basis accidents to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, and a noninvolved worker 640 meters (0.4 mile) from the release point. Accident consequences to the same receptors are summarized in **Table 5–42**. The assessments of dose and the associated cancer risk to the noninvolved worker are not applicable for beyond design-basis accidents. A site emergency would have been declared early in the accident sequence; all nonessential site personnel would have evacuated the site in accordance with site emergency procedures before any radiological release to the environment; and in accordance with emergency action guidelines, evacuation of the public within 16.1 kilometers (10 miles) of the plant would have been initiated.

Presented in Tables 5–41 and 5–42 are the risks and consequences without tritium production (0 TPBARs) and with maximum tritium production (3,400 TPBARs) for severe reactor accidents. The tritium release is governed by the nature of the core melt accident scenarios analyzed, and the accident risks and consequences are governed by actions taken in accordance with the EPA Protective Action Guidelines (e.g., evacuation of the public, interdiction of the food and water supply, condemnation of farmland and public property) in response to the postulated core melt accident with containment failure or containment bypass.

The severity of the reactor accident dominates the consequences, is the basis for implementation of protective actions, and is independent of the number of TPBARs. Accident risk is the product of the accident probability (i.e, accident frequency) times the accident consequences. In this EIS, risk is expressed as the increased likelihood of cancer fatality per year for an individual (i.e., the maximally exposed offsite individual, an average individual in the population within 80 kilometers [50 miles] of the reactor site, or a noninvolved worker). Table 5–41 indicates that the risks associated with tritium production are low. The highest risk to each individual—the maximally exposed offsite individual, one fatality every 2.8 million years (3.6×10^{-7} per year); an average member of the public, one fatality every 1.3 billion years (8.0×10^{-10} per year); the exposed population, one fatality every 4.6 thousand years (0.00022 per year); and a noninvolved worker, one fatality every 230 billion years (4.3×10^{-12} per year)—is from the nonreactor design-basis accident.

Table 5–41 Annual Accident Risks at Bellefonte 1

Accident	Tritium Production Core	Maximally Exposed Offsite Individual [a]	Average Individual in Population to 80 kilometers (50 miles) [a]	Noninvolved Worker [a]
Design-Basis Accidents				
Reactor design-basis accident	0 TPBARs [b]	3.3×10^{-9} [c]	1.4×10^{-12} [c]	[d]
	1,000 TPBARs	3.3×10^{-9}	1.5×10^{-12}	2.4×10^{-15} [e]
	3,400 TPBARs	3.3×10^{-9}	1.9×10^{-12}	8.0×10^{-15} [e]
Nonreactor design-basis accident	0 TPBARs [b]	3.5×10^{-7} [c]	3.8×10^{-11} [c]	[d]
	1,000 TPBARs	3.5×10^{-7}	2.6×10^{-10}	1.2×10^{-12} [e]
	3,400 TPBARs	3.6×10^{-7}	8.0×10^{-10}	4.3×10^{-12} [e]
Sum of design-basis accident risks	0 TPBARs [b]	3.5×10^{-7}	3.8×10^{-11}	[d]
	1,000 TPBARs	3.5×10^{-7}	2.6×10^{-10}	1.2×10^{-12}
	3,400 TPBARs	3.6×10^{-7}	8.0×10^{-10}	4.3×10^{-12}
Handling Accidents				
TPBAR handling accident	1,000 TPBARs	3.9×10^{-9}	2.2×10^{-10}	4.8×10^{-11}
	3,400 TPBARs	1.3×10^{-8}	7.5×10^{-10}	1.6×10^{-10}
Truck cask handling accident	1,000 TPBARs	3.2×10^{-14}	1.7×10^{-15}	3.8×10^{-16}
	3,400 TPBARs	9.6×10^{-14}	5.1×10^{-15}	1.2×10^{-15}
Rail cask handling accident	1,000 TPBARs	1.6×10^{-14}	8.6×10^{-16}	1.9×10^{-16}
	3,400 TPBARs	4.8×10^{-14}	2.6×10^{-15}	5.8×10^{-16}
Sum of handling accident risks	1,000 TPBARs	3.9×10^{-9}	2.2×10^{-10}	4.8×10^{-11}
	3,400 TPBARs	1.3×10^{-8}	7.5×10^{-10}	1.6×10^{-10}
Beyond Design-Basis Accidents (Severe Reactor Accidents)				
Reactor core damage accident with early containment failure	0 TPBARs [c]	1.1×10^{-9}	1.1×10^{-11}	Not applicable
	3,400 TPBARs	1.1×10^{-9}	1.1×10^{-11}	Not applicable
Reactor core damage accident with containment bypass	0 TPBARs [c]	3.1×10^{-8}	9.1×10^{-11}	Not applicable
	3,400 TPBARs	3.1×10^{-8}	9.1×10^{-11}	Not applicable
Reactor core damage accident with late containment failure	0 TPBARs [b]	9.7×10^{-10}	4.1×10^{-11}	Not applicable
	3,400 TPBARs	9.7×10^{-10}	4.3×10^{-11}	Not applicable
Sum of severe reactor accident risks	0 TPBARs [b]	3.3×10^{-8}	1.4×10^{-10}	Not applicable
	3,400 TPBARs	3.3×10^{-8}	1.5×10^{-10}	Not applicable

[a] Increased likelihood of cancer fatality per year.
[b] The No Action Alternative at Bellefonte 1 implies the reactor is not brought into commercial service. The No Action radiological dose is 0.
[c] Derived from AEC 1974.
[d] The dose to the noninvolved worker was not estimated in AEC 1974.
[e] Design-basis accident risks only reflect the incremental increase in accident risk due to the production of tritium in TPBARs.

Table 5–42 Accident Frequencies and Consequences at Bellefonte 1

Accident	Accident Frequency (per year)	Tritium Production	Maximally Exposed Offsite Individual		Average Individual Population to 80 kilometers (50 miles)		Noninvolved Worker	
			Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality[a]	Dose (rem)	Cancer Fatality [a]
Design-Basis Accidents								
Reactor design-basis accident	0.0002	0 TPBARs [b]	0.033 [c]	0.000017	0.000013 [d]	6.7×10^{-9}	e	e
		1,000 TPBARs	0.033	0.000017	0.000015	7.6×10^{-9}	2.9×10^{-8} [f]	1.2×10^{-11}
		3,400 TPBARs	0.033	0.000017	0.000019	9.5×10^{-9}	1.0×10^{-7} [f]	4.0×10^{-11}
Nonreactor design-basis accident	0.01	0 TPBARs [b]	0.070 [c]	0.000035	7.9×10^{-6} [d]	3.9×10^{-9}	e	e
		1,000 TPBARs	0.070	0.000035	0.000051	2.6×10^{-8}	3.1×10^{-7} [f]	1.2×10^{-10}
		3,400 TPBARs	0.071	0.000036	0.00016	8.0×10^{-8}	1.1×10^{-6} [f]	4.3×10^{-10}
Handling Accidents								
TPBAR handling accident	0.0017/ 0.0058 [g]	All TPBAR configurations	0.0045	2.3×10^{-6}	0.00025	1.3×10^{-7}	0.00007	2.8×10^{-8}
Truck cask handling accident	5.3×10^{-7}/ 1.6×10^{-6} [g]	All TPBAR configurations	0.00012	6.0×10^{-8}	6.4×10^{-6}	3.2×10^{-9}	1.8×10^{-6}	7.2×10^{-10}
Rail cask handling accident	2.7×10^{-7}/ 6.0×10^{-7} [g]	All TPBAR configurations	0.00012	6.0×10^{-8}	6.4×10^{-6}	3.2×10^{-9}	1.8×10^{-6}	7.2×10^{-10}
Beyond Design-Basis Accidents (Severe Reactor Accidents)								
Reactor core damage with early containment failure	9.0×10^{-7}	0 TPBARs [b]	2.3	0.0012	0.023	0.000012	Not applicable	Not applicable
		3,400 TPBARs	2.4	0.0012	0.024	0.000012	Not applicable	Not applicable
Reactor core damage with containment bypass	9.1×10^{-7}	0 TPBARs [b]	34[h]	0.034[h]	0.20	0.00010	Not applicable	Not applicable
		3,400 TPBARs	34[h]	0.034[h]	0.20	0.00010	Not applicable	Not applicable
Reactor core damage with late containment failure	5.1×10^{-6}	0 TPBARs [b]	0.37	0.00019	0.016	8.0×10^{-6}	Not applicable	Not applicable
		3,400 TPBARs	0.38	0.00019	0.017	8.5×10^{-6}	Not applicable	Not applicable

[a] Increased likelihood of cancer fatality.
[b] The No Action Alternative at Bellefonte 1 implies the reactor is not brought into commercial service. The No Action radiological dose is 0.
[c] AEC 1974.
[d] Derived from AEC 1974; estimate adjusted for differences in population data.
[e] The dose to the noninvolved worker was not estimated in AEC 1974.
[f] Consequences only reflect the incremental increase in accident consequences due to the production of tritium in TPBARs.
[g] Frequency for 1,000 TPBARs/frequency for 3,400 TPBARs.
[h] Dose greater than 20 rem. Cancer fatality risk is doubled.

The nonreactor design-basis accident has the highest consequence of the design-basis and handling accidents because the postulated accident scenario entails an acute release of tritium in oxide form directly to the environment without any mitigation.

Review of Table 5–42 indicates that there is a very small increase in design-basis and beyond design-basis reactor accident consequences due to the irradiation of TPBARs at Bellefonte 1. The consequences are dominated by the effects of radionuclide releases inherent to the operation without tritium production. As described in Appendix D, Section D.1.1.10, surrogate data were used for the accident sequences and plant responses in the Bellefonte 1 beyond design- basis accident analysis. Sensitivity analyses indicated that the analysis results are driven by the assumed release fractions and release timing sequences (see Appendix D, Table D–13). As indicated by the results provided in Table 5–42, the accidents involving reactor core damage with containment bypass that have the shortest warning time resulted in the highest dose to a maximally exposed offsite individual. This is because after such accidents the offsite individual would not have sufficient time to evacuate and would be exposed to the radionuclide releases at the site boundary. For the other core damage accidents, the individual would have sufficient time to evacuate before radionuclide releases would occur. It should be noted that Bellefonte 1 beyond design-basis accident analysis estimates do not have the same level of applicability as those for the Watts Bar and Sequoyah plants. TVA will perform a plant-specific severe accident analysis for Bellefonte prior to its operation.

The secondary impacts of severe reactor accidents are discussed in Section 5.2.13.

HAZARDOUS CHEMICAL IMPACTS

No Action

No additional impacts to public and occupational health and safety from exposure to hazardous chemicals are anticipated at Bellefonte 1 beyond the effects of existing and future activities that are independent of the proposed action, i.e., tritium production.

Tritium Production

The impacts of using, handling, and storing hazardous chemicals at Bellefonte 1 were assessed. The chemical inventory for Bellefonte 1 was reviewed to identify potential accident scenarios. Details of the review and accident analysis are presented in Appendix D, Section D.2.

Two hazardous chemical accident scenarios were postulated for this EIS: (1) an accidental, uncontrolled release of ammonium hydroxide from a 15,142-liter (4,000-gallon) tank in the basement of the turbine building; and (2) an accidental, uncontrolled release of hydrazine from a 1,987-liter (525-gallon) tank in the same area. For both scenarios, it was postulated that the total tank inventory is released to form a pool on the floor; the size of the pool is limited by a dike around the chemical storage tanks; and vapor is generated from pool evaporation and fills the immediate area, leaks from the building, and is dispersed downwind.

The potential health impacts of accidental releases of hazardous chemicals were assessed by comparing estimated airborne concentrations of the chemicals to Emergency Response Planning Guidelines developed by the American Industrial Hygiene Association. The Emergency Response Planning Guideline values are not regulatory exposure guidelines and do not incorporate the safety factors normally included in healthy worker exposure guidelines. Emergency Response Planning Guideline–1 values are concentrations below which nearly all individuals could be exposed for up to one hour and could experience only mild, transient, and reversible adverse health impacts. Emergency Response Planning Guideline–2 values are indicative of irreversible or serious health effects or impairment of an individual’s ability to take protective action. Emergency Response Planning Guideline-3 values are indicative of potentially life-threatening health effects.

On release of ammonium hydroxide from the storage tank, ammonia would volatilize and disperse. The Emergency Response Planning Guideline values for ammonia were used to evaluate the potential health impacts of an ammonium hydroxide release. The Emergency Response Planning Guidelines for ammonia and hydrazine are presented in **Table 5–43**.

Table 5–43 Emergency Response Planning Guideline Values for Hydrazine and Ammonia

Chemicals	*Emergency Response Planning Guideline-1 (parts per million)*	*Emergency Response Planning Guideline-2 (parts per million)*	*Emergency Response Planning Guideline-3 (parts per million)*
Hydrazine [a]	0.03	8	80
Ammonia [b]	25	200	1000

[a] Gephart, et al. 1994.
[b] Craig, et al. 1995.
Note: Hydrazine Emergency Response Planning Guidelines were removed by the American Industrial Hygiene Association for further study in 1996 and have not been reinserted as of July 1998.

The potential health impacts of the accidental release of ammonium hydroxide and hydrazine were assessed for two types of receptors: (1) noninvolved workers, or workers assumed to be located 640 meters (2,100 feet) from the point of release; and (2) a maximally exposed offsite individual or member of the public located offsite at the site boundary 914 meters (3,000 feet) from the point of release.

Facility workers (i.e., those individuals in the building at the time of the accident) were assumed to be killed by the release. The analysis took no credit for mitigative actions (e.g., area atmosphere monitoring, area evacuation alarms, emergency operating procedures) or accident precursors (e.g., leak before break) to reduce the accident consequences to the facility worker.

The computer code selected for estimation of airborne concentrations is the Computer-Aided Management of Emergency Operations/Areal Locations of Hazardous Atmospheres, developed by the National Safety Council, EPA, and the National Oceanic and Atmospheric Administration (NSC 1990).

The model results are presented for atmospheric Stability Classes D and F, with wind speeds of 5.3 meters per second (17.4 feet per second) and 1.5 meters per second (4.9 feet per second), respectively. Atmospheric Stability Class D is considered to be representative of "average" weather conditions; Stability Class F is considered to be representative of "worst-case" weather conditions. These weather conditions were selected because they are recommended by the EPA in its *Technical Guidance for Hazards Analysis* (EPA 1987).

The potential health impacts of the accidental releases were assessed by comparing the modeled ambient concentrations of ammonia and hydrazine at each of the receptor locations to the Emergency Response Planning Guidelines. **Table 5–44** presents a summary of the impacts data.

Table 5–44 Summary of Impacts Data for Release Scenarios at Bellefonte 1

Impacts		***Hydrazine (Stability Class D)***	***Hydrazine (Stability Class F)***	***Ammonia (Stability Class D)***	***Ammonia (Stability Class F)***
Maximum distance (meters) to concentrations of	ERPG-1 ERPG-2 ERPG-3	greater than 2,000 179 44	greater than 2,000 500 200	464 150 65	2,250 825 425
Noninvolved worker (640 meters)	Parts per million Level of concern Potential health effects	0.8 ERPG-1 Mild, transient	6 ERPG-1 Mild, transient	16 ERPG-1 Mild, transient	318 ERPG-2 Serious

Impacts		Hydrazine (Stability Class D)	Hydrazine (Stability Class F)	Ammonia (Stability Class D)	Ammonia (Stability Class F)
Maximally exposed offsite individual (914 meters)	Parts per million Level of concern Potential health effects	0.4 ERPG-1 Mild, transient	3.2 ERPG-1 Mild, transient	7.7 ERPG-1 None (less than ERPG-1)	169 ERPG-1 Mild, transient

ERPG = Emergency Response Planning Guideline.

Impacts to Noninvolved Workers

The concentrations of ammonia at 640 meters (3,000 feet) would range from 14 to 318 parts per million, depending on the assumed meteorological conditions. The maximum estimated airborne concentration at that point under Stability Class F conditions would exceed the Emergency Response Planning Guideline–2 value of 200 parts per million for ammonia, which suggests that noninvolved workers could experience irreversible or serious, but not life-threatening, adverse health effects if the exposures were not mitigated.

For the hydrazine release scenarios, the concentrations at 640 meters (3,000 feet) range from 0.8 to 6.0 parts per million, depending on the assumed meteorological conditions. As a result, the maximum estimated airborne concentration at that point would exceed the Emergency Response Planning Guideline–1 value of 0.03 parts per million for hydrazine, which suggests the potential for only mild, transient, and reversible adverse health impacts on noninvolved workers.

Impacts to Maximally Exposed Offsite Individual

For the ammonium hydroxide release scenarios, the maximally exposed offsite individual could be exposed to an ammonia concentration of 7.7 parts per million under Stability Class D conditions (see Table 5–44), which is below the Emergency Response Planning Guideline–1 value for ammonia of 25 parts per million. Exposures to concentrations below the Emergency Response Planning Guideline–1 value should not produce any adverse health effects for the maximally exposed offsite individual. Under Stability Class F conditions, the maximally exposed offsite individual could be exposed to an ammonia concentration of about 169 parts per million (see Table 5–44), which is below the Emergency Response Planning Guideline–2 value for ammonia of 200 parts per million. Exposure of the maximally exposed offsite individual to concentrations higher than the Emergency Response Planning Guideline–1 value, but lower than the Emergency Response Planning Guideline–2 value, could produce only mild, transient, and reversible adverse health effects.

For the hydrazine release scenarios, the maximally exposed offsite individual exposure concentrations would range from 0.4 to 3.2 parts per million (see Table 5–44; both stability classes). These concentrations exceed the Emergency Response Planning Guideline–1 value for hydrazine of 0.03 parts per million, but are less than the Emergency Response Planning Guideline–2 value of 8 parts per million. This suggests that the maximally exposed offsite individual could experience only mild, transient, and reversible adverse health effects as a result of the exposure.

The results of this analysis should be considered only as screening-level estimations. TVA would conduct analyses compliant with the requirements of 40 CFR 68 before operation of Bellefonte 1.

5.2.3.10 Environmental Justice

As discussed in Appendix G, Executive Order 12898 directs Federal agencies to address disproportionately high and adverse health or environmental effects of alternatives on minority and low-income populations. The Executive Order does not alter prevailing statutory interpretations under NEPA or existing case law.

Regulations prepared by the Council on Environmental Quality remain the foundation for the preparation of environmental documentation in compliance with NEPA (40 CFR Parts 1500 through 1508).

No Action

There would be no impacts on the general population. Therefore, there would be no disproportionately high and adverse consequences for minority and low-income populations beyond the effects of existing and future activities that are independent of the proposed action.

Tritium Production

Analyses of incident-free operations and accidents have shown estimates of the risk of latent cancer fatalities to the public residing within 80 kilometers (50 miles) of the reactor site to be much lower than 1. Because tritium production would not have significant adverse consequences for the population at large, no minority or low-income populations should experience disproportionately high adverse consequences.

5.2.3.11 Waste Management

No Action

No additional wastes should be generated at the Bellefonte site beyond the wastes generated as a result of activities independent of the proposed action. These wastes and the provisions for their management are described in Section 4.2.3.10. Solid nonhazardous waste is disposed of off site by contract at a permitted facility. The small quantity of hazardous waste is temporarily stored on site until it is shipped to the TVA Hazardous Waste Storage Facility in Muscle Shoals, Alabama, which makes arrangements for disposal at an offsite permitted disposal facility.

Tritium Production

Should Bellefonte 1 or both Bellefonte 1 and 2 be completed for the purpose of producing tritium, some waste would be generated during the construction. During operation, the waste that would be generated would be typical to that of an operating reactor plant like Watts Bar 1, Sequoyah 1, or Sequoyah 2, except for the additional waste due to tritium production.

Construction

No radioactive waste should be generated during construction activities. Hazardous waste generated during construction likely would be due to maintenance activities. This waste could include materials such as waste oils that contain solvent residuals or that are high in selected trace metal content, waste paint and paint thinners, solvents, and degreasers. The estimated amounts of solid and liquid wastes that would be generated over the entire construction period for one or both units are presented in **Table 5–45.**

Table 5–45 Total Amounts of Wastes Generated During Construction to Complete Bellefonte 1 or Both Bellefonte 1 and 2

Waste Category	*Quantity*	
	Bellefonte 1	*Bellefonte 1 and Bellefonte 2*
Hazardous		
Solids (metric tons)	6.3	9.7
Liquids (metric tons)	56.7	87.3
Nonhazardous solids		
Concrete (cubic meters)	392	603
Steel (metric tons)	208	296

Waste Category	Quantity	
	Bellefonte 1	Bellefonte 1 and Bellefonte 2
Other (cubic meters)	21,000	70,000
Nonhazardous liquids		
Sanitary (cubic meters)	309,000	475,000
Flushing (cubic meters)	6,000	49,100
Other (cubic meters)	65	100

Source: TVA 1995b.

It is expected that the monthly solid hazardous wastes generated would be more than 100 kilograms (220 pounds), but less than 1,000 kilograms (2,205 pounds). Hazardous wastes would be stored on site temporarily, pending shipment to the TVA Hazardous Waste Disposal Facility at Muscle Shoals. Nonhazardous solid waste from construction activities would be routinely placed in dumpsters on site and subsequently disposed of off site by contractors.

Operation

Waste would be generated at Bellefonte 1 or both Bellefonte 1 and 2 as a consequence of normal operation as a nuclear power plant. Judging from the operating experience at the Sequoyah and Watts Bar plants, the waste generated under the proposed action would fall into four broad categories: hazardous waste, nonhazardous solid waste, low-level radioactive waste, and sanitary liquid waste. **Table 5–46** summarizes the expected annual amounts of waste that would be generated at Bellefonte 1 or both Bellefonte 1 and 2. The low-level radioactive waste would include an additional 0.43 cubic meters per year (15 cubic feet per year) (WEC 1999) generated as a result of tritium production. It would consist of the approximately 140 base plates and other irradiated hardware remaining after the TPBARs were separated from their assemblies and placed in the 17 × 17 array consolidation baskets at the reactor site.

Table 5–46 Annual Waste Generation at Bellefonte 1

Waste Type	Volume or Mass
Hazardous waste (cubic meters)	1.025
Nonhazardous solid waste (kilograms)	853,438
Low-level radioactive waste (cubic meters)	40
Mixed low-level radioactive waste (cubic meters)	less than 1

Note: For Bellefonte 1 and 2 operations the waste values would be twice the values given for Bellefonte 1.
Source: Based on Watts Bar 1 Operation.

Hazardous Waste

Hazardous waste typical of nuclear plant operation would include paints, solvents, acids, oils, radiographic film and development chemicals, and degreasers. Neutralization would be the only waste treatment performed on site. Hazardous waste normally would be stored in polyethylene containment systems during accumulation. An approved storage building would be used to store hazardous waste for either 90 or 180 days, depending on the plant's hazardous waste generation status (i.e., Small Quantity or Large Quantity Generator) at the time. The waste would be transported to an offsite hazardous waste storage or disposal facility before it exceeded the 90- or 180-day storage limit.

Low-Level Radioactive Waste

One category of low-level radioactive waste would be the solidified and dewatered product of gaseous and liquid waste treatment systems, along with filters and resins. Another would be contaminated protective clothing, paper, rags, glassware, compactible and noncompactible trash, and nonirradiated reactor components. A third category would be the irradiated hardware of the TPBAR assemblies that would have been separated from the TPBARs before the TPBARs were placed in consolidation containers for eventual shipment. Low-level radioactive waste would be shipped to the Barnwell, South Carolina, waste disposal facility.

For purposes of completeness, this EIS also addresses the management of the irradiated TPBAR hardware portion of the low-level radioactive waste at DOE-owned facilities—specifically, the Low-Level Radioactive Waste Disposal Facility at the Savannah River Site, near Aiken, South Carolina. That facility consists of a series of vaults in E–Area that have been operational since September 1994. The operating capacity of each vault is 30,500 cubic meters (1,077,100 cubic feet) of low-level radioactive waste (DOE 1998c, DOE 1999b). Therefore, the addition of low-level radioactive waste from the proposed action at Bellefonte 1 or both Bellefonte 1 and 2 for a 40-year period would be approximately 0.06 percent of the capacity of a single vault. The total production of low-level radioactive waste, approximately 41 cubic meters (1,448 cubic feet), represents 0.1 percent of the capacity of a single vault.

Mixed Waste

Typical sources of mixed low-level radioactive waste would be: beta-counting fluids (e.g., zylene, toluene) used in liquid scintillation detectors; polychlorinated biphenyls susceptible to contact with radioactive contamination through an accidental spill or explosion in a transformer; isopropyl alcohol used for cleaning radioactive surfaces; chelating agents; and various acids. The amount of mixed low-level radioactive waste generated should be less than 1 cubic meter (35 cubic feet), judging from experience with Watts Bar 1 operation.

Bellefonte 1 or Bellefonte 2 would have an active waste minimization program similar to the existing programs described for Watts Bar and Sequoyah in Sections 4.2.1.10 and 4.2.2.10, respectively.

5.2.3.12 Spent Fuel Management

Production of tritium at Bellefonte 1 or Bellefonte 2 with less than 2,000 TPBARs in the reactor core would generate approximately 72 spent nuclear fuel assemblies per fuel cycle. This is the expected normal refueling batch without tritium production. The spent fuel assemblies would be stored in the plant's spent nuclear fuel pools, which have been completed. For the irradiation of the maximum number of 3,400 TPBARs, up to a maximum of 141 spent nuclear fuel assemblies could be generated. This represents up to 69 additional spent nuclear fuel assemblies over the normal refueling batch. For the purposes of this EIS it is assumed that this additional spent nuclear fuel would be stored on site for the duration of the proposed action. If needed, a dry cask ISFSI would be constructed at the site. Environmental impacts of the construction and operation of this generic dry cask ISFSI are presented in Section 5.2.6.

5.2.4 Licensing Renewal

Watts Bar 1 and Sequoyah 1 and 2 are currently operating plants. Their operating licenses would expire before the end of the tritium production program, which is assumed to last until the year 2043. Therefore, these units would need to undergo licensing renewal before the end of the program. The environmental impacts associated with the licensing renewal activities for these units are discussed in this section.

5.2.4.1 Background

The decision whether to seek license renewal rests with the licensees. Each licensee must determine whether they are likely to satisfy NRC requirements and evaluate the costs of the venture. As early as 20 years before the expiration of its current license, an applicant may apply to extend its license for up to 20 years. It is estimated that it would take a licensee between three and five years to prepare an application and that the NRC staff would require between three and five years to complete the review and the hearing process. The license renewal application would be subject to public hearings, using a formal adjudicatory process.

License renewal requirements for power reactors are based on two key principles: (1) the regulatory process, continued into the extended period of operation, is adequate to ensure that the licensing basis of all currently operating plants provides an acceptable level of safety; and (2) each plant's licensing basis is required to be maintained during the renewal term. In other words, the foundation of license renewal rests on the determination that currently operating plants continue to maintain adequate levels of safety and, over the plant's life, this level has been enhanced through maintenance of the licensing bases, with appropriate adjustments to address new information from industry operating experience. Additionally, NRC activities provide ongoing assurance that the licensing bases would continue to provide an acceptable level of safety.

The environmental and technical requirements for the renewal of power reactor operating licenses are contained in NRC regulations 10 CFR, 51 and 54, respectively. The environmental protection regulations in 10 CFR 51 were revised on December 18, 1996, to facilitate the environmental review for license renewal. Part 54 was revised in May 1995 to simplify and clarify the license renewal scope and process.

The license renewal environmental review requirements in 10 CFR 51 are based on a conclusion of a detailed generic environmental impact study (NRC 1996a) that certain environmental issues can be resolved generically rather than separately in each plant-specific licensing application. This approach reduces the number of issues that need to be evaluated in detail for each plant site and improves the efficiency of the licensing process for both the licensee and the NRC.

The changes to the licensing requirements in 10 CFR 54 stress managing the effects of aging rather than managing aging mechanisms, and more explicitly address the role of existing licensee programs and the maintenance rule provisions as means to demonstrate the adequacy of programs to manage the effects of aging for the renewal term. Under this regulatory requirement, licensees are required to identify all systems, structures, and components within the scope of the renewal application. The systems, structures, and components within the scope are: (1) all safety-related systems, structures, and components; (2) all systems, structures, and components whose failure could affect safety-related functions; and (3) systems, structures, and components relied on to demonstrate compliance with the NRC's regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout. A screening review is required of all systems, structures, and components within the scope of the rule to identify “passive” and “long-lived” structures and components for which the applicant must demonstrate that the effects of aging would be managed in such a way that the intended function or functions of those structures and components would be maintained for the period of extended operation. Active equipment is considered to be adequately monitored under the current regulatory process where the detrimental aging effects that may occur are more readily detectable and would be identified and corrected by routine surveillances and performance indicators. For some structures and components within the scope of the evaluation, no additional action may be required where the applicant can demonstrate that the existing programs provide adequate aging management throughout the period of extended operation. However, if additional aging management activities are warranted for a structure or component within the scope of the rule, applicants would have the flexibility to determine appropriate actions. These activities could include, for example, new monitoring programs, new inspections, or revised design criteria. Another requirement for license renewal is the identification and updating of time-limited aging analyses, which are those design analyses for systems, structures, and components based on the current operating license term.

In 1996, the NRC developed a draft regulatory guide for the format and content of a license renewal application that proposes to endorse an implementation guideline prepared by the Nuclear Energy Institute as an acceptable method of implementing the license renewal rule. The NRC plans to maintain the regulatory guide in draft form and use it along with the working draft of the standard review plan for license renewal to review plant-specific and owners group reports. An update of the working draft standard review plan was made publicly available in September 1997. NRC staff will use the experience gained from the review of plant-specific and owners group reports to incorporate improvements into the working draft standard review plan and clarify regulatory guidance before soliciting formal public comment and approval of those documents. The NRC has developed a draft inspection guidance for license renewal. Consistent with the development of the standard review plan and regulatory guide, the inspection guidance will be prepared in final form after the NRC staff completes the review of several license renewal applications.

5.2.4.2 Environmental Effect of Renewing the Operating License of a Nuclear Power Plant

The NRC staff has assessed the environmental impacts associated with granting a renewed operating license for a nuclear power plant to a licensee who holds either an operating license or construction permit as of June 30, 1995, and has documented the results in a report titled, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants,* (NRC 1996a). The NRC amended the environmental protection regulations in 10 CFR 51 to streamline the process of environmental review for license renewal by drawing on the experience of the operating nuclear power reactors and to generically assess many of the environmental impacts. The amendment eliminated consideration of the need for generating capacity and utility economics from the environmental reviews.

The NRC decided to undertake a generic assessment of the environmental impacts associated with the renewal of a nuclear power plant operating license because:

- License renewal would involve nuclear power plants where the environmental impacts of operation are well understood as a result of data evaluated from operating experience to date.

- Activities associated with license renewal are expected to be within this range of operating experience, thus environmental impacts can be reasonably predicted.

- Changes in the environment around nuclear power plants are gradual and predictable with respect to characteristics important to environmental impact analyses.

In general, there are 92 discrete NEPA issues associated with license renewal that require responses in an environmental assessment. Of the 92 issues, 68 were found to have impacts of small significance on all plants and no mitigation would be needed beyond that already employed at the plants. Those issues are adequately addressed in the NRC's generic EIS, and no further assessment of these issues would be required in a plant-specific review. Twenty-four issues were determined to require further analysis and possible new information. The qualitative impacts on these issues were determined to be "small," "moderate," or "large," depending on the specific plant. **Table 5–47** summarizes the issues and the NRC's findings in the generic EIS. These issues need to be addressed by the licensees as part of the plant life extension license renewal application.

Table 5–47 Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants

Issue	*Findings*
Surface Water Quality, Hydrology, and Use (for all plants)	
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on in-stream and riparian communities near these plants could be of moderate significance in some situations. See § 51.53(c)(3)(ii)(A).
Aquatic Ecology	
Entrainment of fish and shellfish in early life stages	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants, but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See § 51.53(c)(3)(ii)(B).
Impingement of fish and shellfish	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants, but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See § 51.53(c)(3)(ii)(B).
Heat shock	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants with once-through and cooling-pond systems. See § 51.53(c)(3)(ii)(B).
Groundwater Use and Quality	
Groundwater use conflicts (potable and service water, and dewatering; plants that use more than 100 gallons per minute)	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gallons per minute may cause groundwater use conflicts with nearby groundwater users. See § 51.53(c)(3)(ii)(C).
Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal. See § 51.53(c)(3)(ii)(A).
Groundwater use conflicts (Ranney wells)	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C).
Groundwater quality degradation (cooling ponds at inland sites)	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See § 51.53(c)(3)(ii)(D).
Terrestrial Resources	
Refurbishment impacts	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See § 51.53(c)(3)(ii)(E).
Threatened or Endangered Species (for all plants)	
Threatened or endangered species	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected. See § 51.53(c)(3)(ii)(E).
Air Quality	
Air quality during refurbishment (non-attainment and maintenance areas)	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage. See § 51.53(c)(3)(ii)(F).

Issue	*Findings*
Human Health	
Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See § 51.53(c)(3)(ii)(G).
Electromagnetic fields, acute effects (electric shock)	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See § 51.53(c)(3)(ii)(H).
Electromagnetic fields, chronic effects	UNCERTAIN. Biological and physical studies of 60-Hertz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a scientific consensus view has not been reached. If in the future the Commission finds that, contrary to current indications, a consensus has been reached by appropriate Federal health agencies that there are adverse health effects from electromagnetic fields, the Commission will require applicants to submit plant-specific reviews of these health effects as part of their license renewal applications. Until such time, applicants for license renewal are not required to submit information on this issue.
Socioeconomic	
Housing impacts	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See § 51.53(c)(3)(ii)(I).
Public services: public utilities	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See § 51.53(c)(3)(ii)(I).
Public services, education (refurbishment)	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance, but larger impacts are possible depending on site- and project-specific factors. See § 51.53(c)(3)(ii)(I).
Offsite land use (refurbishment)	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See § 51.53(c)(3)(ii)(I).
Offsite land use (license renewal term)	SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal. See § 51.53(c)(3)(ii)(I).
Public services, transportation	SMALL, MODERATE, OR LARGE. Transportation impacts are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J).
Historic and archaeological resources	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See § 51.53(c)(3)(ii)(K).
Postulated Accidents	
Severe accidents	SMALL. The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(3)(ii)(L).
Uranium Fuel Cycle and Waste Management	
Transportation	Table S-4 of CFR 51.52 (c) contains an assessment of impact parameters to be used in evaluating transportation effects in each case. See CFR 51.53(c)(3)(ii)(M).
Environmental Justice	
Environmental Justice	This issue was not addressed in the generic EIS. The need for and content of an environmental justice evaluation will be addressed in a plant-specific review.

Note: Consistent with 10 CFR 51, Subpart A, Appendix B, the following definitions of environmental impacts were used.

Small	Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small as the term is used in this table.
Moderate	Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
Large	Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Source: 10 CFR 51.

5.2.5 Decontamination and Decommissioning

Construction of Bellefonte 1 or Bellefonte 2 has not been completed. Neither of the units are operational. For the purposes of this EIS the future operation of these units depends on whether or not they would be used for tritium production. Consequently, the environmental impacts associated with the production of tritium at Bellefonte would include impacts resulting from construction activities, operation of the units to produce tritium, and decontamination and decommissioning of these reactors at the end of their useful life. The following provides a summary of the impacts that can be expected from the decontamination and decommissioning of the Bellefonte units.

5.2.5.1 Background

Since no CLWRs of a size (i.e., about 1,000 megawatts-electric) comparable to the Bellefonte units have been decommissioned, data for decontamination and decommissioning are limited. In 1988, the NRC issued a *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* (NRC 1988). That EIS provided generic assessments and projections of the environmental consequences of decontamination and decommissioning for various nuclear facilities. Projections associated with impacts from commercial pressurized water reactors were used to characterize the environmental impacts.

Another aspect of decontamination and decommissioning of commercial reactors that would continue to influence the nature and extent of environmental impacts is the continuing evolution in the NRC and EPA regulations that govern decontamination and decommissioning activities. An example of this evolution is the *Final Rule on Radiological Criteria for License Termination*, which was issued by the NRC in July 1997. The final rule provides specific radiological criteria for the decommissioning of NRC-licensed facilities. The criteria clarify, for example, that a site would be considered acceptable for unrestricted use if decontaminated to a level of 25 millirem per year. Comparable regulatory guidance on other aspects of decontamination and decommissioning are in various stages of creation/issuance.

5.2.5.2 Decontamination and Decommissioning Options

The decontamination and decommissioning of a CLWR can be accomplished via one of the following three options:

- *Entomb*—Complete isolation of radioactivity from the environment by means of massive concrete and metal barriers until radioactivity has decayed to levels that permit unrestricted release from the facility. This decay may take up to several hundreds of thousands of years.

- *Safstor*—Process of placing and maintaining a nuclear facility in a condition that allows the nuclear facility to be safely stored (to allow radioactive decay) and subsequently decontaminated (i.e., deferred decontamination) to levels that permit the property to be released for unrestricted use.

- *Decon*—Process of immediately removing and disposing of all radioactivity in excess of levels that would permit the release of the facility for unrestricted use.

It would be assumed that the decontamination and decommissioning of the CLWR used for tritium production would select the Decon option. The advantages inherent in Decon are prompt termination of the NRC license shortly after cessation of operation; the elimination of radioactivity at a radioactive site; the return of the site for unrestricted use; the availability of reactor operating staff to support site characterization and subsequent decontamination and decommissioning activities; and the elimination of a need for long-term surveillance and maintenance.

5.2.5.3 Decommissioning Activities

The decontamination and decommissioning of a pressurized water reactor would typically be completed in a period of 8 to 12 years after facility shutdown. It is anticipated that the initial 2 to 3 years would focus on planning and scheduling of the decontamination and decommissioning program and the required coordination activities with local, state and regulatory agencies. The decontamination and decommissioning program would be implemented in a series of steps, but the process can be summarized as follows:

Removal/dismantlement of the major components of the primary system—This would involve the removal of the reactor vessel, vessel internals, steam generators, pressurizer, and other major components. The removal phase may be completed in one of two ways: (1) removal of the intact component (e.g., with all reactor vessel internals intact) for shipment to the final disposal site; or (2) segmentation of the major component and/or its internals with the segments shipped to the final disposal site.

Decontamination of primary system piping—The primary system and the other large-bore contaminated piping systems would be decontaminated in place and subsequently removed and disposed of in accordance with appropriate regulations.

Decontamination of primary containment and facility structures—The primary containment surfaces and structures would be decontaminated in place using scabbling, scarifying, and similar technologies. The waste materials would be packaged and disposed of in accordance with appropriate regulations.

Spent fuel and Greater-Than-Class-C waste shipments—It is assumed that a final high level waste repository would be operational to receive spent fuel and Greater-Than-Class-C waste in a timely manner that does not prolong or delay decontamination and decommissioning activities.

Disposal of low-level radioactive waste—Low-level radioactive waste would be processed in accordance with established procedures.

5.2.5.4 Decontamination and Decommissioning Impacts

The impacts to be anticipated as a result of decontamination and decommissioning activities would vary according to operating history, facility maintenance, and related factors. The NRC's *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586 (NRC 1988), provides estimates of impacts that are be used in the discussion below. [The NUREG estimates recently have been characterized as bounding by a commercial reactor (i.e., 619 Megawatts-electric pressurized water reactor) that submitted its Post Shutdown Decommissioning Activity Report in August 1997.]

Radiation Exposure

NUREG–0586 evaluates the radiation dose to plant workers and the public resulting from decontamination and decommissioning activities for a generic pressurized water reactor (1,175 Megawatts-electric) over a four-year period as follows:

Occupational exposure due to decontamination		1,114.5 person-rem
Occupational exposure due to decontamination truck shipments		100.2 person-rem
Total for workers	=	*1,215 person-rem*
Public exposure due to decontamination		Negligible
Public exposure due to decontamination truck shipments		20.6 person-rem
Total for public	=	*21 person-rem*

These doses are considerably lower than the typical worker doses accumulated during reactor operation, maintenance, and refueling operations.

In addition to the doses calculated above, the NUREG summarized the results of exposure calculations to a maximally exposed individual from accidental airborne release during decommissioning. These analyses indicated that the radiation doses were "quite low."

Waste Disposal

Decontamination and decommissioning of a pressurized water reactor would result in the creation of low-level radioactive waste that would require transportation to and burial within a licensed site for disposal. NUREG–0586 estimates that approximately 18,340 cubic meters (647,677 cubic feet) of low-level radioactive waste would be generated.

In addition, the disposal of highly activated components (e.g., reactor, reactor internals) could require disposal in a deep geologic repository. NUREG–0586 estimates that approximately 11 cubic meters of highly activated waste would require disposal in this manner.

Socioeconomics

Completion of Bellefonte 1 and 2 would generate impacts associated with the eventual decontamination and decommissioning of the plant. Currently, decontamination and decommissioning of a two-unit nuclear station to green-field status using the immediate dismantlement approach (commonly called Decon) is estimated to cost between $600 and $700 million. Offsite disposal of low-level radioactive waste would be responsible for at least half the cost. Low-level radioactive waste disposal costs have escalated at double-digit rates for many years and cannot be forecast with confidence. Currently, onsite costs for labor and materials can be rounded to $200–250 million, excluding the potential for onsite long-term spent fuel storage. It is also impossible to predict what these costs would be 40 years in the future. It is reasonable to expect that decontamination and decommissioning 40 years in the future would not require the kind of dry cask ISFSI that is necessary for existing reactors with limited onsite spent fuel storage pools.

Assuming that decontamination and decommissioning 40 years in the future would take six years and that onsite spending at that time would have a net present value of $200–250 million, the effect of decontamination and decommissioning would be to continue local spending at the level of $30 to 40 million per year. Operations spending would be at roughly $90 million per year, including local procurements. Costs at the upper end of any range would be incurred during the last few years of operation as planning for retirement took place. The net socioeconomic effect of decontamination and decommissioning is to extend the local receipt of income by perhaps six years at roughly 30 percent of the operational level. This is beneficial, since it smooths the transition from operational to post-operational status.

Other Environmental Impacts

NUREG–0586 (NRC 1988) characterizes as "minor" other environmental impacts that result from decommissioning activities when compared to the impacts that result from normal operation of the reactor. These impacts include:

- Water use during decontamination and decommissioning activities is estimated to be 18,000 cubic meters (635,670 cubic feet), which is far less than water use and evaporation during operation—i.e., approximately 27 million cubic meters per year (953 million cubic feet per year).

- Numbers of workers on site typically would not exceed the number of workers during initial construction or operation.

- Disturbance of ground cover would be limited to the restoration of contaminated sites.

5.2.6 Spent Fuel Storage

The environmental impacts from the storage of additional spent fuel due to the production of tritium presented in this section assumes that 3,400 TPBARs would be irradiated in a reactor core over an 18-month reactor operating cycle. Westinghouse has estimated (WEC 1999) that no additional spent nuclear fuel would be generated if approximately 2,000 TPBARs or less were irradiated in each operating cycle.

As discussed in Appendix A, the production of tritium in any of the alternative reactor units considered in this EIS would generate additional spent fuel. For the purposes of this EIS, it is assumed that the additional spent fuel generated from tritium production over the duration of the program would be accommodated at the site in a dry cask ISFSI. This section presents the environmental impact of the construction and operation of, and postulated accidents associated with, a generic dry cask ISFSI should it become necessary. This generic ISFSI would be designed to store the number of additional spent nuclear fuel assemblies required for 40-year tritium production at the reactor site.

Number of ISFSI Casks for 40-Year Tritium Production

The number of ISFSI dry casks required to store the additional nuclear fuel needed for tritium production was calculated using fuel usage information for each nuclear power plant and current NRC-licensed ISFSI dry cask designs applicable to pressurized water reactor spent nuclear fuel (VECTRA 1995, NRC 1996d). **Table 5–48** presents the data used for each nuclear plant and the resulting calculated number of ISFSI dry casks required to accommodate the spent nuclear fuel increment from 40 years of tritium production.

The number of dry storage casks calculated to accommodate tritium production as delineated in Table 5–48 is based on the 24 pressurized water reactor spent nuclear fuel assembly capacity of four of the ISFSI cask designs in the United States (VECTRA 1995, NRC 1996d, NRC 1987, NRC 1989). The number of dry storage casks are used in this report to quantify the specific environmental impact for each of the three nuclear power plants.

Table 5–48 Data for Number of ISFSI Cask Determination for Each Nuclear Power Plant

Data Parameter	*Watts Bar*	*Sequoyah* [a]	*Bellefonte* [a]
Operating cycle length	18 months	18 months	18 months
Fresh fuel assemblies per cycle—no tritium	80	80	72
Fresh fuel assemblies per cycle—maximum tritium production (3,400 TPBARs)	136	140	141
Increase in fresh fuel assemblies per cycle due to tritium production	56	60	69
Number of operating cycles in 40 years[b]	27	27	27
Number of additional fuel assemblies for 40-year tritium production	1512	1620	1863
Integer number of ISFSI dry casks needed to store additional tritium production fuel assemblies	63	68	78

[a] Per reactor.
[b] Forty years of operation covers 26 refueling outages and 27 operating cycles. Spent fuel is discharged 27 times.

A number of ISFSI dry storage designs have been licensed by the NRC and are in operation in the United States (NRC 1996d). These designs include the Modular Vault Dry Store, metal casks, and concrete casks. The majority of operating ISFSIs have chosen to use concrete casks (NRC 1996d). Concrete casks consist of either a vertical or horizontal concrete structure housing a metal basket that confines the spent nuclear fuel. The Modular Vault Dry Store is a large reinforced concrete building that has been judged by the utility industry to be economically noncompetitive with metal and concrete casks, especially for the number and type of spent nuclear fuel assemblies being evaluated in this report. Therefore, for the determination of the maximum environmental impact of any economically viable and currently licensed ISFSI, only concrete dry storage casks would be considered for this environmental impact analysis.

Currently, the two concrete pressurized water reactor spent nuclear fuel dry cask designs licensed in the United States are the VSC–24 (NRC 1996d) and the NUHOMS–24P (VECTRA 1995). The VSC–24 shape is that of a vertical concrete cylinder, whereas the NUHOMS–24P shape is a rectangular concrete block. Both designs store the same 24 pressurized water reactor spent nuclear fuel assemblies. However, the NUHOMS–24P requires a greater quantity of concrete and steel and occupies a larger footprint for the same number of stored fuel assemblies compared to the VSC–24. Therefore, the environmental impact of using the NUHOMS–24P concrete dry storage ISFSI design is determined, since it should bound all other currently licensed dry storage cask designs.

The environmental impact of dry cask storage of the excess pressurized water reactor spent nuclear fuel required for tritium production is presented in the following three sections. Supporting information for this environmental impact evaluation was obtained from the Calvert Cliffs NUHOMS–24P ISFSI (BGE 1989a, BGE 1989b) and the Oconee NUHOMS–24P ISFSI (Duke 1988), as well as the standardized NUHOMS ISFSI report (VECTRA 1995).

Construction Impacts

The construction of a concrete dry cask ISFSI uses conventional equipment for land leveling and grading, rebar and concrete forms installation, and pouring of concrete for base slabs and the NUHOMS–24P horizontal storage module. The horizontal storage module consists of a rectangular, reinforced concrete block 5.79 meters (19 feet) long, 2.76 meters (9.7 feet) wide, and 4.6 meters (15 feet) high. The module has a hollow internal cavity to accommodate a stainless steel cylindrical cask that contains the spent nuclear fuel (VECTRA 1995). The stainless steel cask that is placed inside the horizontal storage module is fabricated off site.

Construction of the spent nuclear fuel ISFSI would use a small amount of local water resources. Concrete would be delivered premixed in trucks, while water for drinking, cleaning, and fugitive dust control would be brought onto the construction site by trucks. The portable toilets that would be used on the construction site would also require no local water.

No construction would be located within the limits of the 100-year flood plain, which would be consistent with the requirements of Executive Order 11988, Floodplain Management. Because these facilities would be considered “critical actions,” they would be located above the 500-year flood elevation.

Land use during construction of an ISFSI is dependent on the specific site characteristics. More land is disturbed than the actual footprint of the ISFSI due to associated security and personnel exclusion fence boundaries. At Calvert Cliffs, a wooded site that is located approximately 700 meters (2,300 feet) from the nuclear power plant was selected for the ISFSI. Preparation of this site affected approximately 24,281 square meters (6 acres) of land for the ISFSI footprint of 13,982 square meters (3.5 acres) (BGE 1989a). The Calvert Cliffs installation was designed to contain 120 spent nuclear fuel casks (also called horizontal storage modules in the NUHOMS–24P design). For this EIS, it is conservatively assumed that the same ratio (e.g., 1.71) of affected land to actual ISFSI footprint land is applicable. **Table 5–49** delineates the land use for each specific nuclear power plant’s tritium excess spent nuclear fuel ISFSI.

Table 5–49 Environmental Impact of ISFSI Construction

No.	***Environmental Parameter***	***Bellefonte***	***Sequoyah***	***Watts Bar***
1	External appearance	78 Horizontal storage modules Rectangular cubes (5.79 × 2.96 meters) (19 × 9.7 feet) constructed on 3 concrete cask foundation pads approximately: (31.4 × 11.58 meters) (106.7 × 38 feet)	68 Horizontal storage modules Rectangular cubes (5.79 × 2.96 meters) (19 × 9.7 feet) constructed on 3 concrete cask foundation pads approximately: (38.43 × 11.58 meters) (126.1 × 38 feet)	63 Horizontal storage modules Rectangular cubes (5.79 × 2.96 meters) (19 × 9.7 feet) constructed on 3 concrete cask foundation pads approximately: (35.47 × 11.58 meters) (116.4 × 38 feet)
Site Preparation and Facility Construction				
2	Health and safety (Only construction work performed subsequent to the loading of any horizontal storage modules with spent fuel may result in worker exposures from direct and skyshine radiation in the vicinity of the loaded horizontal storage modules.)	Total dose during construction: 87.8 person-rem	Total dose during construction: 51.00 person-rem	Total dose during construction: 47.25 person-rem
3	Electrical distribution	Existing electrical services would be used.	Existing electrical services would be used.	Existing electrical services would be used.
4	Construction water use	Small	Small	Small

No.	***Environmental Parameter***	***Bellefonte***	***Sequoyah***	***Watts Bar***
5	Effects on land use	Footprint: 13,700 square meters (3.4 acres) Disturbed: 23,600 square meters (5.8 acres)	Footprint: 12,920 square meters (3.2 acres) Disturbed: 22,093 square meters (5.5 acres)	Footprint: 12,503 square meters (3.1 acres) Disturbed: 21,380 square meters (5.3 acres)
6	Effects on water bodies use	Small	Small	Small
7	Impact on workers	50 workers	50 workers	50 workers
8	Impact of construction generation of fugitive dust	Small	Small	Small
9	Impact on ecology	Small	Small	Small
10	Construction noise	Small	Small	Small
Transmission Facilities Construction Resources Committed				
11	Water	Small	Small	Small
12	Air	None	None	None
13	Biota	Limited to the land used	Limited to the land used	Limited to the land used
14	Materials (approximate)	Concrete: 12,128 metric tons (13,369 tons) Steel: 1,378 metric tons (1,519 tons)	Concrete: 10,533 metric tons (11,611 tons) Steel: 1198 metric tons (1,321 tons)	Concrete: 9,653 metric tons (10,618 tons) Steel: 1,096 metric tons (1,208 tons)
Construction Impact Control				
15	Construction traffic control	Use of existing public roadways is recommended.	Use of existing public roadways is recommended.	Use of existing public roadways is recommended.
16	Dust and particulate emission control	During construction, paved road would be used.	During construction, paved road would be used.	During construction, paved road would be used.
17	Noise control	Small/No provision required	Small/No provision required	Small/No provision required
18	Chemical waste management	A chemical control program would be prepared. Liquid waste would be stored in a tank.	A chemical control program would be prepared. Liquid waste would be stored in a tank.	A chemical control program would be prepared. Liquid waste would be stored in a tank.
19	Solid waste management	Construction scrap would be collected in designated area for recycling or removal.	Construction scrap would be collected in designated area for recycling or removal.	Construction scrap would be collected in designated area for recycling or removal.
20	Site clearing	Site would be paved. By providing drainage, erosion would be controlled.	Site would be paved. By providing drainage, erosion would be controlled.	Site would be paved. By providing drainage, erosion would be controlled.
21	Excavation and soil deposition	Construction site would be stabilized.	Construction site would be stabilized.	Construction site would be stabilized.

Note 1: Consistent with 10 CFR 51, Subpart A, Appendix B, the following definition of environmental impacts was used.
Small Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small as the term is used in this table.
Note 2: These environmental parameters were taken directly from an earlier, approved NRC environmental assessment for similar ISFSI design. This CLWR EIS states that, if built, all NEPA requirements for the ISFSI will be addressed.

A peak workforce of 50 people is projected for the construction of this ISFSI (BGE 1989a). The use of local contractors and the rather small number of personnel would not be expected to have any impact on housing, transportation, and educational facilities. Construction fugitive dust should be small. The small construction area should not have any impact on local flora and fauna. The effects of construction noise should be limited for the construction workers by Occupational Safety and Health Administration regulations, for the public by distance to the nearest public residence, and for the local fauna by the small area involved with easy access and egress. No electric power transmission lines would have to be erected because access to existing transmission lines to the nuclear power plant would provide the electric power requirements.

The ISFSI construction would not require the commitment of any water or air resources. The principal materials used in the construction of this ISFSI would be steel and concrete. The steel and concrete quantities were delineated previously in Table 5–49. During construction, workers building casks could be exposed to radiation emitted from adjacent casks that have already been completed and loaded with spent nuclear fuel. The dose rates to the construction workers from these casks should average 0.5 millirem per hour (BGE 1989a), and an estimated 1,500 person-hours would be required to complete the construction of one cask or horizontal storage module. The construction dose to workers, as delineated in Table 5–49, conservatively assumes that each cask would be immediately loaded with spent nuclear fuel after it was completed.

Construction traffic would be accommodated by existing nuclear power plant site roadways. Any dust or particulate fugitive emissions caused by earth-moving and grading would be controlled by wetting, seeding, and the use of gravel to minimize soil erosion and runoff. Standard equipment and vehicle noise control devices, limited construction hours, and minimal use of explosives, along with adherence to all applicable Occupational Safety and Health Administration requirements, would minimize noise impact during construction. Any liquid or solid wastes generated during construction would be collected at the construction site and removed from the site for suitable recycling or disposal off site in accordance with applicable EPA regulations. None of the wastes would be radioactive.

Operation Impacts

Spent nuclear fuel decay heat is removed by natural air convection in the NUHOMS horizontal storage module dry cask system. Each horizontal storage module cask is designed and licensed to safely remove up to 24 kilowatts of decay heat from pressurized water reactor spent nuclear fuel (VECTRA 1995). Conservative calculations have shown that, for 24 kilowatts of decay heat, air entering the cask at a temperature of 21°C (70°F) would be heated to a temperature of 72°C (161°F) (VECTRA 1995). The actual spent nuclear fuel decay heat expected for the ISFSI casks would be in the range of 7 to 12 kilowatts with a concomitantly smaller air temperature rise (PN 1993). The environmental impact of the discharge of this amount of heat can be compared to the heat (336 kilowatts) emitted to the atmosphere by an automobile with a 150–brake horsepower engine (Bosch 1976). The heat released by an average automobile is the equivalent of 14 to 48 ISFSI casks at their design maximum heat load. The decay heat released to the atmosphere from the tritium spent nuclear fuel ISFSI is equivalent to the heat released to the atmosphere from two to nine average cars.

The operating ISFSI would not release any radioactive material because the spent nuclear fuel would be in a sealed confinement boundary metal cask. The external surface of the cask would be decontaminated inside the spent fuel pool building to remove any radioactive contamination from the spent fuel pool water. The horizontal storage module concrete cask never would be exposed to any radioactive material and, therefore, could not release any radioactive contamination to the environment.

The ISFSI would be a source of direct and skyshine-scattered radiation that would penetrate the thick concrete shielding of the cask. The ISFSI direct and scattered radiation would be composed of greater than 90 percent gamma radiation and less than 10 percent neutron radiation (BGE 1989b, VECTRA 1995, Duke 1988). The combined direct and scattered dose rate would be a function of distance from the ISFSI, the number and configuration of casks in the horizontal storage module, and the presence of any radiation-absorbing natural structures or intervening topographical features such as earth berms. NRC regulations (10 CFR 72.106) require that a minimum distance of 100 meters (328 feet) be maintained as a controlled area around the ISFSI. The direct-scattered total dose rate to an individual at 100 meters was calculated to be in the range of 0.01 to 0.1 millirem per hour (BGE 1989b, Duke 1988). The determination of the dose to an offsite individual would depend on site-specific factors (e.g., distance and direction of the nearest offsite residence, fuel conditions, contribution of offsite dose from reactor plant effluents). Based on site-specific environmental assessments of operating ISFSIs (e.g., Surry, H.B. Robinson, Calvert Cliffs), the annual dose to the nearest "real"individual would be a small fraction of the 25-millirem per year criterion in 10 CFR 72.67 and 40 CFR 190.[1] This dose was calculated to be 0.00006 millirem per year at Surry (VEPCO 1985), 0.4 millirem per year at H.B. Robinson (CPL 1986), and less than 2 millirem per year at Calvert Cliffs (BGE 1989b). When combined with the dose commitment from other reactor operations, the total dose commitment would be well within the regulatory limits. **Table–50** presents an estimated range of dose rates and annual doses, assuming that onsite workers are 100 meters (328 feet) from the ISFSI and that the nearest public residence is 1,000 meters (3,280 feet) from the installation. The radiation dose effect of the number of casks at each specific ISFSI should be minor because of the small magnitude of the doses.

Table 5–50 Environmental Impact of ISFSI Operation

No.	*Environmental Parameter*	*Bellefonte*	*Sequoyah*	*Watts Bar*
1	Effects of operation of the heat dissipation system	Equivalent to heat emitted into the atmosphere by 2–6 average size cars.	Equivalent to heat emitted into the atmosphere by 2–6 average size cars.	Equivalent to heat emitted into the atmosphere by 2–6 average size cars.
2	Facility water use	Transfer cask decontamination water consumption of less than 35 cubic meters (1,236 cubic feet).	Transfer cask decontamination water consumption of less than 28.9 cubic meters (1,020 cubic feet).	Transfer cask decontamination water consumption of less than 26.8 cubic meters (946 cubic feet).
3	Radiological impact from routine operation	Worker Exposure: As the result of daily inspection of casks, during a 40-year life cycle, workers would be exposed to 74.4 person-rem. Public Exposure: The regulatory limit for public exposure is 25 millirem per year. Doses received by a member of the public living in the vicinity of the ISFSI would be well below the regulatory requirements.	Worker Exposure: As the result of daily inspection of casks, during a 40-year life cycle, workers would be exposed to 64.3 person-rem. Public Exposure: The regulatory limit for public exposure is 25 millirem per year. Doses received by a member of the public living in the vicinity of the ISFSI would be well below the regulatory requirements.	Worker Exposure: As the result of daily inspection of casks, during a 40-year life cycle, workers would be exposed to 58.8 person-rem. Public Exposure: The regulatory limit for public exposure is 25 millirem per year. Doses received by a member of the public living in the vicinity of the ISFSI would be well below the regulatory requirements.
3	Radwaste and source terms	Cask loading and decontamination operation generates less than 4.42 cubic meters (156 cubic feet) of low-level radioactive waste.	Cask loading and decontamination operation generates less than 3.85 cubic meters (136 cubic feet) of low-level radioactive waste.	Cask loading and decontamination operation generates less than 3.57 cubic meters (126 cubic feet) of low-level radioactive waste.

[1]*The term "real" is used for an individual living near the ISFSI under realistic conditions, as opposed to a hypothetical individual living under conditions that would tend to overestimate the resulting exposure.*

No.	Environmental Parameter	Bellefonte	Sequoyah	Watts Bar
4	Effects of chemical and biocide discharges	Small	Small	Small
5	Effect of sanitary waste discharges	Small	Small	Small
6	Effects of maintenance of the electrical distribution system	Small	Small	Small
7	Noise impact	Small	Small	Small
8	Climatological impact	Small (less than 0.1 percent of the nuclear power plant's heat emission to the atmosphere)	Small (less than 0.1 percent of the nuclear power plant's heat emission to the atmosphere)	Small (less than 0.1 percent of the nuclear power plant's heat emission to the atmosphere)
9	Impact on wildlife	Small	Small	Small
10	Impact of runoff from operation	The horizontal storage module surface is not contaminated. No contaminated runoff is expected.	The horizontal storage module surface is not contaminated. No contaminated runoff is expected.	The horizontal storage module surface is not contaminated. No contaminated runoff is expected.
11	Vehicle emissions during construction and operation	Small	Small	Small
12	Socioeconomics	Small	Small	Small

Note 1: Consistent with 10 CFR 51, Subpart A, Appendix B, the following definition of environmental impacts was used.
Small Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small as the term is used in this table.
Note 2: These environmental parameters were taken directly from an earlier, approved NRC environmental assessment for similar ISFSI design. This CLWR EIS states that, if built, all NEPA requirements for the ISFSI will be addressed.

The storage cask-loading operation would include moving the spent fuel into the confinement cask; removing the transport cask out of the pool; draining water from the cask; vacuuming and backfilling the cask; welding the cover plate; decontaminating the cask surface; moving the cask to the ISFSI site; and installing the cask into the concrete horizontal storage module. These operations would result in a total dose to all the involved workers that is conservatively estimated to be in the range of 1.05 to 1.45 person-rem for each ISFSI cask loaded and installed at the ISFSI site (Duke 1988, BGE 1989b). Table 5–50 presents onsite worker doses associated with cask-loading operations for the three nuclear power plants being considered for tritium production. These doses assume that casks would be loaded with the same frequency and quantity of spent nuclear fuel as the fuel cycle predictions given in Table 5–48.

Operation of the ISFSI would generate no chemical, biocide, or sanitary wastes. The loading process for each cask would generate less than 0.43 cubic meters (15 cubic feet) of low-level radioactive liquid waste and less than 0.057 cubic meters (2 cubic feet) of low-level solid waste per cask. This amount of low-level radioactive solid and liquid waste is presented in Table 5–50 for each nuclear power plant.

The ISFSI operation would generate minimal noise. The only measurable noise levels would be generated by the truck transporting each cask from the spent fuel pool building to the site (two times for every 18-month fuel cycle). Additional light traffic noise would be generated by personnel transportation for daily ISFSI inspection and periodic health physics or security personnel visits. The noise level should be within the range of noise typically generated by nuclear power plant activities.

The heat emitted by the fully loaded, largest projected tritium ISFSI, even at the maximum design-licensed decay heat level for each cask of 24 kilowatts, would be less than 2 megawatts (i.e., 78 casks × 24 kilowatts = 1,872 kilowatts or 1.87 megawatts). This amount of heat of less than 2 megawatts added to the atmosphere is less than 0.1 percent of the heat released to the environment from any of the proposed nuclear power plants—on the order of 2,400 megawatts for each operating nuclear reactor. The actual decay heat from spent nuclear fuel in the ISFSI should be lower than 1.87 megawatts and would decay with time due to the natural decay of fission products in the spent nuclear fuel. In addition, the incremental loading of the ISFSI over a 40-year period would not generate the full ISFSI heat until 40 years after the initial operation. The heat emitted from the ISFSI would have no effect on the environment or climate because of its small magnitude.

The small amount of land expected to be disturbed would have no impact on local flora and fauna. Runoff from rain would carry no radioactive contamination and would not require monitoring or holdup capability. ISFSI operational vehicle emissions would be a small fraction of the vehicle emissions generated by the operation of the adjacent nuclear power plant. The operation would not involve an irreversible or irretrievable commitment of resources.

Decommissioning and dismantling of the ISFSI should occur sometime after the availability of a Federal permanent ISFSI. The materials used in the ISFSI (e.g., concrete, steel, and lead) would be identical to materials at the adjoining nuclear power plant. Decontamination and decommissioning methods for the nuclear power plant would be applied to the site and would represent a small fraction of the quantity and radioactive contamination level of components within the nuclear plant. Some decontamination of an inner layer of the concrete shielding and the metal confinement cask would be required. A minimal incremental environmental impact is expected from the decontamination and decommissioning of the ISFSI, assuming that it occurs simultaneously with the decontamination and decommissioning of the nuclear power plant.

The potential increase in spent fuel storage requirements due to tritium production would create additional costs, but would not appreciably increase socioeconomic impacts. The spent fuel dry storage casks would be procured from outside the region. The costs incurred at the site for additional fuel transfers, spent fuel storage cask maintenance, spent fuel cask pad expansion, transfer of spent fuel to shipping casks, etc., as well as related storage activities, should be no more than $1 million per year. These costs are not material in a regional socioeconomic context.

Environmental Effects of Postulated Accidents

The most severe environmental impact of all postulated accidents analyzed for the ISFSI is the nonmechanistic release of the gaseous gap content from all 24 pressurized water reactor spent nuclear fuel assemblies in a storage cask (VECTRA 1995). This accident conservatively assumes that 30 percent of all fission product gases present in all the spent nuclear fuel within one cask would be released to the environment. This scenario is extremely conservative because the ISFSI is designed to maintain its confinement capability under all postulated accidents. In addition, ISFSI casks encapsulate intact fuel. Failed fuel must be enclosed in a second sealed container within the cask to ensure the required two levels of confinement for ISFSI design. The radiological consequences of this accident were calculated using the bounding spent nuclear fuel radioisotope fission product inventory and conservative site-specific atmospheric dispersion factors. The regulatory limit for this accident is a 5,000-millirem whole-body or individual organ dose (10 CFR 72.106). The numerical value of the calculated dose for this accident is a function of the specific stored spent nuclear fuel bounding fission product inventory, site-specific atmospheric dispersion factors, and the site-specific distance from the ISFSI to the nearest public boundary. A generic and conservative calculation for the NUHOMS–24P design resulted in a 300-meter (984-foot) whole-body dose of 53 millirem (VECTRA 1995). Similarly, generic conservative calculations for this accident with the VSC–24 ISFSI design (NRC 1996d) resulted in a whole-body dose of 88 millirem at 200 meters (656 feet), 18 millirem at 500 meters (1,640 feet), and 5.7 millirem at 1,000 meters (3,280 feet). All of these results are well within the regulatory limit. The impact of these calculated doses can be compared with the natural radiation dose of about 300 millirem annually received by each human being in the United States (DOE 1996a). Thus, even at an unrealistically close distance of 200 meters, the public dose to this extremely conservative, nonmechanistic accident represents about 29 percent of the average annual dose due to natural sources. At a more realistic distance of 1,000 meters (3,281 feet), the dose from this accident represents only 2 percent of the average annual natural dose to the public. The generic conservative radiological consequences of this accident are presented in **Table 5–51**.

All other postulated ISFSI accidents would either have no radiological impacts on the public or would deliver a dose smaller than that calculated for the 100 percent fuel failure associated with a cask leakage.

Table 5–51 Environmental Impact of Accidents at ISFSI

Normal Operation and Operational Occurrences			
	Postulated Accident	***Accident Evaluation Requirements***	***Consequences***
Anticipated Accident			
1	An inadvertent cask movement causing lateral impact of the fuel basket against the inside of the storage cask	This event should be evaluated to ensure that no release of radioactive materials in the ISFSI would result.	This event does not result in release of radioactive materials.
2	Extreme ambient temperatures	This event should be evaluated to ensure that no release of radioactive materials in the ISFSI would result.	This event does not result in release of radioactive materials
3	Partial blockage of air passages	This event should be evaluated to ensure that no release of radioactive materials in the ISFSI would result.	This event does not result in release of radioactive materials
4	The postulated release of surface contamination from baskets	This event could result in the release of radioactive materials from the ISFSI. An analysis should be conducted to demonstrate that the proposed contamination limits would not result in radiological concern at a distance of 100 meters from the ISFSI. The analysis also should determine the allowable surface contamination limits.	This accident would result in a dose of less than 10 millirem to a person at 100 meters away
Maximum Credible Accident			
1	Fires	The ISFSI Safety Analysis Report should evaluate the consequences of this hypothetical accident to demonstrate that the storage cask system provides a substantial safety margin for the protection of public, facility personnel, and the environment.	Designed to withstand the accident with no consequence
2	Structural collapse	The presence of any structure, the collapse of which may result in any accident, should be acknowledged. The ISFSI Safety Analysis Report should evaluate the consequences of this hypothetical accident to demonstrate that the storage cask system provides a substantial safety margin for the protection of the public, facility personnel, and the environment.	Designed to withstand the accident with no consequence
3	The postulated tipping over of a storage cask	The ISFSI Safety Analysis Report should evaluate the consequences of this hypothetical accident to demonstrate that the storage cask system provides a substantial safety margin for the protection of the public, facility personnel, and the environment.	Designed to withstand the accident with no consequence

Normal Operation and Operational Occurrences			
	Postulated Accident	***Accident Evaluation Requirements***	***Consequences***
4	Blockage of the storage cask air inlet vents	The ISFSI Safety Analysis Report should evaluate the consequences of this hypothetical accident to demonstrate that the storage cask system provides a substantial safety margin for the protection of the public, facility personnel, and the environment.	Designed to withstand the accident with no consequence
Beyond Design-Basis Accident			
5	Dry shielded canister leakage	Sites should identify the radiological consequences of this accident and ensure that it is below the regulatory limit at the ISFSI facility fence.	88 millirem at 200 meters (656 feet) 18 millirem at 500 meters (1,640 feet) 5.7 millirem at 1,000 meters (3,280 feet)
Transportation Accidents Involving Radioactivity			
1	Transportation accidents	Sites should: – Confirm that transportation of the storage system would take place within the existing site boundary. – Describe onsite transportation aspects and procedures (i.e., towing and transfer method, distance traveled). – Ensure that no transportation accident (i.e., drop of a loaded cask) could lead to release of radioactive materials.	Designed to withstand the accident with no consequence
Other Accidents			
1	Tornadoes	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
2	Floods	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
3	Earthquakes	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
4	Volcanoes	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
5	Nearby explosions	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
6	Lightning strikes	Such accidents should be evaluated consistent with the plant's Final Safety Analysis Report requirements.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
7	The collapse of structures around the ISFSI	Sites should determine any probability of a failure of a surrounding structure which could affect the integrity of the ISFSI.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
8	Fire protection	Sites should ensure that no combustible materials are stored within the ISFSI or its boundaries.	Consistent with the ISFSI's design criteria in the Safety Analysis Report
9	Explosion protection	Sites should ensure that no explosive materials and no credible internal explosions are possible.	Consistent with the ISFSI's design criteria in the Safety Analysis Report

5.2.7 Fabrication of TPBARs and Blend-Down of Highly Enriched Uranium

Commercial facilities would fabricate and assemble the TPBARs. Potential fabrication and/or assembly sites include: General Electric, Wilmington, North Carolina; Framatome - Cogema Fuels, Lynchburg Virginia; BWX Technologies, Inc., Lynchburg, Virginia; Asea Brown-Boveri/Combustion Engineering, Hematite, Missouri; Siemens Power Corporation, Richland, Washington; and Westinghouse Electric, Columbia, South Carolina. Each of the facilities has a 10 CFR 70 license issued by the NRC. The successful fabrication bidder will determine whether its NRC license will require an amendment. In the event a license amendment is required, the NRC will prepare the appropriate environmental documentation. In addition, if this DOE fabrication procurement is subject to 10 CFR 1021, DOE will consider the environmental impacts during the fabrication procurement process. Since the fabricator of the TPBARs is still to be determined, the qualitative assessment presented in this EIS presents the reasonably foreseeable impacts of fabrication. This EIS provides a brief description of the fabrication process and a qualitative discussion of the potential, non-site-specific environmental consequences. It also provides estimates of the material resources required by the tritium production program.

The TPBARs consist of multiple components of materials designed to produce, capture, and store tritium until the TPBARs can be removed from the reactor and processed under controlled conditions to remove the tritium. The TPBARs contain lithium aluminate ($LiAlO_2$) pellets. The pellets are enriched in lithium-6 to produce tritium. The pellets are stacked in an unplated zircaloy-4 tube called the liner. The liner absorbs oxygen and supports the pellets. The pellets are surrounded by a metal tube of nickel-plated zircaloy. This tube functions as a getter (absorber of tritium). The pellet, liner, and nickel-plated zircaloy components are inserted in stainless steel cladding. The inside surface of the cladding is aluminized to provide a barrier to limit tritium leakage through the cladding.

The enriched lithium aluminate is produced through the chemical reaction of lithium carbonate/lithium monohydrate and aluminum oxide. In the TPBAR fabrication facility, these two materials would be blended, spray dried (to limit the amount of water trapped in the product), and calcined to form the lithium aluminate. The lithium aluminate would be combined with a binder, conditioned for pressing, pressed into its final ceramic annular shape, and sintered. These annular pellets then would be assembled with the remaining rod components, including the zirconium getter and the rod cladding. Final rod assembly would include additional drying, backfilling of the rods with helium, and welding end caps onto the rods. The TPBARs would be attached to a base plate to create a TPBAR assembly, which would be inserted into a fuel assembly; at this point they would be ready for transport to the CLWR.

No filtration of the off-gases (principally carbon dioxide) produced by this reaction would be necessary. Wastes generated from TPBAR production would consist of sanitary wastes, process wastes, and chemical wastes. Wastes would be primarily generated from TPBAR fabrication laboratory analysis, pellet grinding, and stainless steel tube working. Usable scrap material generated during the machining operations would be recycled for later use in the TPBAR production process (DOE 1992).

The quantities of material required for TPBAR production are presented in **Table 5–52**. These numbers are based on the production of 4,000 TPBARs per year (6,000 TPBARs or 250 TPBAR assemblies produced for refueling outages for reactors on an 18-month operating cycle). Each TPBAR assembly would weigh less than 27 kilograms (60 pounds), of which less than 400 grams (0.8 pound) would be lithium (WEC 1997). The amounts of source material for the production of lithium aluminate would be derived from the amount of lithium required for each TPBAR. Materials used for the fabrication of the TPBARs (i.e., lithium) have been mined and processed and are part of DOE's inventory of material resources. Therefore, no environmental consequences of any significance are expected from activities other than the fabrication and assembly of the TPBARs.

Table 5–52 Materials Required for TPBAR Production

Material	*Annual Requirement (kilograms)*	*Program Requirement (metric tons)* [a, b]
Lithium	61	2.4
Lithium carbonate	325	13
Aluminum oxide	450	18
Other materials [c]	4000	160

[a] Based on a 40-year program duration.
[b] 1 metric ton = 1,000 kilograms (2,200 pounds).
[c] Includes aluminum, zircaloy, stainless steel, and nickel.

The TPBARs would be inserted into fresh fuel assemblies in place of burnable absorber rods or an empty thimble tube. The replacement of the burnable absorber rods with TPBARs for tritium production would require that additional fuel assemblies be used in the CLWR fuel cycle. The addition of lithium into the core design would increase the amount of uranium-235 that must be in the core to produce the design power level throughout the 18-month fuel cycle. The number of fresh assemblies required for each 18-month refueling cycle would depend on the number of TPBARs inserted for irradiation in the reactor core. For up to approximately 2,000 TPBARs, no additional fresh fuel assemblies would be required. As the number of TPBARs increased above 2,000, the additional fresh fuel assemblies would increase. For the maximum number of 3,400 TPBARs considered in this EIS, approximately 60 fresh fuel assemblies would be required in addition to the approximately 80 fresh fuel assemblies normally used in an 18-month refueling cycle nontritium production mode. Therefore, the additional number of fresh fuel assemblies that would be required at Watts Bar or Sequoyah for a 40-year program duration would be approximately 1,700 fresh fuel assemblies. At Bellefonte, all fresh fuel required would be attributed to tritium production; therefore, approximately 3,807 fresh fuel assemblies would be required.

Tritium production would require fuel assemblies with higher enrichments of uranium-235 than the assemblies used in a commercial power reactor (approximately 4.9 percent compared to current 4.5 percent). The increased enrichment would be required to compensate for the increased "loss" of neutrons from the power production capability of the reactor core. These two factors, increased number of fuel assemblies and increased uranium-235 enrichment, would result in an increased use of uranium-235 in a tritium production reactor compared to the same reactor operated solely for power production. **Table 5–53** provides a summary of the amounts of uranium-235 required for both commercial operation and tritium production operation of three reactors. These figures are based on the initial core load of fresh fuel and 26 refueling outages over the 40-year life of the program. An average uranium-235 enrichment of 4.95 percent was assumed for the fuel assemblies used for tritium production (WEC 1997).

Enriched uranium used for fuel assemblies in tritium production has already been mined and processed. Therefore, no environmental consequences of any significance are expected from activities other than from the conversion of highly enriched uranium to commercial reactor fuel.

Table 5–53 Additional Fuel Requirements

Requirements	***Tritium Production Core Configuration***	***Watts Bar 1 Sequoyah 1 or 2***[a]	***Bellefonte 1***
Fresh fuel assemblies	3,400 TPBARs	1,700	3,807
	less than 2,000 TPBARs	0	2,013
Uranium-235 (metric tons)	3,400 TPBARs	34.0	75.5
	less than 2,000 TPBARs	0	40.3

[a] The values in this column reflect the requirements at Sequoyah which bound those for Watts Bar.
1 metric ton = 1,000 kilograms (2,200 pounds)

The enriched uranium to be used for the nuclear fuel assemblies would likely be provided by DOE from highly enriched uranium set aside for national security missions such as tritium production. The highly enriched uranium would be downblended with other uranium materials to commercially usable low enriched uranium. Environmental impacts resulting from the potential downblending of highly enriched uranium are described below.

Impacts from the conversion and blending of highly enriched uranium to commercial reactor fuel have been previously described in DOE's *Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement*, DOE/EIS-0240, June 28, 1996 (DOE 1996b). The Highly Enriched Uranium EIS addresses highly enriched uranium conversion and blending at four sites: DOE's Y-12 Plant at the Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee; DOE's Savannah River Site in Aiken, South Carolina; the Babcock & Wilcox Naval Nuclear Fuel Division facility in Lynchburg, Virginia; and the Nuclear Fuel Services facilities in Erwin, Tennessee. The document evaluated three conversion and blending technologies: uranyl nitrate hexahydrate or liquid blending, molten metal blending, and uranium hexafluoride or gas blending. Of the three technologies, both the uranyl nitrate hexahydrate and uranium hexafluoride convert highly enriched uranium to commercial reactor fuel as well as low-level radioactive waste. The molten metal blending would only convert highly enriched uranium to low-level radioactive waste. The Highly Enriched Uranium EIS addressed the disposition of a nominal 200 metric tons of highly enriched uranium, 170 metric tons of which would be converted to commercial fuel (61 FR 40619).

The environmental analyses in the Highly Enriched Uranium EIS estimated that the incremental radiological impact to workers, the public, and the environment during normal blending operations would be very small and would be well within regulatory requirements for all alternatives, technologies, and sites. Since no new construction would be required and the blending activities would be the same as past blending operations at these sites, all impacts would be small.

5.2.8 Transportation of TPBARs

Transportation impacts may be divided into two parts: the impacts of incident-free or routine transportation and the impacts of transportation accidents. Incident-free transportation and transportation accident impacts are divided into two parts: nonradiological impacts and radiological impacts. Incident-free transportation includes radiological impacts on the public and the crew from the radiation field that surrounds the package. Nonradiological impacts of incident-free transportation include vehicular emissions. Nonradiological impacts of potential transportation accidents are traffic accident fatalities. Only in the worst conceivable conditions, which are of low probability, could a transportation cask of the type used to transport radioactive material be so damaged that there could be a release of radioactivity to the environment.

The impacts of accidents are expressed in terms of probabilistic risk, which is the probability of an accident multiplied by the consequences of that accident and summed over all reasonably conceivable accidents. The impacts due to radiological accidents are measured in terms of the latent cancer fatalities that might result while the effect of non-radiological accidents are measured in additional immediate fatalities. Incident-free effects are also expressed in terms of additional latent cancer fatalities.

The first step in the ground transportation analysis was to determine the incident-free and accident risk factors on a per-shipment basis for transportation of the various materials. Calculation of risk factors was accomplished by using the HIGHWAY (ORNL 1993a) and INTERLINE (ORNL 1993b) computer codes to choose representative routes in accordance with U.S. Department of Transportation regulations. These codes provided population estimates so that RADTRAN (SNL 1993), and TICLD codes could be used to determine the radiological risk factors. This analysis is discussed in Appendix E.

Four transportation segments were evaluated in this EIS: (1) shipment of fabricated TPBARs to an assembly facility; (2) shipment of TPBAR assemblies to each of the CLWRs; (3) shipment of irradiated TPBARs to a Tritium Extraction Facility (assumed for purposes of evaluation to be at DOE's Savannah River Site in South Carolina); and (4) shipment of irradiated hardware to a waste disposal site. **Table 5–54** shows the estimated impacts of transportation for the 40-year duration of the program.

Table 5–54 Risks of Transporting the Hazardous Materials

Reactor Site (No. of TPBARs)	*TPBAR Transportation Mode*	*Routine*			*Accidental*	
		Radiological		*Nonradiological*		
		Crew	*Public*	*Emission*	*Traffic*	*Radiological*
Watts Bar (3,400 TPBARs per cycle)	Truck cask via truck	0.0033	0.021	0.0032	0.031	5.1×10^{-6}
	Truck cask via rail	0.0016	0.008	0.0023	0.029	5.7×10^{-6}
	Rail cask via rail	0.0016	0.008	0.0023	0.029	1.6×10^{-6}
Sequoyah (3,400 TPBARs per cycle)	Truck cask via truck	0.0030	0.019	0.0035	0.029	6.1×10^{-6}
	Truck cask via rail	0.0014	0.007	0.0024	0.028	5.2×10^{-6}
	Rail cask via rail	0.0014	0.007	0.0024	0.028	1.5×10^{-6}
Bellefonte (3,400 TPBARs per cycle)	Truck cask via truck	0.0026	0.018	0.0034	0.030	6.4×10^{-6}
	Truck cask via rail	0.0010	0.005	0.0024	0.028	5.8×10^{-6}
	Rail cask via rail	0.0010	0.005	0.0024	0.028	1.6×10^{-6}
Watts Bar (1,000 TPBARs per cycle)	Truck cask via truck	0.0010	0.007	0.0010	0.009	1.7×10^{-6}
	Truck cask via rail	0.0005	0.002	0.0007	0.009	1.9×10^{-6}
	Rail cask via rail	0.0005	0.002	0.0007	0.009	5.3×10^{-7}
Sequoyah (1,000 TPBARs per cycle)	Truck cask via truck	0.0009	0.006	0.0011	0.009	2.0×10^{-6}
	Truck cask via rail	0.0004	0.002	0.0007	0.008	1.7×10^{-6}
	Rail cask via tail	0.0004	0.002	0.0007	0.008	4.9×10^{-7}
Bellefonte (1,000 TPBARs per cycle)	Truck cask via truck	0.0008	0.006	0.0010	0.009	2.1×10^{-6}
	Truck cask via rail	0.0003	0.001	0.0007	0.009	1.9×10^{-6}
	Rail cask via rail	0.0003	0.001	0.0007	0.009	5.4×10^{-7}

Notes: 1. Maximum impacts are assumed for fabrication, assembly, and waste transportation, and are included in these totals.
2. All risks are expressed in latent cancer fatalities during the implementation of the policy, except for the Accident-Traffic column, which is the number of fatalities.

The impacts from transportation segments (1) and (2) are limited to toxic vehicle exhaust emissions and traffic fatalities since the fabricated TPBARs contain no radioactive elements. Combinations of fabrication and assembly sites were evaluated, including Richland, Washington, (Siemens Power Corporation); Lynchburg, Virginia, (Framatome-Cogema Fuels or B&W Technologies, Inc.); Hematite, Missouri, (Asea Brown-Boveri/Combustion Engineering); and Columbia, South Carolina, (Westinghouse Electric Corporation). The maximum possible impacts are included in Table 5–54. The choice of facilities would be made by DOE using normal commercial procurement practices.

Transportation segment (3) involves shipment of irradiated TPBARs from the CLWRs to the Tritium Extraction Facility at DOE's Savannah River Site. This EIS evaluated the shipment of TPBARs by three distinct methods: (1) truck casks on trucks, (2) truck casks on trains, and (3) rail casks on trains.

Transportation segment (4) involves shipment of irradiated hardware from the CLWRs to either DOE's Savannah River Site or the Barnwell disposal facility in South Carolina for disposal as low-level radioactive waste. Irradiated hardware includes base plates and thimble plugs removed from the TPBARs at the CLWR site. The number of thimble plugs and base plates cannot be determined until the detailed plans for irradiation are completed.

The next step is to use the risk factors and the number of shipments to estimate the risk for transportation segments. The exact number of shipments cannot be determined unless the precise numbers of TPBARs to be handled are known. The transportation analysis provided information to bound the impacts at each site in **Figure 5–7**. The transportation analysis looked at potential implementation approaches for each of the three reactor sites. The approaches quantitatively addressed include production at a single unit with 1,000 TPBARs and maximum production at a single unit with 3,400 TPBARs.

5.2.9 Sensitivity Analysis

As discussed in Section 3.2.1, the maximum number of TPBARs to be fabricated, irradiated, and transported to the Tritium Extraction Facility under the proposed action would be approximately 6,000 TPBARs per 18-month reactor operating cycle, or approximately 4,000 TPBARs per year. This requirement is based on a tritium production design limit of 1.2 grams of tritium per TPBAR. For the purpose of this sensitivity analysis, the "baseline" tritium production CLWR configuration is defined as a CLWR containing 3,400 TPBARs, with a production design limit of 1.2 grams of tritium per TPBAR operating on an 18-month cycle. The environmental consequences of the baseline tritium production CLWR configuration (3,400 TPBARs), as well as a 1,000 TPBAR case, are evaluated in Sections 5.2.1 through 5.2.3 for the Watts Bar plant, the Sequoyah plant, and the Bellefonte plant, respectively. This section provides a sensitivity analysis of the environmental consequences at a single reactor site that would result by considering some variations on assumptions made for the baseline configuration. These variations are: (1) reducing the number of TPBARs to be irradiated in a single reactor to 100 TPBARs, (2) changing the production design limit of tritium to 1.5 grams per TPBAR and, (3) reducing the length of the reactor operating cycle to 15.5 months or 12 months, in conjunction with the tritium production design limit of 1.5 grams per TPBAR. **Table 5–55** provides the values of key parameters used in the sensitivity analyses discussed below. **Table 5–56** presents the public health and safety-related results of the analyses in percent change from the baseline configuration for a single reactor facility. This section also discusses the possibility of producing tritium at some later date than 2005, the production date assumed for the baseline analysis in the EIS.

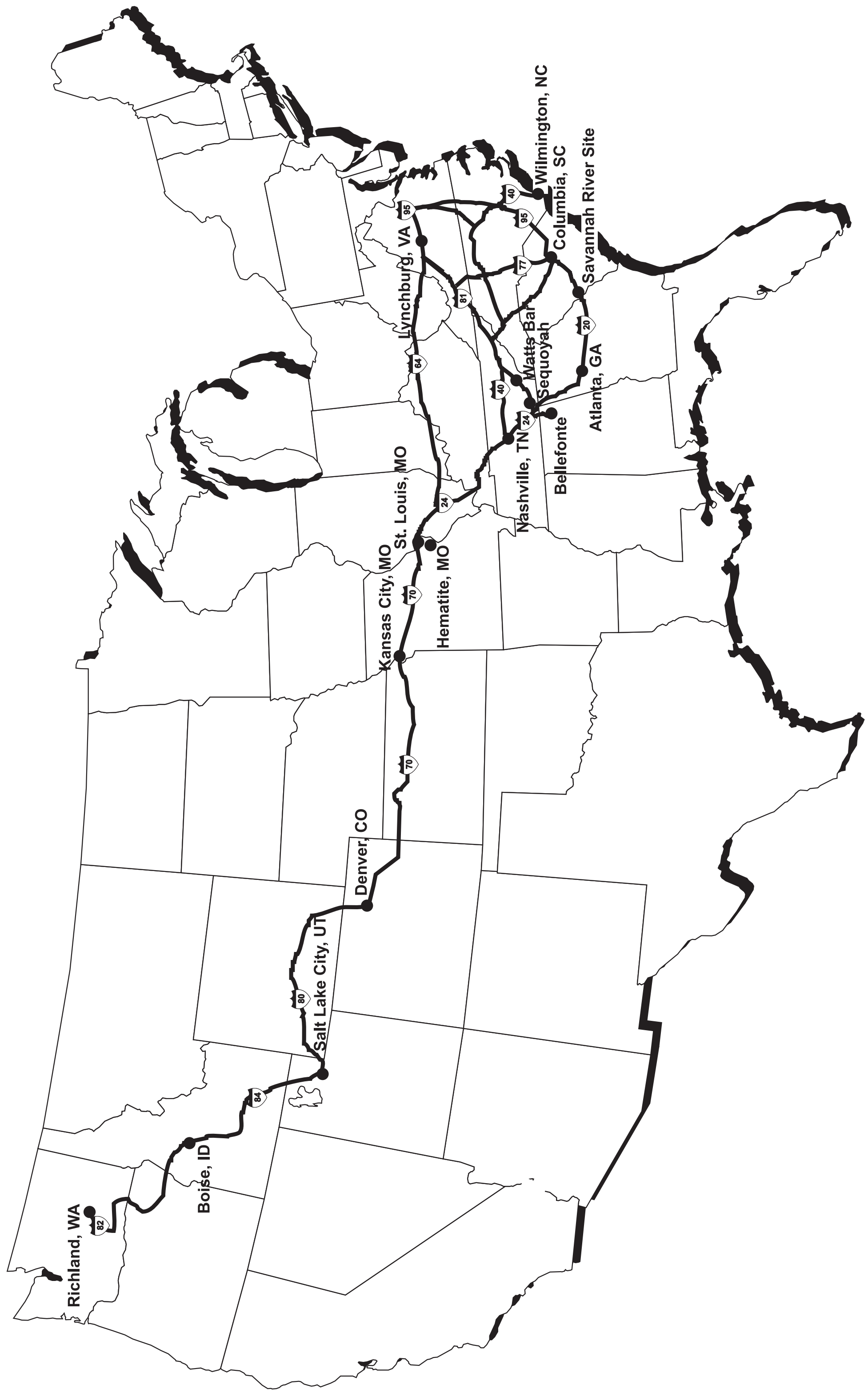

Figure 5–7 Representative Overland Truck Routes

Table 5–55 Sensitivity Analysis Key Parameters

Parameter	*Baseline Configuration*	*Sensitivity Analysis*		
TPBAR production design limit (grams)	1.2	1.2	1.5	1.5
Number of TPBARs in reactor core	3,400	100	3,400	3,400
Operating cycle (months)	18	18	15.5	12
Refueling time (months)	1	1	1	1
Tritium production per TPBAR (grams)	1.0 [a]	1.0	1.2 [b]	1.0 [c]
Total tritium production (grams)	3,400	100	4,080	3,400
Annualized tritium production (grams)	2,267	67	3,160	3,400
TPBAR leakage to Reactor Coolant System (Curies per TPBAR per year)	1 [d]	1 [d]	2 [e]	2 [e]
TPBAR leakage to Reactor Coolant System (Curies per TPBAR per operating cycle) [h]	1.5	1.5	2.6	2
Breached TPBAR leakage to fuel pool (Curies per TPBAR per day)	50 [f]	50 [f]	100 [e]	100 [e]
Breached TPBAR leakage to transportation cask (grams of tritium per TPBAR per hour)	0.00001 [g]	0.00001 [g]	0.00002 [e]	0.00002 [e]
Truck shipments per operating cycle (1 unit per shipment) [I]	12	1	12	12
Rail shipments per operating cycle (2 units per shipment) [I]	6	1	6	6

[a] Westinghouse estimated 0.84 gram average and 1.07 peak for the reference plant (WEC 1997).
[b] Westinghouse estimated 1.07 gram average and 1.31 peak for the reference plant (WEC 1997).
[c] Rounded up to 1.0.
[d] Average value for TPBARs in an operating reactor (PNNL 1999).
[e] Detailed design and analyses of the TPBAR with a tritium production limit of 1.5 grams are not available. For the purpose of this sensitivity analysis, it is assumed that the value associated with the 1.5 gram design-limit TPBAR is two times the equivalent value for the 1.2 gram design-limit TPBAR.
[f] Average value for breached TPBARs in a fuel pool (PNNL 1999).
[g] Average value for breached TPBARs in an air or inert atmosphere. No water or moisture is present in the breached TPBAR and the ambient temperature of the air or inert atmosphere is less than 93°C (200°F) (PNNL 1999).
[h] Nominal value. No credit taken for refueling outage.
[I] 1 unit = 1 17 × 17 consolidation unit array = 289 TPBARs.

Reduction of Number of TPBARs at a Single Reactor

Reducing the number of TPBARs to be irradiated in a single reactor could affect the need for fresh nuclear fuel and spent nuclear fuel production. As discussed in Section 3.2.1 and 5.2.6, the need for additional fresh fuel assemblies for a core reload starts at about 2,000 TPBARs for a single reactor. Therefore, if the implementation of the proposed action would take place in more than one reactor with less than 2,000 TPBARs to be irradiated in each, there would be no need for additional fuel assemblies and associated material resources. In addition, there would be no need for the construction and operation of additional dry storage spent fuel facilities at the reactor sites solely because of tritium production.

Table 5–56 Sensitivity Analysis Summary for a Single Reactor Site

CLWR Configuration				
	Number of TPBARs in Core	***100***	***3,400***	***3,400***
	Operating Cycle (months)	***18***	***15.5***	***12***
	Tritium Production Design Limit per TPBAR per gram	***1.2***	***1.5***	***1.5***
Normal Operation		**Percent Change from Baseline Configuration**		
Radiological liquid effluent (tritium)	Quantity per year	-97	100	100
Radiological gaseous emissions (tritium)	Quantity per year	-97	100	100
Hazardous chemical liquid emissions	Quantity per year	0	0	0
Hazardous chemical gaseous emissions	Quantity per year	0	0	0
Facility Accidents		**Percent Change from Baseline Configuration**		
Reactor design-basis accident[a]	Consequence[d]	-97	20	0
	Risk per year[e]	-97	13	-8
Reactor design-basis accident[b]	Consequence [d]	0	0	0
	Risk per year[e]	0	-6	-8
Nonreactor design-basis accident[a]	Consequence[d]	-97	72	31
	Risk per year[e]	-97	100	97
Nonreactor design-basis accident[b] (Thyroid dose consequences and risks)	Consequence[d]	-69	51	23
	Risk per year[e]	-69	75	85
Nonreactor design-basis accident[b] (Beta+gamma whole body dose consequences and risks)	Consequence[d]	-2	1	0
	Risk per year[e]	-2	17	51
TPBAR handling accident	Consequence[d]	0	20	0
	Risk per year[e]	-97	39	50
Truck cask handling accident	Consequence[d]	0	100	100
	Risk per year[e]	-94	132	200
Rail cask handling accident	Consequence[d]	0	100	100
	Risk per year[e]	-83	132	200
Severe reactor accident	Consequence[d]	-1	0	0
	Risk per year[e]	-1	-6	-8
Hazardous chemical accident	Consequence[d]	0	0	0
	Risk per year[e]	0	0	0
Low-Level Radioactive Waste		**Percent Change from Baseline Configuration**		
Low-level radioactive waste generation	Quantity per year	-96	16	50
Spent Fuel Space		**Percent Change from Baseline Configuration**		
Spent fuel storage space	Storage positions per year	[c]	16	50
Overland Transportation of Irradiated TPBARs from a Single Reactor Facility		**Percent Change from Baseline Configuration**		
Truck shipments	Number per year	-92	16	50
Rail shipments	Number per year	-83	16	50

[a] Design-basis accident consequences only reflect the incremental increase in accident consequences due to the production of tritium in TPBARs.
[b] Design-basis accident consequences estimated using NRC-based deterministic approach.
[c] The baseline configuration requires 56 to 69 additional fresh fuel assemblies and, therefore, requires 75-96 percent of additional spent fuel storage space for each core reload with 3,400 TPBARs. No additional fresh fuel assemblies are required for 2,000 TPBARs.
[d] Maximally exposed offsite individual, average individual in population, and noninvolved worker dose in rem.
[e] Maximally exposed offsite individual, average individual in population, and noninvolved worker increased likelihood of cancer fatalities per year.

Reducing the number of TPBARs to be irradiated in a single reactor would reduce the tritium releases to the environment under normal operation from that reactor, since the normal operation release of tritium is assumed to be proportional to the number of TPBARs.

Reducing the number of TPBARs to be irradiated in a single reactor would reduce the low-level radioactive waste production and the number of irradiated TPBAR shipments from the reactor site. It would not affect environmental resources at a reactor site such as land, ecology, historical resources, aesthetics, and socioeconomics, and would have reduced already small impacts on resources such as noise and aesthetics. Overall, the baseline analysis of 3,400 TPBARs at a single reactor site bounds the effects of irradiation with fewer TPBARs at the site.

Tritium Production Design Limit of 1.5 grams per TPBAR

The increase of the tritium production design limit to 1.5 grams per TPBAR, assuming the maximum number of 3,400 TPBARs to be irradiated at a reactor site, would increase the tritium emission to the environment under normal operating and accident conditions compared to the baseline case. The necessary shortening of the reactor operating cycle from 18 months to 15.5 months also would result in increases in low-level radioactive waste production and spent fuel generation and storage requirements. It would have no effect on all other environmental resources considered in this EIS, such as land, aesthetics, archeological and historic resources, ecology, and socioeconomics. The increase in noise due to more frequent refuelings would be small.

From a program point of view, the increase of the tritium production design limit from 1.2 grams per TPBAR to 1.5 grams per TPBAR, would provide the potential for using fewer TPBARs for the same tritium production goal. The number of TPBARs that would need to be fabricated, irradiated, and transported would be reduced. Fewer TPBARs would mean lesser environmental consequences from fabrication. The number of shipments of both nonirradiated and irradiated TPBARs would be reduced, thus proportionately reducing the incident-free risk to the health and safety of the public.

Length of Reactor Operating Cycle

Shortening the length of the reactor operating cycle to 12 months is discussed in conjunction with the 1.5 grams per TPBAR design limit, as opposed to the 1.2 grams per TPBAR design limit. As discussed above, a shorter cycle (15.5 months) would be required to irradiate the maximum number of 3,400 TPBARs in a reactor. Shortening the reactor operating cycle even further to 12 months with the 1.5 grams per TPBAR design limit, would allow the increase of tritium production from 2,667 grams per year (baseline in a single reactor) to 3,400 grams per year.

Shortening the reactor operating cycle to 12 months would directly affect the number of TPBARs that could be irradiated annually in a single reactor, from 3,400 in 18 months (2,267 grams per year) to 3,400 per year. This would increase the annual generation of spent fuel; the annual generation of low-level radioactive waste; the annual gaseous emissions and liquid effluent releases of tritium; the activities required to handle the irradiated TPBARs at the site; and the number of refueling outages required at the reactor for the 40-year duration of the proposed action. Consequently, there would be proportional increases to impacts associated with air and water quality, ecological resources, and occupational and public health and safety.

Shortening the reactor operating cycle to 12 months would increase the environmental consequences associated with the construction and operation of a dry cask ISFSI at the reactor site by approximately 50 percent. It would have no effect on all other environmental resources considered in this EIS such as land, archaeological and historic resources, aesthetics, and socioeconomics. The noise increase due to more frequent refuelings would be small.

From a program point of view, shortening the reactor operating cycle to 12 months would be practical if the program requirements for tritium production were reduced so that the total number of TPBARs that would need to be fabricated and transported were reduced to approximately 3,400 TPBARs per year, which would be irradiated at single rather than multiple reactor facilities.

Producing Tritium at a Later Date

This EIS evaluates the environmental impacts associated with producing tritium at one or more of five TVA reactors. The need for this tritium is based on the 1996 Nuclear Weapons Stockpile Plan and the accompanying Presidential Decision Directive. The 1996 Nuclear Weapons Stockpile Plan, which represents the latest official guidance for tritium requirements, is based on a START I-level stockpile size of approximately 6,000 accountable weapons. In accordance with the Nuclear Nonproliferation Treaty, the United States is committed to good faith efforts to reduce the nuclear weapons stockpile. The United States recently ratified the START II Treaty and is hopeful that Russia will do likewise. In the event START II is ratified by Russia, a program to allow for a lower START II stockpile size of approximately 3,500 accountable weapons would be implemented. Under such a scenario, the existing tritium reserve would last a little longer and the need date for tritium would be pushed out until approximately 2011. At the same time, the annual steady-state tritium requirement also would be reduced to approximately 1.5 kilograms of tritium. This section addresses the environmental impacts associated with tritium production in one or more CLWRs to support a smaller stockpile than the current START I requirements.

The alternatives evaluated in this EIS would not change for a smaller START II stockpile. In fact, the procurement process through which the five TVA reactors were identified as reasonable alternatives included a requirement that offerors respond to a range of tritium production quantities. This range was designed to allow for varying tritium requirements, including a production level commensurate with supporting a START II stockpile size. Accordingly, all 18 of the alternatives presented in Table 3-2, Tritium Production Reasonable Alternatives (see Section 3.2.3) are also reasonable alternatives for a smaller START II-sized stockpile.

Use of existing TVA reactors to satisfy this reduced START II quantity of tritium would result in environmental impacts similar to those presented in Sections 5.2.1 and 5.2.2 of this EIS. A slightly smaller number of TPBARs would be manufactured and transported to the reactors, and a slightly smaller number of irradiated TPBARs would be shipped from the reactor sites to the Savannah River Site. The reactor site impacts associated with the reduction of the number of TPBARs to be irradiated at a single reactor are discussed earlier in this section. The impacts from transportation are bounded by the analysis presented in Section 5.2.8.

For the Bellefonte alternative, environmental impacts could be similar to those presented in Section 5.2.3 of this EIS, should DOE and TVA choose to complete these reactors according to a similar schedule. With a smaller sized stockpile, however, DOE and TVA would have the additional flexibility either to delay the construction start date or to stretch out construction over a longer period of time. Delaying the construction start date would entail similar environmental impacts to those presented in Section 5.2.3 of this EIS. These would be incurred at a later date (commensurate with the delay in the construction start date). If DOE chooses to stretch out the construction period over a longer period of time, the socioeconomic impacts described in Section 5.2.3 of this EIS likewise would be spread out over a longer period of time. This would lessen the severity of the impacts on housing, transportation, and schools.

5.2.10 Safeguards and Security

CLWRs are required by the provisions of their NRC license to have security and safeguard procedures to protect against a design-basis threat. On a site-specific basis, a design-basis threat comprises: (1) a determined, violent, external attack by stealth or deception by several persons or a small group; (2) a well-trained and dedicated adversary group with suitable weapons and hand-carried equipment, tools, and/or explosives that may be aided by an insider; (3) an internal threat by an insider who may attempt theft and per or sabotage; and (4) other threat actions such as attacks on computer systems. Requirements for developing the design-basis threat, as well as requirements for measures to guard against this threat for NRC-licensed facilities, are provided in 10 CFR 73 and 74.

Facilities and activities associated with the production of tritium for DOE are also required to comply with the requirements in DOE 5632.1C and 5633.3A. DOE Orders require a graded protection for all safeguard and security interests, classified matter, property, and sensitive information from theft, diversion, industrial sabotage, radiological sabotage, espionage, unauthorized access or modification, loss or compromise, or other hostile acts that could cause unacceptable adverse impacts on national security, our business partners, or on the health and safety of employees and the public. The DOE Orders also require a facility associated with the production of tritium to provide protection against a design-basis threat. A CLWR used for the production of tritium must comply with NRC and DOE regulatory requirements. The transportation of DOE materials also are required to comply with a graded set of DOE safeguard and security requirements, in addition to the NRC, DOE, and the U.S. Department of Transportation safety requirements.

The DOE Safeguards and Security Protection Program defines procedures to ensure physical protection of material and equipment, materials control and accountability, nuclear materials control, nuclear materials accountability, security of personnel, personnel security awareness, information security, automated information security, and personnel training.

TPBARs were placed in the Watts Bar Nuclear Plant as part of the Lead Test Assembly Demonstration Project. The Inspection Branch of DOE's Safeguards and Security Division, Oak Ridge Operations Office, conducted a security survey of the Watts Bar plant in preparation for the Lead Test Assembly Demonstration Project. The existing NRC Program was found to fulfill all DOE requirements satisfactorily. (DOE 1997b)

No environmental impacts are expected as a result of compliance with both NRC and DOE safeguard and security provisions based on the adequacy of the existing TVA security provisions. Before introducing any TPBARs into any CLWR, DOE would conduct an in-depth site-specific safeguards and security inspection. This rigorous review would ensure that the existing safeguards and security programs of any reactor used in the CLWR program satisfy the stringent DOE requirements. Any inadequacies would be resolved before the introduction of any DOE materials to the facility. Although it is not anticipated, if the safeguards and security review determined that additional security provisions were required, DOE would perform the appropriate NEPA review.

This EIS identifies credible accident scenarios caused by internal disturbances; addresses the probability of such accidents; and quantifies the releases and exposures resulting from such accidents. Accidents initiated as a result of sabotage are considered speculative and, accordingly, have not been addressed in the CLWR EIS.

5.2.11 Programmatic No Action

DOE is preparing a separate EIS to analyze the environmental impacts of the construction and operation of an Accelerator Production of Tritium (APT) facility at DOE's Savannah River Site in South Carolina. DOE published an APT Draft EIS in December 1997, (DOE 1997e), and the Final EIS in March 1999 (DOE 1999a). Since the No Action Alternative for the CLWR EIS entails production of tritium in the APT facility, this section summarizes the environmental impacts from accelerator production of tritium as presented in Chapter 4 of the APT Draft EIS. For a more detailed analysis of these potential impacts, the reader is referred directly to the APT Draft EIS (DOE 1997e, DOE 1999a).

The APT EIS considered two design alternatives: klystron radio frequency power tubes (the preferred alternative) and inductive output radio frequency power tubes. It also considered two operating temperature alternatives for the design of the accelerator: (1) operating electric components at essentially room temperature, and (2) operating most components at superconducting temperatures and the rest at room temperature (the preferred alternative). Two feedstock alternatives were considered: helium-3 (the preferred alternative) and lithium-6. Four cooling water system designs were considered for the APT EIS: mechanical-draft cooling towers with groundwater makeup; once-through cooling using river water; and use of the existing K-Area natural-draft cooling tower with river water makeup.

The APT EIS also considered two design variations to the preferred alternative to enhance DOE's flexibility: a modular or staged accelerator configuration and a combination of tritium separation and tritium extraction facilities. It also considered two site alternatives. The preferred site is 4.8 kilometers (3 miles) northeast of the Tritium Loading Facility and approximately 10.5 kilometers (6.5 miles) from the boundary of DOE's Savannah River Site. The alternative site is located 3.2 kilometers (2 miles) northwest of the Tritium Loading Facility and approximately 6.4 kilometers (4 miles) from the boundary of DOE's Savannah River Site. Due to the projected magnitude of the electric power usage (peak load as high as 600 megawatts for the room temperature alternative), the APT EIS considered obtaining electricity from the construction and operation of two new electrical source alternatives: coal-fired or natural gas-fired generating plants.

The potential environmental impacts are presented as construction impacts and operational impacts. This summary provides the potential impacts of the APT Preferred Alternative and indicate where alternative impacts vary from the Preferred Alternative. Since the APT EIS was developed in parallel with the CLWR EIS, the impacts represent the conclusions of the APT Draft EIS. These impacts are not expected to change in the APT Final EIS.

Construction Impacts

For the APT Preferred Alternative, construction of the APT facility would convert approximately 101 hectares (250 acres) of forested land into an industrialized area. Excavation of 20 meters (65 feet) in depth would be required. If DOE were to choose the modular design variation, construction impacts could be spread over a longer period of time and require the clearing of an additional 12 hectares (30 acres). New roads, bridge upgrades, and rail lines also would be required. At the preferred site, the construction excavation would reach the water table; therefore, the site would require dewatering. Impacts on the water table would be minimal due to the rather short period of dewatering and the fact that construction would only affect the shallowest portion. Air emissions (fugitive dust and exhaust emissions) should be well below applicable regulatory standards.

Potential impact to terrestrial ecology would result from clearing this land. DOE does not expect, however, that this would create a long-term reduction in the local or regional diversity of plants and animals. No threatened or endangered species occur at any of the alternative sites for the APT facility.

The generation of construction wastes could require the construction of a state-permitted construction debris landfill at DOE's Savannah River Site. Sanitary solid waste would be disposed of in the Three Rivers Regional Landfill. Construction noise at the APT facility site could be higher than the limits imposed by the Occupational Safety and Health Administration. However, DOE would ensure compliance with the Occupational Safety and Health Administration's 8-hour noise exposure guidelines through the use of administrative controls, engineering, and protective equipment. Noise to offsite receptors would not present a nuisance.

DOE expects an incremental increase in occupational injuries based on historic Savannah River Site information for injuries requiring medical attention and injuries resulting in lost work time during the construction phase. DOE also expects a slight increase in the potential for traffic fatalities.

The potential socioeconomic impacts of the APT facility should not stress existing regional infrastructure or result in a “boom” situation. Peak employment would add about 1,400 additional jobs during the construction period.

Operational Impacts

Operation of the APT facility could affect surrounding groundwater. If the groundwater makeup alternative were selected, the removal of 22,700 liters per minute (6,000 gallons per minute) on a sustained basis could result in changes or reductive groundwater flows to some streams surrounding the well field and compaction of clay layers. Operation of the APT facility would produce neutrons that have the potential to penetrate the accelerator’s protective shielding and be absorbed by the soil and groundwater. The accelerator would be designed so that the dose associated with this activity would be less than one-eighth of the EPA drinking water standard of 4 millirem per year.

The withdrawal of Savannah River water for cooling would result in the impingement of adult fish and the entrainment of fish eggs and larvae at the river water intake. The once-through cooling water alternative would result in considerably higher rates of impingement and entrainment than the various cooling tower alternatives, but losses of adult fish, fish eggs, and fish larvae under all alternatives would be small relative to total fish production in the upper and middle reaches of the Savannah River.

Operation of the APT facility would result in thermal discharges from the cooling water system to either Indian Grave or Pen Branch or the existing series of precooler ponds and ultimately Par Pond. For all cooling alternatives except the once-through cooling water alternative, water temperature in the receiving water bodies would not exceed 32°C (90°F), meeting South Carolina Department of Health and Environmental Control standards for fresh water. In the case of the once-through cooling water alternative, however, discharges would be well in excess of 32°C (90°F) in late summer. Under this scenario, DOE could be required to conduct a Clean Water Act Section 316a(1) Demonstration. Under each cooling water alternative, cesium-137 trapped in the fine sediments of Par Pond would be disturbed and remobilized. The once-through cooling water alternative would remobilize the most cesium-137, but in all cases, exposures of the public would be less than allowed by regulatory limits. Par Pond and the precooler ponds, however, are utilized by American alligators and bald eagles. The alligators do not breed in Ponds 2 and 5 and would abandon the ponds and relocate if water temperature exceeded their tolerance range. In Par Pond and Pen Branch, potential effects on alligators could be positive in that the warmer waters could lengthen the active period for the reptiles. Bald eagles use the Par Pond system for feeding. Potential fish kills associated with the once-through cooling water alternative could provide the eagles with an additional food source.

Air emissions of both radiological and nonradiological pollutants would be well below applicable standards for the operation of the APT facility. Offsite concentrations would be slightly higher from the nonpreferred alternative site because it is closer to the Savannah River Site boundary. Tritium would constitute over 99 percent of the offsite dose, but would be well below the 100 millirem per year dose limit for Savannah River Site atmospheric releases.

Operational waste would be managed and treated according to waste type using both Savannah River Site and offsite facilities. Potential impacts on other facilities should be negligible because of the low volume of waste generation.

From normal operations, DOE expects that the dose to the public from the APT facility would be within regulatory limits. Similarly, all concentrations of noncarcinogenic materials would be well below all established limits; consequently, there should be no health impacts. Of the materials expected to be released from the APT facility, only beryllium is a carcinogen. Using EPA’s Integrated Risk Information System database, DOE calculated an additional lifetime latent cancer risk of 4.6×10^{-9} to the maximally exposed individual. This value is well below the 1 × 10^{-6} risk value that the EPA typically uses as a threshold of concern. Impacts would be slightly higher at the alternative site because it is closer to the Savannah River Site boundary, but would still be well below the EPA threshold of concern. Potential impacts on workers would be slightly higher.

All accidents with a postulated frequency of more than once during the 40-year operating life of the accelerator would have negligible consequences. Only four low-probability accidents (highest frequency = once per 2,000 years) would raise offsite doses high enough (1 rem at site boundary) to warrant public protective actions under the Savannah River Site Emergency Plan.

There should be no significant socioeconomic impacts from the operation of the APT facility at the DOE's Savannah River Site in South Carolina. The workforce of 500 additional individuals would produce approximately one-third of the socioeconomic impacts during construction of the APT facility.

The preferred APT alternative would require approximately 350 megawatts of electricity to operate. DOE is considering either purchasing electricity from existing sources through market transactions or obtaining electricity from a new electric power-generating plant. The purchasing of electricity would increase expected environmental impacts from 1 to 3 percent. If a new electricity-generating plan were to be constructed, potential impacts would depend upon its operation. If it were constructed at the Savannah River Site, impacts would probably be only slightly higher than those of the purchasing option.

Although impacts would depend upon the specific location and type of the new electric power-generating facility, such a facility could require about 45 hectares (110 acres) for a natural gas plant or 117 hectares (290 acres) for a coal plant. While the specific constituents of air emissions and discharges to surface water would depend upon the actual location of the new electric power generating plant, overall environmental impacts should be no higher than those of the Preferred Alternative. A peak workforce of about 1,100 workers would be required for the rather short construction period and a workforce of about 200 individuals for operation of the facility. Impacts on the socioeconomics of the region would depend upon the actual location of the facility.

In addition to the impacts on land use, waste would be generated from construction, and the operation of such an electric power generating facility would generate greenhouse gas emissions. Of the greenhouse gases expected to be generated, carbon dioxide emissions would be the largest. **Table 5–57** summarizes the expected carbon dioxide emissions from the APT power plant options and compares these emissions to existing U.S. and global carbon dioxide emissions.

Table 5–57 Estimated Accelerator Production of Tritium Carbon Dioxide Emissions

Accelerator Production of Tritium Power Plant Option	***Estimated Carbon Dioxide Emissions (million tons per Year)***	***U.S. Fossil Combustion Carbon Dioxide Emissions (%)[a]***	***Global Combustion Carbon Dioxide Emissions (%)[b]***
Existing capacity/market transactions	3.45	0.063	0.014
New coal-fired power plant	3.60	0.066	0.014

[a] U.S. estimates of fossil fuel carbon dioxide emissions is 5.446 million tons per year (TVA 1997f).
[b] Global estimates of fossil fuel carbon dioxide emissions is 25.038 million tons per year (TVA 1997f).
Source: DOE 1997e.

5.2.12 CLWR Facility Accident Impact to Involved Workers

The range of accident impacts to involved workers at a CLWR tritium production facility would vary depending on the energy and radioactive material released during the accident. The involved workers would evacuate the immediate area of the accident to minimize exposure in accordance with general employee training and emergency procedures. **Table 5–58** summarizes accident impacts on involved workers.

Table 5–58 Accident Impacts on Involved Workers

Accident	*Worker Location*	*Impact on Worker*	*Mitigation*
Reactor design-basis accident (large break loss of coolant accident)	Reactor containment	Workers in containment at the time of the accident will die due to the energy (steam) released to the containment. Evacuation from the containment is not considered feasible.	The containment is not normally occupied during power operation. Entrance to containment during power operation is limited by work permits approved by the operations staff.
Nonreactor design-basis accident (waste gas decay tank rupture)	Auxiliary building waste gas tank area	If the accident is initiated by rupture of the tank or associated piping, the worker could be injured by debris or the stream of gas from the rupture. In addition, the worker could receive a radiation dose while evacuating the area.	The probability of this initiating event is extremely unlikely (in the range of 10^{-6} to 10^{-4} per year). Involved workers will evacuate the immediate area of the accident to minimize radiation exposure in accordance with general employee training and emergency procedures.
		If the accident is initiated by a valve failure or human error, the release will be vented out of the auxiliary building stack. The involved worker is not at risk of injury or an additional radiation dose.	None required
TPBAR handling accident	Auxiliary building spent fuel pool area	The involved worker would observe the drop and immediately evacuate the area. Adequate time will exist to evacuate the area before the release of tritium from the TPBARs. The worker would receive no additional radiological dose.	Involved workers will evacuate the immediate area of the accident to minimize radiation exposure in accordance with general employee training, emergency procedures, and TPBAR handling operating procedures.
Truck or rail cask handling accident	Auxiliary building spent fuel pool area	The involved worker would observe the drop and immediately evacuate the area. Adequate time will exist to evacuate the area before the release of tritium from the TPBARs. The worker would receive no additional radiological dose.	Involved workers will evacuate the immediate area of the accident to minimize radiation exposure in accordance with general employee training, emergency procedures, and TPBAR handling operating procedures.
Beyond design-basis accident	Reactor containment	If the accident sequence is initiated by a large break loss of coolant accident or another high energy release mechanism, workers in containment at the time of the accident will die due to the energy (steam) released to the containment. Evacuation from the containment is not considered feasible.	The containment is not normally occupied during power operation. Entrance to containment during power operation is limited by work permits approved by the operations staff.
		Most of the postulated accident sequences have adequate time for workers to evacuate the containment before there is a radioactive release to the containment.	Involved workers will evacuate the containment to minimize radiation exposure. As the accident sequence progresses, all nonessential personnel will be directed to evacuate the site in accordance with site emergency procedures.

5.2.13 Secondary Impact of CLWR Facility Accidents

For purposes of this EIS, the primary impacts are measured in terms of public and worker exposures to radiation and toxic chemicals. Accidents could also affect elements of the environment other than humans. For example, a radiological release could contaminate farmland, surface water, recreational areas, industrial parks, historic sites, or the habitat of an endangered species. As a result, farm products might have to be destroyed; the supply of drinking water could be lowered; recreational areas could be closed; industrial parks could suffer economic losses during shutdown for decontamination; historical sites could have to be closed to visitors; and endangered species could move closer to extinction. These types of impacts are referred to as secondary impacts in this EIS.

There should be no secondary impacts from design-basis accidents. The most severe class of design-basis accident, a core damage accident with no containment failure or bypass, occurred at the Three Mile Island Nuclear Plant, Unit 2, in Middletown, Pennsylvania, in 1979. There were no secondary impacts of this accident.

This section addresses the secondary impacts of a reactor beyond design-basis accident with radiological release. Secondary impacts are addressed qualitatively; that is, the types of impacts that could result and a range of potential outcomes are identified. These secondary impacts are divided into two types: (1) habitation of land by humans (population dependent); and (2) agricultural uses of land (area dependent). Each of these impact types are discussed below.

Population Dependent—Secondary impacts could produce four possible outcomes: (1) land is immediately habitable; (2) land will be habitable after decontamination; (3) land will be habitable after a combination of decontamination and interdiction; and (4) land will not be habitable (condemnation).

Area Dependent—Secondary impacts could produce three possible outcomes: (1) no restrictions on agricultural use; (2) short-term restrictions on agricultural use; or (3) long-term restrictions on agricultural use (condemnation).

At the Watts Bar and Sequoyah plants, tritium production would not change the potential secondary impacts that could result from a beyond design-basis accident. This is due to the fact that secondary impacts would be dominated by the radionuclides other than tritium that would be released; any such impact would be independent of tritium production.

At the Bellefonte plant, there would be a potential for secondary impacts arising from the proposed action. This is because the Bellefonte reactors are currently not operating. While it is noted that any secondary impacts would be caused by radionuclides other than tritium, these impacts would still represent a change from no action. As described above, these secondary impacts could range from no change to land habitability/use to long-term restrictions on agricultural use (condemnation). Any secondary impacts would have an extremely low probability of occurring—less than one in a million years.

5.3 CUMULATIVE IMPACTS

A cumulative impact is identified as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

5.3.1 TPBAR Fabrication

The fabrication and assembly process of the TPBARs would not result in environmental impacts beyond the impacts associated with the normal activities of the commercial facilities where fabrication and assembly would take place. Therefore, the fabrication and assembly process would not alter the cumulative impacts at these facilities.

5.3.2 TPBAR Irradiation

The only significant distinction between the effects of tritium production and those of the No Action Alternative at Watts Bar and Sequoyah would be the additional release of tritium and an associated small increase in the risk to occupational and public health and safety. No other known actions, Federal and nonfederal, could effect further changes in the radiological environment of the region of influence. Accordingly, the cumulative impacts at Watts Bar and Sequoyah, as reflected in **Tables 5–59** and **5–60**, respectively, are the sum of the impacts of the No Action Alternative and the small, incremental impacts of tritium production.

Table 5–59 Cumulative Impacts at the Watts Bar Nuclear Plant Site

Resource/Material Categories	*Tritium Production Increment*	*Cumulative Total*
Land resources	Potential permanent land requirement - 3.1 acres of developed land at the dry cask ISFSI if constructed	1,770 acres (existing developed land; no additional undisturbed land requirement)
Air quality		
Nonradiological emissions	No additional emissions	No change from current air quality conditions (See Table 4–1)
Greenhouse gases (carbon dioxide)	No additional emissions	0.027 metric tons per year
Radiological emissions	Annual radiological emissions of tritium: 1,000 TPBARs: 100 Curies 3,400 TPBARs: 340 Curies Other Emissions: 0 Curies	Annual radiological emissions of tritium: 1,000 TPBARs: 106 Curies 3,400 TPBARs: 346 Curies Other emissions: 283 Curies
Water quality		
Surface water	No additional surface water requirements, discharge, or water quality conditions	No changes from current surface water requirements, discharge, or water quality conditions (see Table 4–3)
Radioactive effluent	Annual radiological effluent of tritium: 1,000 TPBARs: 900 Curies 3,400 TPBARs: 3,060 Curies Other releases: 0 Curies	Annual radiological effluent of tritium: 1,000 TPBARs: 1,539 Curies 3,400 TPBARs: 3,699 Curies Other releases: 1.32 Curies
Groundwater	No additional groundwater requirements or additional impacts to groundwater quality conditions	No change from current groundwater requirements or additional impacts to groundwater quality conditions
Socioeconomics	Less than 1 percent impact on regional economy	No change from current regional socioeconomic conditions

Resource/Material Categories	*Tritium Production Increment*	*Cumulative Total*
Public and occupational health and safety Normal operation	Annual dose for 1,000 TPBARs: *Average worker*: 0.33 millirem *Maximally exposed (offsite) individual*: 0.013 millirem *50-mile population*: 0.34 person-rem Annual dose for 3,400 TPBARs: *Average worker*: 1.1 millirem *Maximally exposed (offsite) individual:* 0.047 millirem *50-mile population*: 1.2 person-rem	Annual dose for 1,000 TPBARs: *Average worker*: 104.33 millirem. *Maximally exposed (offsite) individual:* 0.30 millirem *50-mile population*: 0.89 person-rem. Annual dose for 3,400 TPBARs: *Average worker*: 105.1 millirem. *Maximally exposed (offsite) individual:* 0.34 millirem *50-mile population*: 1.8 person-rem.
Waste management	Low-level radioactive waste: approximately 0.43 cubic meters per year	Low-level radioactive waste: approximately 41 cubic meters per year
Spent nuclear fuel generation	less than 2,000 TPBARs: 0 fuel assemblies 3,400 TPBARs: up to a maximum of 56 fuel assemblies per cycle	less than 2,000 TPBARs: 80 fuel assemblies per cycle 3,400 TPBARs: up to a maximum of 136 fuel assemblies per cycle

Table 5–60 Cumulative Impacts at the Sequoyah Nuclear Plant Site

Resource/Material Categories	*Tritium Production Increment*[a]	*Cumulative Total* [b]
Land resources	Potential permanent land requirement - 3.2 acres of developed land at the ISFSI if constructed.	525 acres (existing developed land, no additional undisturbed land requirement)
Air quality Nonradiological emissions	No additional emissions	No change from current air quality conditions (See Table 4–14)
Greenhouse gases (carbon dioxide)	No additional emissions	0.039 metric tons per year
Radiological emissions	Annual radiological emissions of tritium: 1,000 TPBARs: 100 Curies 3,400 TPBARs: 340 Curies Other emissions: 0 Curies	Annual radiological emissions of tritium: 1,000 TPBARs: 249 Curies 3,400 TPBARs: 729 Curies Other emissions: 240 Curies
Water quality Surface water	No additional surface water requirements, discharge, or water quality conditions	No changes from current surface water requirements, discharge, or water quality conditions (see Table 4–16)
Radioactive effluent	Annual radiological effluent of tritium: 1,000 TPBARs: 900 Curies 3,400 TPBARs: 3,060 Curies Other releases: 0 Curies	Annual radiological effluent of tritium: 1,000 TPBARs: 3,277 Curies 3,400 TPBARs: 7,597 Curies Other releases: 2.3 Curies
Groundwater	No additional groundwater requirements or additional impacts to groundwater quality conditions	No change from current groundwater requirements or additional impacts to groundwater quality conditions

Resource/Material Categories	*Tritium Production Increment*[a]	*Cumulative Total* [b]
Socioeconomics	Less than 1 percent impact on regional economy	No change from current regional socioeconomic conditions
Public and occupational health and safety Normal operation	Annual dose for 1,000 TPBARs: *Average worker*: 0.24 millirem *Maximally exposed (offsite) individual*: 0.017 millirem *50-mile population*: 0.57 person-rem Annual dose for 3,400 TPBARs: *Average worker*: 0.82 millirem *Maximally exposed (offsite) individual*: 0.057 millirem *50-mile population*: 1.9 person-rem	Annual dose for 1,000 TPBARs: *Average worker*: 90.24 millirem *Maximally exposed (offsite) individual*: 0.14 millirem *50-mile population*: 4.4 person-rem Annual dose for 3,400 TPBARs: *Average worker*: 90.82 millirem *Maximally exposed (offsite) individual*: 0.22 millirem *50-mile population*: 7.0 person-rem
Waste management	Low-level radioactive waste: approximately 0.43 cubic meters per year	Low-level radioactive waste: approximately 384 cubic meters per year
Spent nuclear fuel generation	less than 2,000 TPBARs: 0 fuel assemblies 3,400 TPBARs: up to a maximum of 60 fuel assemblies per cycle	less than 2,000 TPBARs: 160 fuel assemblies per cycle 3,400 TPBARs: up to a maximum of 280 fuel assemblies per cycle

[a] Assumes tritium production in one unit.
[b] Assumes tritium production in both units.

As discussed in Chapter 5, operating the Bellefonte units as a nuclear power plant represents a change from the No Action Alternative with impacts to air, water, and ecological resources; socioeconomic characteristics; and an increased risk to human health and safety from potential radiological emissions. Expansion of existing industry and the planned development of new industries in the vicinity of the Bellefonte site also would affect the environmental and socioeconomic characteristics of the region. **Table 5–61** indicates industrial expansion would occur in Jackson County, and that additional population growth would occur in the absence of any developments at Bellefonte (TVA 1997f). **Table 5–62** shows the cumulative impacts for two-unit operation at the Bellefonte site.

Table 5–61 Announced Major Recent and Future Expansions and New Industrial Facilities for Jackson County (1997 and 1998)[a]

Nature of Business	*Size of Expansion/Facility*	*Location*
Aluminum forming (Southeastern Metals)	1997 New Facility - 25 new jobs, $1.6 million	Scottsboro
Nylon fiber (Beaulieu)	1997 Expansion - 15 jobs, $28 million 1998 Expansion - 50 jobs, $25 million	Bridgeport
Coaxial TV cable for electronics (CommScope, Inc.)	1997 Expansion - 81 jobs 1998 Expansion - 40 jobs	Scottsboro
Air purifiers (Environmental Health)	1997 Expansion - 45 jobs	Scottsboro
Floor rugs (Maple Industries)	1997 Expansion - 120 jobs 1998 Expansion - 50 jobs, $4.0 million	Scottsboro
Rolled Aluminum (Norandal USA)	1997 Expansion - $5 million	Scottsboro
Industrial Plastics (Polymer Industries)	1997 Expansion - 20 jobs, $2.1 million	Henagar
U.S. Textiles	1997 Expansion - 43 jobs	Scottsboro
Wausau Homes	1998 New - 175 jobs	Scottsboro

Nature of Business	*Size of Expansion/Facility*	*Location*
ARES Corporation	1998 New - 45 jobs, $5.9 million	Scottsboro
Premier Industries	1998 New - 40 jobs	Scottsboro
Buccaneer Rope	1998 New - 40 jobs	Skyline
Wenzel Metals	1998 Expansion - 15 jobs, $1.66 million	Scottsboro

[a] Only those expansions larger than 40 new jobs or a $1 million investment are listed.
Source: Jackson County 1998.

Table 5–62 Cumulative Impacts at the Bellefonte Nuclear Plant Site

Resource/Material Categories	*Tritium Production Increment* [a]	*Cumulative Total* [b]
Land resources	Potential permanent land requirement - 3.4 acres of developed land at the ISFSI if constructed and a small amount of land for support buildings	1,500 acres (existing developed land, no additional undisturbed land requirement)
Air quality		
Nonradiological emissions	Additional emissions; concentrations within standards (see Tables 5–23 and 5–25)	Additional emissions; concentrations within standards (see Tables 5–23 and 5–25)
Greenhouse gases (carbon dioxide)	0.031 metric tons per year	0.031 metric tons per year
Radiological emissions	Annual radiological emissions of tritium: 1,000 TPBARs: 105.6 Curies 3,400 TPBARs: 345.6 Curies Other emissions: 283 Curies	Annual radiological emissions of tritium: 1,000 TPBARs: 211 Curies 3,400 TPBARs: 691 Curies Other emissions: 566 Curies
Water quality		
Surface water	Increased surface water use and discharge. Water usage less than 1 percent of Tennessee River flow. All water quality parameters within limits (see Tables 5–21, 5–22, and 5–23).	Increased surface water use and discharge. Water usage less than 1 percent of Tennessee River flow. All water quality parameters within limits (see Tables 5–21, 5–22, and 5–23).
Radioactive effluent	Annual radiological effluent of tritium: 1,000 TPBARs: 1,539 Curies 3,400 TPBARs: 3,699 Curies Other releases: 1.32 Curies	Annual radiological effluent of tritium: 1,000 TPBARs: 3,078 Curies 3,400 TPBARs: 7,398 Curies Other releases: 2.6 Curies
Groundwater	No groundwater requirements or additional impacts to groundwater quality conditions	No change from current groundwater requirements or additional impacts to groundwater quality conditions
Ecological resources	Additional impacts on ecological resources including fish impingement and entrainment of aquatic biota and thermal impacts of less than 5°F on resident aquatic communities in the vicinity of the diffuser	Additional impacts on ecological resources including fish impingement and entrainment of aquatic biota and thermal impacts of less than 5°F on resident aquatic communities in the vicinity of the diffuser
Socioeconomics	800 to 1,000 workers. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually); decrease in the unemployment rate (from 7.9 percent to approximately 5.9 percent; and minor impacts to school resources.	1,555 to 1,755 workers including other industries. Increase in payment-in-lieu of taxes to state and local jurisdictions (approximately $5.5 to $8 million annually); decrease in the unemployment rate (from 7.9 percent to approximately 4.4 percent); and minor impacts to school resources.

Resource/Material Categories	***Tritium Production Increment*** [a]	***Cumulative Total*** [b]
Public and occupational health and safety Normal operation	Annual dose for 1,000 TPBARs: *Average worker*: 104.33 millirem *Maximally exposed (offsite) individual*: 0.26 millirem *50-mile population*: 1.6 person-rem Annual dose for 3,400 TPBARs: *Average worker*: 105.1 millirem *MEI*: 0.28 millirem *50-mile population*: 2.3 person-rem	Annual dose for 1,000 TPBARs: *Average worker*: 104.33 millirem *Maximally exposed (offsite) individual*: 0.52 millirem *50-mile population*: 3.2 person-rem Annual dose for 3,400 TPBARs: *Average worker*: 105.1 millirem *MEI*: 0.56 millirem *50-mile population*: 4.6 person-rem
Waste management	Low-level radioactive waste: approximately 41 cubic meters per year	Low-level radioactive waste: approximately 82 cubic meters per year
Spent nuclear fuel generation	less than 2,000 TPBARs: 72 fuel assemblies per cycle 3,400 TPBARs: up to a maximum of 141 fuel assemblies per cycle	less than 2,000 TPBARs: 144 fuel assemblies per cycle from both units 3,400 TPBARs: up to a maximum of 213 fuel assemblies per cycle from both units

[a] Assumes tritium production in one unit.
[b] Assumes tritium production in both units.

5.3.3 TPBAR Transportation

In determining the impacts of the transportation of DOE-owned spent fuel, the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995a) analyzed the cumulative impacts of all transportation of radioactive materials, taking into account impacts from reasonably foreseeable actions that include transportation of radioactive material and general radioactive materials transportation that is not related to a particular action. The total worker and general population collective doses are summarized in **Table 5–63**. Total collective worker doses from all types of shipments (historical, the alternatives, reasonably foreseeable actions, and general transportation) were estimated to be 320,000 person-rem (130 latent cancer fatalities) for the period 1943 through 2035 (93 years). Total general population collective doses were also estimated to be 320,000 person-rem (160 latent cancer fatalities). The majority of the collective dose for workers and the general population resulted from the general transportation of radioactive material. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The total number of latent cancer fatalities estimated to result from radioactive materials transportation over the period between 1943 and 2035 was 290. Over this same period of time (93 years), approximately 28 million people would die from cancer, based on 300,000 cancer fatalities per year (NRC 1977). It should be noted that the estimated number of transportation-related latent cancer fatalities would be indistinguishable from other latent cancer fatalities, and the transportation-related latent cancer fatalities would be 0.0010 percent of the total number of latent cancer fatalities.

Table 5–63 Cumulative Transportation-Related Radiological Collective Doses and Latent Cancer Fatalities (1943 to 2035)

Category	*Worker Dose (person-rem)*	*General Population Dose (person-rem)*
CLWR		
Shipment of TPBAR and LLW	less than 100	less than 100
Latent cancer fatalities from TPBAR and LLW	less than 1	less than 1
Other nuclear material shipments		
Reasonably foreseeable actions[a]		
Truck	11,000	50,000
Rail	820	1,700
General transportation (1943–2035)	310,000	270,000
Total collective dose	320,000	320,000
Total latent cancer fatalities	130	160

LLW = Low-level radioactive waste.
[a] DOE 1995a.

5.3.4 Impacts at the Tritium Extraction Facility

An integral part of the program to produce tritium in a CLWR is the Tritium Extraction Facility proposed for construction and operation at DOE's Savannah River Site in South Carolina (as discussed in Section 1.5.2.2). The Draft EIS for the Tritium Extraction Facility was issued in May 1998; a Final EIS was issued concurrently with the CLWR EIS (DOE 1998c, DOE 1999b). **Table 5–64** provides a summary of the environmental impacts associated with the Preferred Alternative in the Tritium Extraction Facility EIS. Since the Tritium Extraction Facility EIS was developed in parallel with the CLWR EIS, the impacts shown in Table 5–64 are those provided in the Draft Tritium Extraction Facility EIS. These impacts are not expected to change in the Final EIS.

Table 5–64 Summary of Environmental Impacts, Tritium Extraction Facility

Resource	*Savannah River Site Baseline*	*Increment Above Baseline for Preferred Alternative*
Schedule and Operating Parameters		
Construction	Tritium Extraction Facility is not built	5 years
Annual electricity (megawatt-hours)		20,600
Annual sanitary wastewater (gallons)		770,000
Annual radioactive process wastewater (gallons)		11,000

Resource	***Savannah River Site Baseline***	***Increment Above Baseline for Preferred Alternative***
Impacts to the Physical and Manmade Environment		
Geology	Existing sites are cleared and graded, grassed, paved, or graveled, and used for industrial purposes	Minimal construction impacts through application of best management practices and compliance with Federal and state regulations. Minor dewatering during construction activities near or below the water table. Design would prevent process water migration into the groundwater during operations. With an immediate response by Savannah River Site to contain and remediate spills, it is unlikely that a spill would impact groundwater.
Surface water	Construction in an industrial area with established stormwater control systems Permitted process wastewater discharges Permitted sanitary wastewater discharges	Minimal construction impacts; construction would not disturb undeveloped areas. Effluent treatment would remove radioactive cobalt from process water to safe levels before discharge to Upper Three Runs. Tritium concentration in the effluent would be less than the regulatory limit of 20,000 picocuries per liter. Effluent would be treated before release to Fourmile Branch. All discharges would be within permit limits. Minimal impacts expected.
Air resources Nonradiological constituent concentrations at the Savannah River Site and Allied General Nuclear Services Facility site boundaries	Concentrations vary from approximately 0 to 60 percent of applicable standards and average 25 percent.[a]	Concentrations vary from approximately 0 to 0.19 percent of applicable standards and average 0.02 percent.[a] Ozone concentrations (measured as VOCs) would be 0.19 percent of the regulatory standard of 235 $\mu g/m^3$. All other contaminant levels would be less than 0.02 percent of their respective regulatory standards.
Annual radiological dose to the maximally exposed (offsite) individual (millirem). Dose limit = 10 millirem per year.	0.05 millirem	0.02 millirem: The emission is 0.2 percent of the dose limit.

Resource	***Savannah River Site Baseline***	***Increment Above Baseline for Preferred Alternative***
Impacts to the Physical and Manmade Environment Continued		
Waste Total estimated construction debris (metric tons)	Not applicable	385
Total operations waste by type (cubic meters)		
High-level Low-level	150,750 (30 years) 343,710 (30 years)	0 (40 years) 9,320 (40 years)
Hazardous or mixed Transuranic	90,450 (30 years) 18,090 (30 years)	132 (40 years) 0 (40 years)
Impacts to Human Environment		
Aesthetics[b]	Area is not visible to and noise is not heard by offsite public. Historical and archaeological resources are not present.	Temporary increase in noise during construction phase, but it would not be heard by the offsite public. No adverse aesthetic impacts during Tritium Extraction Facility operation. Historical and archaeological resources are not present.
Socioeconomics	Savannah River Site employment is assumed to decline to 10,000 employees by 2001, and regional growth trends are expected to continue.	Regional temporary increase of 740 jobs during peak year of construction, which is 0.29 percent of the projected baseline regional employment of 258,000 jobs. The number of jobs at the Savannah River Site would decline to 108 for Tritium Extraction Facility operation. The overall effects would be positive in terms of assisting to stabilize the regional employment base.
Environmental justice	Minorities or low-income communities would not receive disproportionately high and adverse impacts.	Health effects would be minimal. Minority or low-income communities would not be disproportionately affected.
Public health Annual probability of fatal cancer to the maximally exposed (offsite) individual (annual fatal cancer risk from all natural causes is 3.4×10^{-3}).	9.5×10^{-8}	1.0×10^{-8}
Occupational health Total estimated number of additional latent cancer facilities to all involved workers from an annual dose.	0.066	0.0016
Number of construction worker injuries resulting in lost work time.	Not applicable	11

Resource	***Savannah River Site Baseline***	***Increment Above Baseline for Preferred Alternative***
	Impacts to Human Environment Continued	
Accidents[c] Additional latent cancer facilities in offsite population	Not applicable	
Annual frequency — Bounding accident		
$>10^{-2}$ — Hood or room fire		0.4
$\geq 10^{-4}$ to $\leq 10^{-2}$ — Area fire		0.4
$\geq 10^{-6}$ to $<10^{-4}$ — Design-basis seismic event with a fire		0.7
	Impacts to Ecological Resources	
Terrestrial ecology	The affected environment is within developed areas consisting of paved lots, graveled surfaces, buildings and trailers, providing minimal terrestrial wildlife habitat.	No physical alterations to the landscape outside of H Area, but limited potential to disturb any nearby resident wildlife as a result of construction and operations noise.
Aquatic ecology	No aquatic habitat within H Area boundaries.	All construction activities would occur under best management practices to limit sedimentation in detention basins. Operations wastewater would be discharged through NPDES-permitted outfalls. DOE would continue to comply with the regulatory standards for water quality established for these outfalls.
Wetland ecology	No wetland habitat within H Area boundaries.	Wetlands in the Upper Three Runs watershed, including Crouch Branch, or the Fourmile Branch watershed would not be adversely affected by the construction and operation of the Tritium Extraction Facility
Threatened and endangered species	No threatened and endangered species within H Area boundaries	No threatened or endangered species live or forage in H Area. There would be no adverse impact.

$\mu g/m^3$ = micrograms per cubic meter.

a Concentration increments that would be less than 0.1 percent of standard for both locations are not listed.

b Includes land use, visual resources and noise, and historical and archeological resources.

c Events with the most additional latent fatalities in offsite public are a full-facility fire and a design-basis earthquake with a secondary fire.

AGNS = Allied General Nuclear Services Facility.

VOCs = Volatile Organic Compound.

Source: DOE 1998c.

5.4 RESOURCE COMMITMENTS

This section describes the unavoidable adverse environmental impacts that could result from the proposed action, short-term uses of the environment, maintenance and enhancement of long-term productivity, and irreversible and irretrievable commitments of resources.

5.4.1 Unavoidable Adverse Environmental Impacts

Construction and operation activities associated with the irradiation of TPBARs at the CLWR sites and the transportation of the irradiated TPBARs to the Tritium Extraction Facility at DOE's Savannah River Site would result in unavoidable adverse impacts to the human environment. In general, the unavoidable adverse impacts from the operation of Watts Bar and Sequoyah are the incremental impacts attributed to tritium production. For the Bellefonte units, the unavoidable adverse impacts are associated with the full operation of the units as a nuclear reactor plant.

Unavoidable adverse impacts at the Watts Bar and Sequoyah sites would be related to the construction activity if the plants are required to provide additional spent fuel dry storage. Workers would receive exposure from the direct and skyshine radiation of the spent fuel already stored there. These exposures would be of the order of 40 to 50 person-rem. In addition, approximately 2 to 2.5 hectares (5 to 6 acres) of land within the site boundary at each site would be disturbed. Any liquid and solid waste generated during the construction activities, none of which would be radioactive, would be collected at the site, stored, and eventually removed for suitable recycling or disposal off site in accordance with applicable EPA regulations.

The construction activities that could be required for the completion of the Bellefonte units and the associated spent fuel dry storage facility would result in unavoidable adverse impacts on land, air, and water resources. The limited amount of land disturbance would result in small impacts to the ecological resources and public and occupational health and safety. More significant adverse effects associated with the completion of the Bellefonte units would be socioeconomic, arising from the rapid increase of the work force in the region of influence. These effects would be offset by the long-term benefits.

Operation of Watts Bar or Sequoyah in a tritium-producing mode would result in unavoidable increases of radiation exposures to workers and the general public. Annual doses from routine radiological air emissions from the proposed action to the maximally exposed individual, general population, and workers are discussed in Sections 5.2.1.9 and 5.2.2.9.

Operation of the Bellefonte units would result in unavoidable impacts to air and water quality, visual resources, and the surrounding communities. Air quality would be affected by routine radioactive gaseous emissions typical of CLWR operations. Impacts to water resources could affect surface use and quality because of routine radioactive liquid effluent releases and the need for cooling water. The routine emission of chemicals would affect the aquatic biota near the plant intake and discharge pipes. Socioeconomic resources of the community could be affected. These impacts would be associated with the operation of Bellefonte as a nuclear power plant regardless of tritium production. They have also been addressed in the EIS for the construction and operation of Bellefonte 1 and 2, issued by the Tennessee Valley Authority in 1974 (AEC 1974).

Spent nuclear fuel would be generated as an unavoidable result of reactor operations to produce tritium. If more than approximately 2,000 TPBARs were to be irradiated at a single unit, construction of a new dry cask ISFSI could be required. However, as stated in Section 3.2.7, under the Preferred Alternative DOE and TVA would minimize, to the extent practicable, the generation of additional spent nuclear fuel. Also unavoidable would be the generation of additional low-level radioactive waste, which would be transported and managed off site at the low-level radioactive waste disposal facility at the Barnwell facility or at the Savannah River Site.

5.4.2 Relationship Between Local Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

Each reactor site would require additional land for the construction of a dry cask ISFSI. Such short- term usage would remove this land from other beneficial uses for the facilities as CLWRs. This land, which is within the site boundary at each candidate site, would not be expected to be used for any other activities as long as the plant is operating.

The use of CLWRs to produce tritium is significant in that carbon dioxide emissions associated with the accelerator option for producing tritium would be avoided. Producing tritium in a CLWR would not add to the "greenhouse" effect and global warming (see Sections 5.2.11 and 5.3).

The use of short-term resources to complete and operate the Bellefonte units for tritium production would affect the long-term productivity of the site by providing both a secure and reliable source of tritium to meet the nation's needs and production of electricity. The purpose and need for the Bellefonte units as a nuclear power plant is the subject of the *Final Environmental Impact Statement Related to the Construction of Bellefonte Nuclear Plant Unit 1 and Bellefonte Unit 2* (AEC 1974).

5.4.3 Irreversible and Irretrievable Commitments of Resources

This section discusses the major irreversible and irretrievable commitments of resources resulting from the proposed action. A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. An irreversible commitment refers to the use or consumption of resources that are neither renewable nor recoverable for later use by future generations. The discussion is divided into the functional segments of the proposed action, such as TPBAR fabrication and irradiation.

TPBAR Fabrication

Under the proposed action up to 4,000 TPBARs would need to be fabricated annually for the 40-year duration of the program. The materials involved in the fabrication of the TPBARs, such as lithium, aluminum, stainless steel, and zirconium, would be rendered radioactive during the tritium production process. These materials then would be consumed or reduced to unrecoverable forms of waste. In large part, however, the TPBARs would replace the burnable absorber rods normally used in the operation of the CLWRs and would produce no net change in the irretrievable material resources. None of the associated material resources associated with the fabrication of the TPBARs is in short supply. Material resources associated with the fabrication of the TPBARs are presented in Section 5.2.7.

TPBAR Irradiation

At the reactor facilities where construction is necessary (such as the completion of Bellefonte 1 and 2), the materials required include wood, concrete, sand, gravel, plastics, aluminum, steel, and other materials. No unusual construction materials requirements have been identified for any of the alternative sites. None of these identified construction resources is in short supply. No additional transmission lines, roads, rail line, water pipeline, wastewater pipeline, or wastewater treatment facilities would be required for Watts Bar or Sequoyah as a result of tritium production. Additional material (e.g., concrete and steel) would be required if an ISFSI were to be constructed.

Resources that would be consumed during completion of construction at Bellefonte 1 and 2 are summarized in **Table 5–65.**

Table 5–65 Resources Consumed During Construction–Bellefonte 1 and 2

Resources	Total Consumed	
	Bellefonte 1	Bellefonte 2
Utilities		
Electricity	575,000 megawatts-electric (80 megawatts peak demand [a])	500,000 megawatts-electric (80 megawatts peak demand [a])
Water	280,000 cubic meters (330 cubic meters per day peak demand [a])	160,000 cubic meters (280 cubic meters per day peak demand [a])
Solids		
Concrete	2,190 cubic meters	1,791 cubic meters
Steel	353 metric tons	98 metric tons
Liquids		
Fuel	9,652,872 liters	3,785,440 liters
Gases		
Industrial gases [b]	500 cubic meters	1,300 cubic meters

[a] Peak demand is the maximum rate expected during any hour.
[b] Standard cubic meter measured at 1 atmosphere and 15.55°C.
Source: TVA 1995b.

Additional materials for nuclear fuel assemblies would be required to operate the reactors in a tritium-producing mode. Materials associated with nuclear fuel assemblies include uranium, steel, and zircaloy. After irradiation, these materials and other material byproducts of the fission and irradiation process constitute the high-level radioactive waste constituents of the spent nuclear fuel. At this time, all constituents of the spent fuel are considered nonrecoverable since no reprocessing of the spent fuel is allowed. Material resources associated with use of additional nuclear fuel assemblies were discussed in Section 5.2.7.

5.5 MITIGATION MEASURES

Following the completion of an EIS and its associated Record of Decision, DOE is required to prepare a Mitigation Action Plan that addresses any mitigation commitments expressed in the Record of Decision (10 CFR, 1021.331). This Mitigation Action Plan is required to explain how the corresponding mitigation measures designed to mitigate adverse environmental impacts associated with the course of action directed by the Record of Decision will be planned and implemented. This Mitigation Action Plan is to be prepared before DOE takes any action directed by the Record of Decision that is the subject of a mitigation commitment.

Based on the analyses of the environmental consequences resulting from the proposed action, no mitigation measures would be necessary since all potential environmental impacts would be substantially below acceptable levels or promulgated standards. However, each potential reactor site would follow construction and/or operational practices that would minimize the impacts in such areas as air and surface water quality, noise, operational and public health and safety, and accident prevention and mitigation. These practices are dictated by Federal and state licensing and permitting requirements, as described in Chapter 6.

The completion of the Bellefonte facility could cause impacts which might require mitigative actions. In this situation, the final completion of construction activities would require a large number of workers. Since many of these workers are not available in the immediate area, there would be an immigration to the area for the construction period. Such an immigration could impact the available housing inventory and could place substantial demands upon the school system by requiring additional facilities, teachers, administrators, and buses. Section 5.2.3.8 also estimates a noticeable increase in local traffic over current levels during the potential completion and operation of one or both Bellefonte units. As discussed in that section, possible measures that could be used to mitigate traffic volume impacts are physical improvements to the local roads or road network to increase capacity, including construction of additional vehicle lanes throughout road segments, construction of passing lanes in certain locations, or realignment to eliminate some of the no-passing zones. Employee programs that provide flexible hours could also reduce road travel during peak hours, and restrictions for trucks traveling during the peak hours could be made. Also, establishing employee programs and incentives for ride-sharing could be encouraged, and bus and/or vanpool programs could be initiated.

Although mitigative actions are discussed in the CLWR EIS for these areas, no commitment on the part of DOE can be made until the Record of Decision is issued. It should be noted that the completion of the Bellefonte facility is not the Preferred Alternative.

Although not anticipated, it is possible that DOE may commit to mitigative actions in the CLWR Record of Decision. If this occurs, the Department would prepare a Mitigation Action Plan explaining how all mitigative actions would be planned for and implemented. Such a Mitigation Action Plan would be prepared prior to taking any actions directed by the Record of Decision. Copies of such a Mitigation Action Plan would be placed in the appropriate DOE reading rooms and would be provided to interested parties upon written request.

6. APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Chapter 6 identifies the Federal and state statutes and regulations that require licenses, permits, or other requirements related to environmental protection, emergency planning, and worker safety and health. In addition, the chapter summarizes the U.S. Department of Energy's regulations and orders, as well as the regulatory compliance history of the three nuclear plants being considered for tritium production.

6.1 INTRODUCTION AND BACKGROUND

Like most nuclear activities, the production of tritium in a commercial reactor would be closely regulated to ensure the health and safety of the public, protect the environment, and guard employee health. Most of these regulatory requirements already apply to the operating Watts Bar Nuclear Plant Unit 1 (Watts Bar 1) and Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2), and have been accounted for in the planning and partial construction of the incomplete Bellefonte Nuclear Plant Units 1 and 2 (Bellefonte 1 and 2). The addition of tritium production would necessitate few, if any, physical or substantive changes to current compliance plans and activities at the plants. The legal responsibility for continued U.S. Nuclear Regulatory Commission (NRC) regulatory compliance would remain with the Tennessee Valley Authority (TVA).

To ensure that individual facilities satisfy the established standards of nuclear safety and environmental protection, some of the applicable laws require the facilities to have licenses or permits. The most comprehensive of these are the operating licenses issued by the NRC under the Atomic Energy Act of 1954, as amended. Tritium production was not contemplated in the existing operating licenses for Watts Bar 1 and Sequoyah 1 and 2, or in the construction permit (the precursor to an operating license) for Bellefonte 1 and 2. The NRC would, therefore, have to review the tritium production proposal under established processes to amend the operating licenses for Watts Bar 1 and Sequoyah 1 and 2, and as part of the safety analysis and licensing review process associated with the construction of Bellefonte 1 and 2.

Permits for air pollution emissions and water pollution discharges are issued by the relevant state environmental agencies (the Alabama Department of Environmental Management and the Tennessee Department of Environment and Conservation) under state programs approved by the U.S. Environmental Protection Agency (EPA) pursuant to the Clean Air and Clean Water Acts. Continued compliance with the terms of these permits would be required. Based on the projections for air emissions and liquid effluents, no changes to the existing permits at Watts Bar or Sequoyah should be necessary. TVA has noted, however, that it ships all hazardous wastes to permitted offsite facility contractors; therefore, it does not need its own hazardous waste permits (TVA 1997d). Unless this practice changes as a result of tritium production, no new hazardous waste permits should be required. Each facility has a Hazardous Waste Generator Identification Number and a Special Waste Permit that would have to be transferred to the U.S. Department of Energy (DOE) if it were to purchase the reactors.

Some applicable laws, such as the National Environmental Policy Act (NEPA), the Endangered Species Act, and the Emergency Planning and Community Right-To-Know Act, require specific reports and/or consultations rather than ongoing permits or activities. These would be satisfied through the legal/regulatory process, including the preparation of the *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS), leading to the proposed tritium production.

The other applicable laws establish general requirements that must be satisfied, but do not include processes (such as the issuance of permits or licenses) to consider compliance prior to specific instances of violations or other events that trigger their provisions. These include the Toxic Substances Control Act (affecting polychlorinated biphenyl transformers and other designated substances); the Federal Insecticide, Fungicide, and Rodenticide Act (affecting pesticide/herbicide applications); the Hazardous Materials Transportation Act; and (if there were to be a spill of a hazardous substance) the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund).

Finally, both TVA and DOE have their own internal requirements that would be applicable to the proposed production of tritium. Occupational safety and health programs constitute the most important internal requirements. The Occupational Safety and Health Act and the Department of Labor regulations established under it do not apply directly to government agencies (such as DOE) or government-owned corporations (such as TVA). However, both are required by statute (29 CFR 1910, 29 U.S.C. 668) and Executive Order 12196 to have their own programs to protect worker safety and health "consistent" with the Occupational Safety and Health Act's standards. Radiological aspects of worker safety and health are governed through the NRC licensing process.

DOE also has numerous requirements that are set forth in DOE Orders to ensure its activities provide general protection of health, safety, and the environment. Most of these, however, do not apply to activities at non-DOE facilities (such as DOE production of tritium in TVA reactors).

Section 6.2 of this chapter discusses the major Federal and state statutes and regulations that impose nuclear safety and environmental protection requirements on the subject facilities, and that might require the reactor facility to obtain a permit or license, or amendment thereof, prior to tritium production. Each of the applicable regulations and statutes establishes how potential releases of pollutants and radioactive materials are to be controlled or monitored. These applicable regulations and statutes include requirements for the issuance of permits or licenses for new operations or new emission sources and for amendments to existing permits or licenses to allow new types of operations at existing sources. In addition to nuclear and environmental license and permit requirements, the regulations and statutes may require consultations with various authorities to determine whether an action requires a permit to be obtained or amended, or whether protective or mitigative measures relative to the action's effect on cultural, natural, or biological resources need to be implemented. Sections 6.2.1 and 6.2.2 discuss the nuclear and environmental licensing and permitting processes, respectively, and list the licenses and permits applicable to tritium production in the subject facilities.

Section 6.3 addresses other general requirements regarding environmental protection, emergency planning, and worker safety and health. Section 6.4 discusses the DOE regulations and Orders that pertain to DOE activities.

6.2 STATUTES AND REGULATIONS REQUIRING LICENSES OR PERMITS

The Atomic Energy Act of 1954, as amended by the Energy Reorganization Act of 1974, gives NRC jurisdiction over the construction and operation of commercial nuclear reactors (including those of TVA) and over the possession, use, transportation, and disposal of radioactive materials (including wastes). The NRC carries out this role by applying extensive regulations and performance standards to specific facilities and operations through a required licensing process. Although most DOE facilities and operations are not subject to NRC jurisdiction, the proposed tritium production services provided to DOE by TVA would be subject to the NRC regulations and license requirements governing TVA.

Federal and state environmental laws establish standards for radiation exposure in the general environment (i.e., everything outside NRC- or DOE-regulated facilities) and for sources of air pollution, water pollution, and hazardous waste. Some of these standards are applied to specific facilities and operations through required permits. To obtain these permits, the facility operator (in the present case, TVA) must submit construction and operation plans and specifications for new or modified sources of pollutants for review by the appropriate government agencies. The environmental permits: (1) contain specific conditions governing construction and operation of a new or modified emission source; (2) describe pollution abatement and prevention methods to reduce pollutants; and (3) contain emission limits for the pollutants that will be emitted from the facility. Section 6.2.2 discusses the environmental regulations and statutes under which new or amended permits may be required for tritium production at the candidate facilities.

6.2.1 Nuclear Regulatory Commission Permits and Licenses

Atomic Energy Act of 1954 (42 U.S.C. 2011 *et seq.*, as amended) (10 CFR 50)

The Atomic Energy Act, as amended, requires entities that operate nuclear power plants, such as TVA, to have a plant license issued by the NRC. The NRC regulations that implement this requirement provide for permits to be issued for the construction or alteration of such facilities. Operating licenses are applied for after completion of the construction or alteration of the facilities (10 CFR Sections 50.23, 50.56, 50.57). Construction permits and operating licenses include detailed provisions regarding their duration and the design, safety, and quality assurance requirements for the subject facilities (10 CFR Sections 50.54, 50.55).

Permits and licensing for completion of the Bellefonte 1 and 2 reactors for tritium and electricity production will be addressed as part of the NRC's consideration of TVA's operating license application. To address tritium production, TVA will be required to apply to the NRC for appropriate amendments to its operating license application for Bellefonte 1 and 2, or to its existing operating licenses for the Watts Bar 1 and Sequoyah 1 and 2 reactors. The NRC must grant Bellefonte 1 an operating license before it can produce tritium, and the NRC must approve TVA's license amendments for Watts Bar 1 and Sequoyah 1 and 2 before those plants can produce tritium.

Regulatory Limits of Radiation Exposure (10 CFR 50, Appendix I, 10 CFR 20)

Limits of exposure to members of the public and radiation workers are based on International Commission on Radiological Protection recommendations. Each country's regulatory organization adopts the International Commission on Radiological Protection's recommendations and sets specific annual exposure limits. For nuclear facilities in the United States, annual exposure limits to the public and radiation workers are established by the NRC in 10 CFR 20 (Standards for Protection Against Radiation) and 10 CFR, Appendix I (Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion, "As Low as is Reasonably Achievable," for radioactive material in light-water-cooled nuclear power reactor effluents).

6.2.2 Environmental Protection Permits

Clean Air Act, as amended, and EPA regulations thereunder (42 U.S.C. 7401 *et seq.*), (40 CFR 50-99); Tennessee Air Quality Act and regulations thereunder (Title 68 Tennessee Code Chapter 201); Alabama Air Pollution Control Act and regulations thereunder (Title 22 Alabama Code Chapter 28); air pollution ordinances of the relevant municipal and county governments

The Clean Air Act, as amended, is intended to "protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the Clean Air Act, as amended, requires each Federal agency (including TVA and DOE) with jurisdiction over any property or facility that might result in the discharge of air pollutants to comply with "all Federal, state, interstate, and local requirements" with regard to the control and abatement of air pollution.

The Act requires EPA to establish National Ambient Air Quality Standards as necessary to protect public health and welfare with an adequate margin of safety from any known or anticipated adverse effects of a regulated pollutant (42 U.S.C. 7409). The Act also requires the establishment of national standards of performance for new or modified stationary sources of atmospheric pollutants (42 U.S.C. 7411 and 7412) and requires specific emission increases to be evaluated to prevent a significant deterioration in air quality (42 U.S.C. 7470 *et seq.*). Air emissions are regulated by the EPA in 40 CFR Parts 50 through 99. Hazardous air pollutants, including radionuclide emissions from Federal facilities, are regulated under the National Emission Standards for Hazardous Air Pollutants Program (40 CFR 61).

These national standards are implemented by states that have an air pollution control program approved by the EPA. In Tennessee, the program is administered by the State Department of Environment and Conservation under the State Air Quality Act (Title 68 Tennessee Code Chapter 201). In Alabama, the program is administered by the State Department of Environmental Management under the Alabama Air Pollution Control Act (Title 22 Alabama Code Chapter 28). The National Emission Standards for Hazardous Air Pollutants Programs standards for radionuclides (40 CFR 61, Subparts H and I) are not applicable to NRC-licensed facilities such as TVA reactors. As cited in EPA's Final Rule (60 FR 46206), compliance with NRC regulations constitutes compliance with 40 CFR 61, Subparts H and I. As indicated in Chapter 5, the radiation exposure of the public would be well within the regulatory limits.

The U.S. Environmental Protection Agency also establishes standards for radiation protection for members of the public in the general environment and for radioactive materials introduced into the general environment as the result of operations that are a part of a nuclear fuel cycle. These standards are found in 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations. TVA reactors are subject to these standards.

Federal Clean Water Act, as amended (33 U.S.C. 1251 *et seq.*); Tennessee Water Quality Act (Title 69 Tennessee Code Chapter 3) and regulations thereunder (regulations Chapter 1200-4); Alabama Water Pollution Control Act (Title 22 Alabama Code Chapter 22)

The Federal Water Pollution Act (commonly known as the Clean Water Act) was enacted to "restore and maintain the chemical, physical, and biological integrity of the nation's water." The Clean Water Act prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States (Section 101). Section 313 of the Clean Water Act, as amended, requires all branches of the Federal Government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, state, interstate, and local requirements.

In addition to setting water quality standards for the nation's waterways, the Clean Water Act supplies guidelines and limitations (Sections 301-303) for effluent discharges from point-source discharges and provides authority (Sections 401-402) for the EPA to implement the National Pollutant Discharge Elimination System (NPDES) permitting program pursuant to 40 CFR 122 and subsequent revisions.

EPA has delegated primary enforcement authority for the Clean Water Act and the NPDES permitting program to the States of Tennessee and Alabama for the waters therein.

Federal Safe Drinking Water Act, as amended [42 U.S.C. 300f *et seq.*, 40 CFR 41-149]; Tennessee Safe Drinking Water Act (Title 68 Tennessee Code Chapter 221); Alabama Water Pollution Control Act (22 Alabama Code Chapter 22)

The primary objective of the Safe Drinking Water Act, as amended (42 U.S.C. 300f *et seq.*), is to protect the quality of the public water supplies and all sources of drinking water. The implementing regulations, administered by the EPA unless delegated to the states, establish standards applicable to public water systems. They promulgate maximum contaminant levels (including those for radioactivity) in public water systems, which are defined as water systems that serve at least 15 service connections used by year-round residents or that regularly serve at least 25 year-round residents. Safe Drinking Water Act requirements have been promulgated by the EPA in 40 CFR 100-149; for tritium, a concentration limit of 20,000 picocuries per liter has been established per 40 CFR 141.16. As indicated in Chapter 5, the tritium concentration would remain well below the regulatory limits.

The Resource Conservation and Recovery Act and its Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. 6901 *et seq.*); Tennessee Hazardous Waste Management Act (Title 68 Tennessee Code Chapter 212); Alabama Hazardous Waste Management and Minimization Act (22 Alabama Code Chapter 30)

The treatment, storage, and/or disposal of hazardous and nonhazardous waste is governed by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. Pursuant to Section 3006 of the Act, any state that seeks to administer and enforce a hazardous waste program pursuant to the Resource Conservation and Recovery Act may apply for EPA authorization of its program. Tennessee and Alabama have such authorization. EPA regulations implementing the Resource Conservation and Recovery Act (40 CFR 260-280) define hazardous wastes and specify hazardous waste transportation, handling, treatment, storage, disposal, record keeping, and reporting requirements. The regulations imposed on a generator or a treatment, storage, or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, or disposed. The method of treatment, storage, or disposal also affects the extent and complexity of the requirements. These regulations require that facilities obtain a Resource Conservation and Recovery Act permit if they store hazardous waste on site more than 90 days (for large quantity generators) or 180 days (for small quantity generators) or treat hazardous waste. TVA has stated that it does not store waste beyond the periods allowed for hazardous waste generators or conduct treatment of hazardous wastes that require a Resource Conservation and Recovery Act permit at its nuclear facilities; therefore, TVA does not have Resource Conservation and Recovery Act permits for those facilities. Each facility does have an EPA/state Hazardous Waste Generator identification number and files the documents required for the generation of hazardous waste.

The Resource Conservation and Recovery Act does not apply to radioactive waste. However, the courts have held that it does apply to the hazardous (i.e., nonradioactive) component of mixed hazardous and radioactive wastes in *Legal Environmental Assistance Foundation (L.E.A.F.) versus Hodel*.

Federal Facility Compliance Act (42 U.S.C. 6961)

The Federal Facility Compliance Act, enacted on October 6, 1992, amended the Resource Conservation and Recovery Act. The Federal Facility Compliance Act waived sovereign immunity from fines and penalties for violations at the facilities of Federal agencies (including government-owned corporations such as TVA) associated with the management of mixed waste. However, TVA has stated in its submissions for Watts Bar 1 and Bellefonte 1 and 2 that it does not store hazardous waste at any of its nuclear facilities.

6.3 OTHER REQUIREMENTS RELATED TO ENVIRONMENTAL PROTECTION, EMERGENCY PLANNING, AND WORKER SAFETY AND HEALTH

6.3.1 Environmental Protection

National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*); DOE Order 451.1A.

NEPA establishes a national policy promoting awareness of the environmental consequences of human activity on the environment and consideration of environmental impacts during the planning and decisionmaking stages of a project. This Act requires Federal agencies to prepare a detailed statement on the environmental effects of proposed major Federal actions that might significantly affect the quality of the human environment.

This EIS has been prepared in response to NEPA requirements and policies and in accordance with the Council on Environmental Quality (40 CFR 1500-1508), DOE (10 CFR 1021, DOE Order 451.1A), and TVA provisions for implementing the procedural requirements of NEPA. It discusses reasonable alternatives and their potential environmental consequences.

Executive Order 11514 (Protection and Enhancement of Environmental Quality); (40 CFR 1500-1508)

Executive Order 11514 (regulated by 40 CFR 1500-1508) requires Federal agencies to monitor and control their activities continually to: (1) protect and enhance the quality of the environment, and (2) develop procedures to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs that may have potential environmental impacts so that the views of interested parties can be obtained.

Executive Order 11988 (Floodplain Management); (10 CFR 1022); (18 CFR 725)

Executive Order 11988 (regulated by 10 CFR 1022 and 18 CFR 725) requires Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken in a floodplain, and that floodplain impacts be avoided to the extent practicable. The production of tritium in the subject TVA facilities would not require further consideration of this Executive Order.

Executive Order 11990 (Protection of Wetlands); (10 CFR 1022); (18 CFR 725)

Executive Order 11990 (regulated by 10 CFR 1022 and 18 CFR 725) requires Federal agencies to avoid any short- and long-term adverse impacts on wetlands wherever there is a practicable alternative. The production of tritium in the subject TVA facilities would not require further consideration of this Executive Order.

Endangered Species Act, as amended (16 U.S.C. 1531 *et seq.*)

The Endangered Species Act prohibits Federal actions that might harm a listed endangered species or designated critical habitat, unless a special exemption is granted. Consultation with the U.S. Fish and Wildlife Service of the U.S. Department of Interior is required whenever a proposed action is likely to affect a listed species or critical habitat (50 CFR 17). Preparation of a biological assessment of potential effects on listed species is also required for Federal actions that are "major construction activities." As discussed in Sections 5.2.1.6, 5.2.2.6 and 5.2.3.6, the consultation process between TVA and the U.S. Fish and Wildlife Service of the U.S. Department of Interior has been completed for all three candidate sites at Watts Bar, Sequoyah, and Bellefonte (DOI 1998a, DOI 1998c, DOI 1998d).

National Historic Preservation Act of 1966 (16 U.S.C. 470 *et seq.*)

This Act provides that sites with significant national historic value be placed on the *National Register of Historic Places* maintained by the Secretary of the Interior. No permits or certifications are required under the Act. However, if a particular Federal activity may impact a historic property resource, consultation with the Advisory Council on Historic Preservation is required by 16 U.S.C. 470f. The National Historic Preservation Act provides for an expanded National Register and establishes the Advisory Council on Historic Preservation (36 CFR 800.3, Section 106). Section 110 of the Act requires Federal agencies to identify, evaluate, inventory, and protect National Register resources on properties they control. Such consultation usually generates a Memorandum of Agreement that includes stipulations that must be followed to minimize adverse impacts. Coordination with the State Historic Preservation Officer also is done to ensure that potentially significant sites are properly identified and appropriate mitigative actions are implemented. It should be noted that the Tennessee State Historic Preservation Office has reviewed the Draft EIS and concluded that the proposed action at Watts Bar and Sequoyah would have no effect upon properties listed or eligible for listing with the *National Register of Historic Places* (TN DC 1998b).

Pollution Prevention Act of 1990 (42 U.S.C. 13101 *et seq.*)

The Pollution Prevention Act of 1990 establishes a national policy for waste management and pollution control that focuses first on source reduction, followed sequentially by environmentally safe recycling, treatment, and disposal. Disposal or releases to the environment should occur only as a last resort. In response, DOE has committed to participation in the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) Amendments and Reauthorization Act Section 313, U.S. EPA 33/50 Pollution Prevention Program. The goal for facilities already involved in Section 313 compliance was to achieve by 1997 a 33-percent reduction in the release of 17 priority chemicals from a 1993 baseline. On August 3, 1993, President Clinton issued Executive Order 12856, expanding the 33/50 program such that DOE must reduce its total release of all toxic chemicals by 50 percent by December 31, 1999. The Order applies to all Federal agencies (such as DOE) and government-owned corporations (such as TVA).

Comprehensive Guideline for Procurement of Products Containing Recovered Materials (40 CFR 247)

This regulation was issued under the authority of Section 6002 of the Resource Conservation and Recovery Act and Executive Order 12873, which set forth requirements for Federal agencies (including government-owned corporations) to procure products containing recovered materials for use in their operations according to EPA guidelines. The purpose of these regulations is to promote recycling by using government purchasing to expand markets for recovered materials. Resource Conservation and Recovery Act Section 6002 requires that any purchasing agency, when using appropriated funds to procure an item, must purchase it with the highest practicable percentage of recovered materials. The procurement of materials to be utilized in the tritium production program should be conducted in accordance with these regulations.

Executive Order 12856 (Right-to-Know Laws and Pollution Prevention Requirements)

Executive Order 12856 requires all Federal agencies to reduce the toxic chemicals entering any waste stream. This Order also requires Federal agencies to report toxic chemicals entering waste streams; improve emergency planning, response, and accident notification; and encourage clean technologies and testing of innovative prevention technologies.

Executive Order 12898 (Environmental Justice)

Executive Order 12898 requires Federal agencies to identify and address any disproportionately high, adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. Chapter 5 and Appendix G of this EIS discuss Environmental Justice.

Executive Order 12902 (Energy Efficiency and Water Conservation at Federal Facilities)

Executive Order 12902 requires Federal agencies to develop and implement a program for conservation of energy and water resources.

6.3.2 Emergency Planning and Response

This section discusses laws that address the protection of public health and worker safety and require the establishment of emergency plans; coordination with local and Federal agencies is also covered. These laws relate to the operation of facilities, such as nuclear reactors, that engage directly or indirectly in the production of special nuclear material.

Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release (10 CFR 30.72 Schedule C)

This list determines the need for emergency response plans for unscheduled releases of radiological materials at all NRC-regulated facilities.

Commercial Nuclear Power Plant Emergency Preparedness Planning (44 CFR 352)

These regulations generally establish the policies, procedures, and responsibilities of the Federal Emergency Management Agency, the NRC, and DOE as guidance for implementing a Federal Emergency Preparedness Program.

Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001 *et seq.*) (also known as "SARA Title III")

The Emergency Planning and Community Right-to-Know Act of 1986 requires emergency planning and notice to communities and government agencies of the presence and release of specific chemicals. EPA implements this Act under regulations found in 40 CFR 355, 370, and 372. Under Subtitle A of this Act, Federal facilities (including those of government-owned corporations such as TVA) provide information (such as inventories of specific chemicals used or stored and any releases that occur) to the State Emergency Response Commission and the Local Emergency Planning Committee to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances.

Transportation of Hazardous Materials (49 U.S.C. 5101 *et seq.*); Hazardous Materials Tables & Communications, Emergency Response Information Requirements (49 CFR 172)

The regulatory requirements for marking, labeling, placarding, and documenting hazardous material shipments are defined in these regulations. Requirements for providing hazardous material information and training also are specified. Materials shipped to and from the subject facilities would be required to comply with these regulations.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. 9601 *et seq.*); National Oil and Hazardous Substance Contingency Plan (40 CFR 300)

More popularly known as "Superfund," the Act and the implementing regulations provide the needed general authority for Federal and state governments to respond directly to hazardous substance incidents. The regulations require reporting spills of hazardous substances to the National Response Center of EPA, including (in the limited circumstances specified in 40 CFR 302.6(b)(2)) radionuclides specified in 40 CFR 302.4. Tritium production operations would be required to comply with these regulations if a hazardous substance spill occurred.

6.3.3 Worker Safety and Health

Occupational Safety and Health Act of 1970, as amended (29 U.S.C. 651 *et seq.*); Occupational Safety and Health Administration Emergency Response, Hazardous Waste Operations, and Worker Right to Know (29 CFR 1910)

The Occupational Safety and Health Act (29 U.S.C 651) establishes standards to enhance safe, healthy working conditions in places of employment throughout the United States. The Act is administered and enforced by the Occupational Safety and Health Administration, a U.S. Department of Labor agency. While the Occupational Safety and Health Administration and EPA both have a mandate to reduce exposure to toxic substances, the Occupational Safety and Health Administration's jurisdiction is limited to safety and health conditions that exist in the workplace environment. In general, under Occupational Safety and Health Act, it is the duty of each employer to furnish all employees a place of employment that is free of recognized hazards that are likely to cause death or serious physical harm. Employees have a duty to comply with the occupational safety and health standards and all Occupational Safety and Health Act-related rules, regulations, and orders. The Occupational Safety and Health Administration's regulations (29 CFR) establish specific standards that tell employers what must be done to achieve a safe, healthy working environment. These regulations set down the Occupational Safety and Health Administration's requirements for employee safety in a variety of working environments, including employee emergency and fire prevention plans (29 CFR 1910.38), hazardous waste operations and emergency response (29 CFR 1910.120), and hazards communication (29 CFR 1910.1200) to increase employee awareness of the dangers they face from hazardous materials at their workplace.

Occupational Safety and Health Act and the regulations thereunder do not directly apply to Federal agencies or government-owned corporations. However, Section 19 of Occupational Safety and Health Act (29 U.S.C. 668) requires all Federal agencies to have occupational safety programs "consistent" with Occupational Safety and Health Act standards. This requirement has been applied to government-owned corporations, as well as agencies, through 5 U.S.C. 7902 and Executive Order 12196.

Radiological protection for employees of NRC-licensed facilities is regulated by the NRC. DOE Order 440.1, "Worker Protection Management for DOE Federal and Contractor Employees," also applies at all DOE facilities, even if they are also regulated by the NRC. This Order will not apply to the TVA facilities, since TVA will not be a DOE contractor.

6.4 DOE Regulations and Orders

The Atomic Energy Act makes DOE responsible for establishing a comprehensive health, safety, and environmental program for its activities. DOE carries out this responsibility through the promulgation of regulations (set forth in 10 CFR 830) and the issuance of DOE Orders. The DOE regulations, however, do not apply to activities regulated by the NRC (see 10 CFR 830.2(a), 835.1(b)). Thus, the DOE regulations would not apply to tritium production at the TVA reactors.

6.5 Compliance History

This CLWR EIS considered three nuclear facilities for tritium production: Watts Bar 1; Sequoyah 1 and 2; and Bellefonte 1 and 2. A description is provided of each facility's performance in the following areas: (1) compliance with NRC regulations; (2) compliance with environmental and nonnuclear safety regulations; (3) NRC Performance Indicators; and (4) Systematic Assessments of Licensee Performance. The assessment is based on the following information sources:

- Information submitted by TVA in response to DOE's request for proposal

- NRC documentation, including Systematic Assessments of Licensee Performance reports, transcripts of Commission briefings, and summaries of Notices of Violation
- Review of Industry Performance Indicators compiled by NRC

6.5.1 Compliance Indicators

The purpose of this section is not for DOE to assess the adequacy of TVA's operation of its CLWRs. Such an assessment is the responsibility of NRC. The information contained in this section provides a basis for DOE to assess whether there are any compliance issues that would interfere with the production of tritium or create a potentially significant environmental impact. Three selected compliance indicators used to describe TVA's compliance history are: (1) Systematic Assessment of Licensee Performance; (2) enforcement actions; and (3) performance indicators.

6.5.1.1 Systematic Assessments of Licensee Performance

of the NRC's evaluation tools, the Systematic Assessments of Licensee Performance Program, has been used to characterize this compliance performance. The Systematic Assessments of Licensee Performance Program is an integrated effort by the NRC to collect and evaluate observations and data to assess and better understand the reasons for a licensee's performance. The program was started in the early 1980s. The Systematic Assessments of Licensee Performance evaluation is based on a compilation of the NRC staff's regulatory experience with the plant over an extended period of time. Normally, the Systematic Assessments of Licensee Performance Program covers about 18 months. This period can be extended to 24 months for plants that are performing well and can be reduced to about 12 months for poorer performers.

Each plant is rated in four functional areas: plant operations, maintenance, engineering, and plant support. Each functional area is assigned a rating of 1, 2, or 3. The "1" rating represents a superior level of safety performance that may support a reduced NRC inspection effort. A "2" rating reflects a good level of performance. A rating of "3" designates an acceptable level of performance where the NRC will consider increased inspection efforts.

6.5.1.2 NRC Notices of Violations and Enforcement Actions

The review of each facility's NRC enforcement history also presents an overview of day-to-day compliance with NRC regulations. The NRC's Enforcement Program seeks to protect public health and safety by ensuring compliance with NRC regulations and license conditions; obtaining prompt correction of violations and conditions averse to quality; deterring future violations; and encouraging improvement of licensee performance.

Violations are identified through inspections and investigations. There are three primary enforcement sanctions available: Notices of Violation, civil penalties, and orders.

- A Notice of Violation summarizes the results of an inspection and formalizes a violation. Severity levels for Notices of Violation of NRC regulations range from Severity Level I, for the most significant violations, to Severity Level IV for those of more minor concern.
- A civil penalty is a monetary fine issued under the authority of the Atomic Energy Act. Civil penalties may be assessed up to $110,000 per violation per day. Notices of Violation and civil penalties are issued based on violations.
- Orders may be issued for violations, or in the absence of a violation, because of a public health and safety issue.

6.5.1.3 Performance Indicators

Performance Indicators for Operating Commercial Nuclear Power Reactors (NRC 1998b) was most recently issued in December 1997. This document contains data through September 1997 for 109 commercial power reactors. The information focuses on eight performance indicators using information that was submitted by the reactor operators in Licensee Event Reports, monthly operating reports, and information provided by the Institute of Nuclear Power Operations. The information is grouped in "Peer Groups" to provide a useful perspective to evaluate a unit's performance against reactors of similar operating history, age, and manufacturer. Also, performance indicator data were categorized by similar data to be characterized as a Peer Group. Plants were categorized by Nuclear Steam Supply System vendor, product line, generating capacity, and licensing date. The following are the Peer Group categories listed under *Performance Indicators for Operating Commercial Nuclear Power Reactors* (NRC 1998b):

- Pre-Three Mile Island General Electric Plants
- Post-Three Mile Island General Electric Plants
- Babcock and Wilcox Plants
- Combustion Engineering Plants without Core Protection Calculators
- Combustion Engineering Plants with Core Protection Calculators
- Westinghouse 2-Loop and Small 3- and 4-Loop Plants
- Westinghouse Older 3-Loop Plants
- Westinghouse New 3- and 4-Loop Plants
- Westinghouse Older 4-Loop Plants
- All New Plants Since 1/1/87

6.5.2 Watts Bar 1

Watts Bar 1 started commercial power operations in 1996. The compliance review includes an overview of the plant's regulatory performance from the latter stages of construction through current operations.

6.5.2.1 NRC Performance

NRC Overview

In discussing the compliance history in a September 1995 Commission briefing (NRC 1995d), the NRC staff indicated that it had applied "unprecedented NRC inspection resources" to Watts Bar 1 to ensure that the systemic problems that created design and construction concerns in the pre-1985 time frame were effectively addressed by TVA as it completed construction and prepared the plant equipment, systems, and staff for full power operations. Stewart Ebneter, NRC Region II Administrator noted, "I believe we have inspected Watts Bar 1 more than any other plant...I think this one is the most inspected plant." These inspections provided the NRC an effective forum to review all aspects of the construction, testing, and operation of Watts Bar 1 prior to approval of the Operating License in 1996. In a July 1995 Commission briefing (NRC 1995c), John S. Jaudon, NRC Deputy Director, Division of Reactor Safety, Region II, characterized TVA's performance by saying, "Our inspections indicate that TVA performance on the site has been generally good since the fall of 1994."

This theme was reiterated in the September 1995 Commission briefing as NRC management reviewed the results of recent testing at Watts Bar 1 and summarized the progress of preparing Watts Bar 1 for operation (NRC 1995d).

Systematic Assessments of Licensee Performance Evaluations

Watts Bar 1 operations have been evaluated by the NRC in two Systematic Assessments of Licensee Performance inspections (NRC 1996c, NRC 1998a). As summarized in **Table 6–1**, Watts Bar 1 has an average Systematic Assessment of Licensee Performance score of 1.25 for these two evaluations (see Section 6.5.1.1).

Table 6–1 Systematic Assessments of Licensee Performance Results for the Watts Bar Nuclear Power Plant

Review Period	*Plant Operations*	*Maintenance*	*Engineering*	*Plant Support*
November 1995 to November 1996	2	1	1	1
November 1996 to December 1997	2	1	1	1

The NRC's January 1998 Systematic Assessment of Licensee Performance report for the period from November 1996 to December 1997 (NRC 1998a) characterized the engineering, maintenance, and plant support functional areas as "superior." However, the report indicated that, "configuration control of plant equipment remained problematic...component mispositions by nonlicensed operators continued to occur, including examples found by the NRC which rendered safety equipment inoperable." These issues are being addressed by the NRC.

NRC Notices of Violation and Enforcement Actions

TVA's compliance information (TVA 1997e, NRC 1998f), which was submitted in response to DOE's request for proposal, identified the following NRC Notices of Violation issued during the latter stages of construction:

- 1992 - 15 Level IV violations
- 1993 - 3 Level II violations with civil penalty of $100,000 and 46 Level IV violations
- 1994 - 50 Level IV violations
- 1995 - 25 Level IV violations

TVA's compliance information for Watts Bar 1 (TVA 1997e) indicates that there were 35 Level IV violations, and 1 Level II violation with a civil penalty of $80,000 (this penalty was withdrawn in April 1998) during the period from initial operation in 1996 through 1997. These enforcement actions are summarized below:

Civil Penalties - Watts Bar 1

NRC Notices of Violation for Watts Bar 1 were found dating back to 1988. There have been no further violations since 1992, except for one civil penalty notice in combination with the Sequoyah Nuclear Plant. This penalty was withdrawn in April 1998. The Sequoyah/Watts Bar Nuclear Plants received Level I and Level II Notices of Violation that proposed imposition of civil penalties regarding alleged acts of discrimination in violation of 10 CFR 50.7. These Notices of Violation dated back to 1988 on different discrimination act charges that totaled $200,000 in civil penalties. Twenty-six cases noted in the NRC letters of January 20 and 25, 1993, included: (1) two cases in which the final order of the Secretary of Labor determined that discrimination was a factor in the actions taken against the employees, (2) 13 cases that were conciliated after an initial U.S. Department of Labor determination of discrimination, and (3) 11 cases that were conciliated before an initial determination of discrimination by the U.S. Department of Labor (NRC 1998f). Payment of these civil penalties was made by wire transfer on January 26, 1994.

The Level IV violations have been found to fit in the following categories as stated: lack of site standard practices; failure to meet code requirements; deficiencies in quality control; improper work instructions; deficiencies in procedures; failure to establish adequate measures to assure that materials conformed to requirements; failure to train personnel properly; drawing errors; inadequate design control; failure to distribute agenda; design and construction practices; and failure to adequately control and secure safeguards. The overview of all Notices of Violation at this level fit into two classifications: a lack of management control and procedural interpretation (NRC 1998f).

Performance Indicators

Performance Indicators for Operating Commercial Nuclear Power Reactors (NRC 1998b) presents performance indicator information for Watts Bar 1 using a peer group defined as "All New Plants Since 1/1/87." Accordingly, the data presented in *Performance Indicators for Operating Commercial Nuclear Power Reactors* were reviewed for the six (of eight) performance indicators that address operational activities. The following data characterizes Watts Bar 1 performance since the second quarter of 1996 in these categories:

- *Automatic Scrams While Critical* [An automatic scram is a reactor shutdown that has been initiated by the plant's safety systems.] The industry average for this indicator was less than 0.3 scrams per quarter. Watts Bar 1's performance included four quarters with no automatic scrams, one quarter with one automatic scram, and two quarters with two scrams, for an average of 0.7 scrams per quarter.

- *Safety System Actuations* The industry average for this indicator was approximately 0.005 actuations per quarter. Watts Bar 1's performance included six quarters with no actuations, and one quarter with three actuations (two occurring with the reactor operating and one with the reactor shut down), for an average of 0.14 actuations per quarter.

- *Significant Events* The industry average for this indicator was approximately zero significant events per quarter, which equaled Watts Bar 1's performance of no significant events through seven quarters.

- *Safety System Failures* The industry average for this indicator was approximately 0.5 failures per quarter. Watts Bar 1's performance included three quarters with no failures, three quarters with one failure per quarter (all during operation), and one quarter with two failures (both with the reactor shut down), for an average of 0.7 failures per quarter.

- *Forced Outage Rate* The industry average for this indicator was less than a 20 percent forced outage rate per quarter. Watts Bar 1's performance included three quarters with no forced outages, one quarter with a 1 percent forced outage rate, one quarter with a 2 percent forced outage rate, and one quarter with an 18 percent forced outage rate.

- *Equipment Forced Outages* The industry quarterly average for this indicator was approximately 0.2 equipment forced outages per 1,000 commercial critical hours. Watts Bar 1's performance included four quarters with no outages resulting from equipment problems, one quarter with a rate of 1.5 outages per 1,000 commercial critical hours, and one quarter with a rate of 1.65 outages per 1,000 commercial critical hours.

Also, a review of performance indicator criteria addressed Collective Radiation Exposure, which is the total radiation dose accumulated by unit personnel. The industry average for this indicator was less than 50 person-rem per quarter. The performance of Watts Bar 1 was only reported in the *Performance Indicators for Operating Commercial Nuclear Power Reactors* (NRC 1998b) for two quarters with values of 3 person-rem per quarter.

6.5.2.2 Environmental, Safety & Health (Nonnuclear) Performance

Occupational Safety and Health Act Compliance/Worker Safety Performance

As noted in TVA's summary of its Occupational Safety and Health Act performance indicators for the period from 1992 through mid-1997 (TVA 1997e), both the recordable injury rate and the lost-time injury rate are below the rates reported by the industry in general and specifically for the electric industry. This reflects performance from 1992 to 1995, when Watts Bar 1 was completing construction, system testing, and related startup activities. Similarly, 1996 to mid-1997 was a period in which facility staff were transitioning from a construction phase to a power generation phase (i.e., reactor and operating systems were energized and potentially radioactive, and discipline in all phases of facility operations was critical).

Environmental Performance

As noted in their submittal (TVA 1997e), Watts Bar 1 had no Notices of Violation from 1992 through 1994, only one in 1995, and again one in 1996. None were received in the first seven months of 1997. The 1995 and 1996 Notices of Violation involved the following violations:

- 1995 Notice of Violation - Auxiliary boiler operating hours exceeded limit in air permit
- 1996 Notice of Violation - Unmonitored release from yard pond in sewage treatment plant effluent stream

6.5.3 Sequoyah 1 and Sequoyah 2

6.5.3.1 NRC Performance

NRC Overview

Sequoyah 1 and 2 initially achieved commercial operation in July 1981 and June 1982, respectively. The regulatory history of these plants includes the following:

- In 1985, TVA voluntarily shut down five reactors (including Sequoyah 1 and 2) because of charges of mismanagement and inattention to safety requirements. Sequoyah 2 was the first of the shut-down units to be returned to operation in mid-1988 (TVA 1997e).

- The NRC added the Sequoyah Nuclear Plant to its "watch list" as a result of the 1985 shutdown. (The NRC's Watch List identifies power plants that require additional regulatory oversight because of declining performance. Once placed on the "watch list," a plant must demonstrate consistent improved performance before it is removed from the list.) Both Sequoyah 1 and Sequoyah 2 were removed from this list in 1989 (TVA 1997e).

- A reactor trip (i.e., automatic reactor shutdown) at Sequoyah 1 in March 1993 identified a problem with piping that resulted in the shutdown of both units. Sequoyah 2 was restarted in October 1993, and Sequoyah 1 was restarted after completion of a refueling outage.

Systematic Assessment of Licensee Performance Evaluations

A review of the most recent evaluations was conducted to determine the facility's current regulatory stature, as described in the NRC's Systematic Assessments of Licensee Performance inspections (NRC 1995a, NRC 1996b). As summarized in **Table 6–2**, the Sequoyah Nuclear Plant has an average Systematic Assessments of Licensee Performance score of around 2.0. These scores and the associated assessments by the NRC characterized the overall performance of Sequoyah 1 and 2 as "good."

Table 6–2 Systematic Assessments of Licensee Performance Results for the Sequoyah Nuclear Power Plant

Review Period	*Plant Operations*	*Maintenance*	*Engineering*	*Plant Support*
August 1992 to October 1993	3	3	2	1
October 1993 to January 1995	2	2	2	2
January 1995 to July 1996	2	2	2	2
July 1996 to February 1998	2	2	2	1

As noted in the Systematic Assessments of Licensee Performance reports, the NRC has acknowledged that progress and improvements have been made in many areas. However, additional improvements are warranted and expected in the remaining areas. Two examples of the NRC's comments in the recent Systematic Assessments of Licensee Performance reports are provided below.

The February 1995 Systematic Assessments of Licensee Performance reports for October 1993 to January 1995 (NRC 1995a) summarized the NRC's findings as:

> "Performance improved in the Operations and Maintenance functional areas, and remained the same in the Engineering functional area. However, emerging problems and operational occurrences continued to require reactive organizational responses. Performance declined in the Plant Support functional area due to weaknesses in corrective actions for long-standing problems in the fire protection, secondary chemistry, and post-accident sampling system areas." (NRC 1995a)

The September 1996 Systematic Assessments of Licensee Performance report (for January 1995 to July 1996) summarized its findings as:

> "Plant performance was characterized by an excessive number of reactor trips and transients early in the assessment period....Operations performance continued to be good in plant transient response, safety sensitivity, and problem identification. Improvement was noted in shutdown operations and personnel error reduction. Weak areas were found in root cause evaluations and controls for infrequently performed evolutions." (NRC 1996b)

The April 1998 Systematic Assessment of Licensee Performance report (for July 1996 through February 1998) summarized its findings as:

> "Performance in the plant support area improved to superior, and performance in maintenance, plant operations, and engineering areas was still characterized as good. The plant operated well during the last six months of the assessment period. However, it is unclear whether this positive performance indicates a consistent trend towards improved performance.
>
> The performance from a safety assessment and quality assurance perspective was mixed. Quality Assurance assessments were generally considered good, as were self-assessments in maintenance and most plant support areas. However, the ability to conduct meaningful self-assessments in all areas was not demonstrated, nor was the identification of root causes and resulting corrective action universally effective." (NRC 1998c)

NRC Notices of Violation and Enforcement Actions

TVA's compliance information on Sequoyah 1 and 2 identifies the following NRC Notices of Violation issued since 1993 (TVA 1997e, NRC 1998e):

- 1993 - 4 Level III and 26 Level IV violations
- 1994 - 29 Level IV violations
- 1995 - 14 Level IV violations
- 1996 - 14 Level IV violations
- 1997 - 4 Level III violations with civil penalties of $80,000 (this penalty was withdrawn in April 1998) and 18 Level IV violations [These were the first violations to include civil penalties since 1993, according to the TVA data.]

The NRC Notices of Violation were found in all four levels of violation dating back to 1988; since 1992 the Notices of Violation have only been at the Level III and Level IV categories.

The Level IV violations were found to fit in the following categories as stated: lack of maintenance and operating procedures, poor management, improper installation of safety controlled instrumentation, and failure to follow code. The overview of all Notices of Violation at this level fit into two classifications: a lack of management control and procedural interpretation.

The Level III violations were for failure to comply with technical specification requirements, for example: inoperation of mechanical mechanisms, mispositioned safety-system throttle valves, failure to maintain the refueling water storage tank solution temperature, and loss of reactor coolant pump seal injection flow during recovery. The Level III Notices of Violation fit into two classifications: a lack of operation of safety-related devices and failure to maintain system operations guidelines.

Sequoyah received Level I and Level II Notices of Violation that proposed imposition of civil penalties regarding alleged acts of discrimination against employees for engaging in certain protected activities in violation of 10 CFR 50.7. These Notices of Violation resulted in the imposition of a civil penalty in the amount of $200,000. Payment of this civil penalty was made on January 26, 1994. On January 21, 1997, Sequoyah received a Level I violation and $100,000 civil penalty for alleged acts of discrimination against an employee engaging in certain protected activities in violation of 10 CFR 50.7.

Performance Indicators

Performance Indicators for Operating Commercial Nuclear Power Reactors (NRC 1998b) presents performance indicator information for Sequoyah 1 and 2 using a peer group defined as "Westinghouse New 3- and 4-Loop Plants." The data presented in *Performance Indicators for Operating Commercial Nuclear Power Reactors* (NRC 1998b) was reviewed for the six (of eight) performance indicators that address operational activities. The following data characterizes Sequoyah 1 and 2 performance during the period from the fourth quarter of 1994 through the third quarter of 1997 in these categories:

- *Automatic Scrams While Critical* [An automatic scram is a reactor shutdown that has been initiated by the plant's safety systems.] The industry average for this indicator was less than 0.19 scrams per quarter. The performance of Sequoyah 1 and 2 reflected an average of 0.3 scrams per quarter.

- *Safety System Actuations* The industry average for this indicator was approximately 0 actuations per quarter. The performance of Sequoyah 1 and 2 reflected an average of 0.17 actuations per quarter.

- *Significant Events* The industry average for this indicator was approximately 0 significant events per quarter, while the performance of Sequoyah 1 and 2 reflected 1 significant event each during the reporting period for an average of 0.08 events per quarter.

- *Safety System Failures* The industry average for this indicator was less than one failure per quarter. The performance of Sequoyah 1 and 2 reflected 1 safety system failure for Sequoyah 1 and 0 failures for Sequoyah 2 during the 12-month reporting period.

- *Forced Outage Rate* The industry average for this indicator was less than a 20 percent forced outage rate per quarter. The performance of Sequoyah 1 reflected 1 quarter with a forced outage rate of 26 percent and the remaining 11 quarters reflected a forced outage rate of 10 percent or less, with 4 quarters having an outage rate of 0. The performance of Sequoyah 2 reflected 2 quarters with forced outage rates that exceeded the industry rate and the remaining 10 quarters reflected a forced outage rate of 4 percent or less, with six quarters having an outage rate of 0.

- *Equipment Forced Outages* The industry quarterly average for this indicator was approximately 0.3 equipment forced outages per 1,000 commercial critical hours. The performance of Sequoyah 1 included six quarters with forced outage rates caused by equipment problems that exceeded the industry rate and the remaining six quarters with a forced outage rate of 0. Sequoyah 2 performance included five quarters with forced outage rates that exceeded the industry rate and the remaining seven quarters with a forced outage rate of 0.

Also, a review of performance indicator criteria addressed Collective Radiation Exposure. The industry average for this indicator was less than 50 person-rem per quarter. The performance of Sequoyah 1 reflects four quarters with quarterly radiation exposures that exceeded the industry rate (with a peak of 165 person-rem), and the remaining seven quarters reflected exposures of 3 to 17 person-rem per quarter. The performance of Sequoyah 2 reflects two quarters with quarterly radiation exposures that exceeded the industry rate (with a peak of 213 person-rem) and the remaining nine quarters reflected exposures of 2 to 17 person-rem per quarter.

6.5.3.2 Environmental, Safety & Health (Nonnuclear) Performance

Occupational Safety and Health Act Compliance/Worker Safety Performance

As noted in TVA's summary of its Occupational Safety and Health Act performance indicators for 1992 through mid-1997 (TVA 1998a), both the Recordable Injury Rate and the Lost-Time Injury Rate were below the rates reported by industry in general and the electric industry in particular.

Environmental Performance

Sequoyah 1 and 2 had a total of three Notices of Violation issued by the Tennessee Department of Environment and Conservation from 1992 through 1997 (TVA 1997e). These notices involved the following violations:

- 1992 Notice of Violation - Subsurface release of fuel oil

- 1993 Notice of Violation - Storage of mixed waste (i.e., waste with radioactive and hazardous constituents) on site for over 90 days without a permit

- 1995 Notice of Violation - Failure to notify regulator of a waste stream that had existed since 1991

6.5.4 Bellefonte 1 and Bellefonte 2

6.5.4.1 Performance

NRC Overview

As noted earlier, the Bellefonte Nuclear Power Plant includes two partially completed reactor units. Construction was halted in 1988 when Bellefonte 1 was 90 percent complete and Bellefonte 2 was 57 percent complete. As a result, the regulatory history is limited. As noted in the TVA submittal, Bellefonte 1 and 2 had received no Notices of Violation since 1989 and have had no escalated enforcement actions, fines, or penalties during their construction history (TVA 1997e).

6.5.4.2 Environmental, Safety & Health (Nonnuclear) Performance

Occupational Safety and Health Act Compliance/Worker Safety Performance

As noted in TVA's summary of its Occupational Safety and Health Act performance indicators for the period from 1992 through mid-1997, the Recordable Injury Rate was below the rates reported by industry in general and the electric industry in particular. The data also indicates that the Lost-Time Injury Rate was 0 for the same period, which is obviously well below the rates reported by industry in general and the electric industry in particular (TVA 1997e).

Environmental Performance

As noted in their submittal (TVA 1997e), Bellefonte 1 and 2 had one Notice of Violation, a fuel oil spill, issued by the Alabama Department of Environment and Conservation in 1993.

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General Public/Stakeholders
Approximately 700 copies of the Final EIS were sent to stakeholders
Approximately 2800 copies of the Summary of the Final EIS were sent to stakeholders

10. GLOSSARY

***Accident Sequence* —** With regard to nuclear facilities, an initiating event followed by system failures or operator errors, which can result in significant core damage, confinement system failure, and/or radionuclide releases.

***Activation Products* —** Nuclei, usually radioactive, formed by the bombardment and absorption of material with neutrons, protons, or other nuclear particles.

***Acute Exposure* —** The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. The period of acute exposure is generally assumed to end 1 week after the inception of a radiological accident.

***Air Pollutant* —** Any substance in the air which could, if in a high-enough concentration, harm man, animals, vegetation, or material.

***Air Quality Control Region* —** Geographic subdivisions of the United States, designed to deal with pollution on a regional or local level. Some regions span more than one state.

***Alpha Activity* —** The emission of alpha particles by radioactive materials.

***Alpha Particle* —** A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

***Alpha Wastes* —** Wastes containing radioactive isotopes that decay by producing alpha particles.

***Ambient* —** Surrounding.

***Ambient Air* —** The surrounding atmosphere as it exists around people, plants, and structures. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

***Ambient Air Quality Standards* —** The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

***Aquatic* —** Living or growing in, on, or near water.

***Aquatic Biota* —** The sum total of living organisms within any designated aquatic area.

***Aquatic Macrophytes* —** Visible plants occurring in water.

***Aquifer* —** A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

***Archaic* —** Artifacts from the North American archaeological period dating from 8000 B.C. to 1000 B.C.

Archaeological Sites (resources) — Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact — An object produced or shaped by human workmanship of archaeological or historical interest.

As Low as Reasonably Achievable (ALARA) — A concept applied to ensure the quantity of radioactivity released to the environment and the radiation exposure of onsite workers in routine operations, including "anticipated operational occurrences," is maintained as low as reasonably achievable. It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Atmospheric Dispersion — The process of air pollutants being dispersed in the atmosphere. This occurs by the wind that carries the pollutants away from their source, and by turbulent air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

Atomic Energy Act of 1954, as amended — The statute that established U.S. requirements with respect to nuclear energy and nuclear materials. This Act, as amended, provides the statutory framework for government control of the possession, use, and production of atomic energy, special nuclear material, and other radioactive material, whether owned by the government or others.

Atomic Energy Commission (AEC) — A five-member commission, established by the *Atomic Energy Act* of 1946, to supervise nuclear weapons design, development, manufacturing, maintenance, modification, and dismantlement. In 1974, the Atomic Energy Commission was abolished and all functions were transferred to the Nuclear Regulatory Commission and the Administrator of the Energy Research and Development Administration. The Energy Research and Development Administration was later terminated and its functions, vested by law in the Administrator, were transferred to the Secretary of Energy.

Background Radiation — Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location.

Badged Worker — A worker who has the potential to be exposed to radiation and is equipped with a dosimeter to measure his/her dose.

Barrier — Any material or structure that prevents or substantially delays movement of radionuclides toward the accessible environment.

Baseline — A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and progress of a project can be measured. For this environmental impact statement, the environmental baseline is the site environmental conditions as they exist or have been estimated to exist in the absence of the proposed action.

BEIR V — Biological Effects of Ionizing Radiation; referring to the fifth in a series of committee reports from the National Research Council.

Benthic — Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

Beta Particle — A charged particle emitted from the nucleus of an atom during radioactive decay. A negatively charged beta particle is identical to an electron; a positively charged beta particle is called a "positron."

***Biodiversity* —** The diversity of life in all its forms and all its levels of organization. Also termed "biological diversity."

***Biota (biotic)* —** The plant and animal life of a region (pertaining to biota).

***Block* —** U.S. Bureau of the Census term describing small areas bounded on all sides by visible features or political boundaries; used in tabulation of census data.

***Block Groups* —** U.S. Bureau of the Census term describing a cluster of blocks generally selected to include 250 to 550 housing units.

***Blowdown* —** A maintenance procedure to remove sediment in power plant components.

***Boiler* —** A pressurized system in which water is vaporized to steam, the desired end product, by heat transferred from a source of higher temperature, usually the products of combustion from burning fuels.

***Boiling Water Reactor* —** A type of nuclear reactor that uses fission heat to generate steam in the reactor core or vessel to drive turbines and generate electricity.

***Boost* —** The process by which fusion of deuterium-tritium gas inside the pit of a nuclear weapon produces neutrons that increase the fission output of the primary.

***Boron-10* —** An isotope of the element boron that has a high-capture cross-section for neutrons. It is used in reactor absorber rods for reactor control.

***Burial Ground* —** With regard to radioactive wastes, a place for burying unwanted (i.e., radioactive) materials in which the earth acts as a receptacle to prevent the escape of radiation and the dispersion of wastes in the environment.

***Burnable Absorber* —** A material, such as boron or lithium, that captures neutrons and transmutes or changes to another isotope.

***Burnable Poison Rod* —** A nuclear reactor rod used to capture or absorb neutrons created in the core by the fission reactions during the early core life.

***Cancer* —** The name given to a group of diseases characterized by uncontrolled cellular growth with cells having invasive characteristics such that the disease can transfer from one organ to another.

***Capable Fault* —** A fault that has exhibited one or more of the following characteristics:

(1) Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.

(2) Macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault.

(3) A structural relationship to a capable fault according to characteristics (1) or (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other.

***Capacity Factor* —** The ratio of the annual average power production of a power plant to its rated capacity.

Carbon Dioxide (CO_2) — A colorless, odorless gas that is a normal component of the ambient air; it results from fossil fuel combustion and is an expiration product.

Carboniferous Age — Noting or pertaining to a period of the Paleozoic era, including the Pennsylvanian, Mississippian, and formerly the Permian periods as epochs: from 270 million to 350 million years ago.

Carbon Monoxide (CO) — A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

Cask — A heavily shielded container that meets U.S. Nuclear Regulatory Commission and U.S. Department of Transportation regulatory requirements and is used to store and/or ship radioactive materials (i.e., spent nuclear fuel, irradiated tritium-producing burnable absorber rods, or high-level waste). Lead, depleted uranium, and steel are common materials used in the manufacture of casks.

Cesium — A silver-white alkali metal. A radioactive isotope of cesium, cesium-137, is a common fission product.

Chain Reaction — A reaction that initiates its own repetition. In a fission chain reaction, a fissionable nucleus absorbs a neutron and fissions spontaneously, releasing additional neutrons. These, in turn, can be absorbed by other fissionable nuclei, releasing still more neutrons. A fission chain reaction is self-sustaining when the number of neutrons is constant or increases over a period of time.

Chemical Oxygen Demand — A measure of the quantity of chemically oxidizable components present in water.

Chronic Exposure — Low-level radiation exposure incurred over a long time period due to residual contamination.

Cladding — The metal tube that forms the outer jacket of a nuclear fuel rod or burnable absorber rod. It prevents the release of radioactive material into the coolant. Stainless steel and zirconium alloys are common cladding materials.

Class I Areas — National parks and wilderness areas designated by the Prevention of Significant Deterioration section of the Clean Air Act amendments. These amendments and the implementing regulations provide special protection to air quality and air quality-related values in such areas. Only very slight deterioration of air quality is allowed in Class I areas.

Class II Areas — Most of the country not designated as Class I is designated as Class II. Class II areas are generally cleaner than air quality standards require and moderate increases in new pollution are allowed after a regulatory-mandated impacts review.

Claystone — A massive sedimentary rock made up largely of clay minerals having the composition of shale, but lacking its fine lamination.

Clean Air Act — This Act mandates and provides for enforcement of regulations to control air pollution from various sources.

Clear Air Act Amendments of 1990 — Expands the Environmental Protection Agency's enforcement powers and adds restrictions on air toxics, ozone-depleting chemicals, stationary and mobile emissions sources, and emissions implicated in rain and global warming.

***Clean Water Act of 1972, 1987* —** This Act regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit, as well as discharges to or dredging of wetlands.

***Climatology* —** The science that deals with climates and investigates their phenomena and causes.

***Code of Federal Regulations (CFR)* —** All Federal regulations in force are published in codified form in the Code of Federal Regulations.

***Cold Standby* —** Maintenance of a protected reactor condition in which the fuel is removed, the moderator is stored in tanks, and equipment and system lay-up is performed to prevent deterioration, such that future refueling and restart are possible.

***Collective Committed Effective Dose Equivalent* —** The committed effective dose equivalent of radiation for a population.

***Commercial Light Water Reactor (CLWR)* —** A term used to describe commercially operated power-producing U.S. reactors that use “light” (as opposed to “heavy”) water for cooling and neutron moderation.

***Committed Dose Equivalent* —** The predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of a radionuclide into the body. It does not include external dose contributions. Committed dose equivalent is expressed in units of rem or Sievert. The committed effective dose equivalent is the sum of the committed dose equivalents to various tissues of the body, each multiplied by the appropriate weighting factor.

***Community (biotic)* —** All plants and animals occupying a specific area under relatively similar conditions.

***Complex* —** The Nuclear Weapons Complex, which is a set of Federal sites and government-owned/contractor-operated facilities administered by the U.S. Department of Energy.

***Comprehensive Test Ban Treaty* —** A proposed treaty prohibiting nuclear tests of all magnitudes.

***Computational Modeling* —** The use of a computer to develop a mathematical model of a complex system or process and to provide conditions for testing it.

***Conformity* —** Conformity is defined in the Clean Air Act as the action’s compliance with an implementation plan’s purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of such standards; and that such activities will not: (1) cause or contribute to any new violation of any standard in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely attainment of any standard or any required interim emission reduction or other milestones in any area.

***Consumptive Water Use* —** The difference in the volume of water withdrawn from a body of water and the amount released back into the body of water.

***Container* —** With regard to radioactive wastes, the metal envelope in the waste package that provides the primary containment function of the waste package and is designed to meet the containment requirements of 10 CFR 60.

***Containment Design-Basis* —** For a nuclear reactor, those bounding conditions for the design of the containment, including temperature, pressure, and leakage rate. Because the containment is provided as an additional barrier to mitigate the consequences of accidents involving the release of radioactive materials, the containment design-basis may include an additional specified margin above those conditions expected to result from the plant design-basis accidents to ensure that the containment design can mitigate unlikely or unforeseen events.

***Control Rod* —** A rod containing material such as boron that is used to control the power of a nuclear reactor. By absorbing excess neutrons, a control rod prevents the neutrons from causing further fissions; i.e., increasing power.

***Coolant* —** A substance, either gas or liquid, circulated though a nuclear reactor or processing plant to remove heat.

***Cooperating Agency* —** Any other Federal agency having jurisdiction or special expertise with respect to any environmental issue.

***Credible Accident* —** An accident that has a probability of occurrence greater than or equal to one in a million years.

***Criteria Pollutants* —** The Clean Air Act required the U.S. Environmental Protection Agency to set air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their health effects. Today there are standards in effect for six "criteria pollutants": sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than or equal to 10 microns in diameter (PM_{10}) and less than or equal to 2.5 microns in diameter ($PM_{2.5}$), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb).

***Critical Habitat* —** Defined in the *Endangered Species Act* of 1973 as "specific areas within the geographical area occupied by [an endangered or threatened] species, essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species that are essential for the conservation of the species."

***Criticality* —** A reactor state in which a self-sustaining nuclear chain reaction is achieved.

***Cultural Resources* —** Archaeological sites, historical sites, architectural features, traditional use areas, and Native American sacred sites.

***Cumulative Impacts* —** In an environmental impact statement, the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or nonfederal), private industry, or individual(s) undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

***Curie (Ci)* —** A unit of radioactivity equal to 37 billion disintegrations per second; also a quantity of any nuclide or mixture of nuclides having 1 Curie radioactivity.

***Day-Night Average Sound Level* —** The 24-hour A-weighted equivalent sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during nighttime hours.

***Decay Heat (radioactivity)* —** The heat produced by the decay of certain radionuclides.

***Decay (radioactive)* —** The decrease in the amount of any radioactive material with the passage of time due to the spontaneous transformation of an unstable nuclide into a different nuclide or into a different energy state of the same nuclide; the emission of nuclear radiation (alpha, beta, or gamma radiation) is part of the process.

Decibel (dB) — A logarithmic unit of sound measurement which describes the magnitude of a particular quantity of sound pressure power with respect to a standard reference value. In general, a sound doubles in loudness for every increase of 10 decibels.

Decibel, A-weighted (dBA) — A unit of frequency weighted sound pressure level, measured by the use of a metering characteristic and the "A" weighting specified by the American National Standards Institution ANSI S1.4-1983 (R1594), that accounts for the frequency response of the human ear.

Deciduous — Trees which shed leaves at a certain season.

Decontamination — The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Deposition — In geology, the laying down of potential rock-forming materials; sedimentation. In atmospheric transport, the settling out on ground and building surfaces of atmospheric aerosols and particles ("dry deposition") or their removal from the air to the ground by precipitation ("wet deposition" or "rainout").

Design-Basis — For nuclear facilities, information that identifies the specific functions to be performed by a structure, system, or component and the specific values (or ranges of values) chosen for controlling parameters for reference bounds for design. These values may be: (1) restraints derived from generally accepted state-of-the-art practices for achieving functional goals; (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals; or (3) requirements derived from Federal safety objectives, principles, goals, or requirements.

Design-Basis Accident — For nuclear facilities, a postulated abnormal event that is used to establish the performance requirements of structures, systems, and components that are necessary to: (1) maintain them in a safe shutdown condition indefinitely; or (2) prevent or mitigate the consequences of the design-basis accident so that the general public and operating staff are not exposed to radiation in excess of appropriate guideline values.

Design-Basis Events — Postulated disturbances in process variables that can potentially lead to design-basis accidents.

Deuterium — A nonradioactive isotope of the element hydrogen with one neutron and one proton in the atomic nucleus.

Direct Economic Effects — The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct Effect Multiplier — The total change in regional earnings and employment in all related industries as a result of a one-dollar change in earnings and a one-job change in a given industry.

Direct Jobs — The number of workers required at a site to implement an alternative.

Disposition — The ultimate "fate" or end use of a surplus U.S. Department of Energy facility following the transfer of the facility to the Office of the Assistant Secretary for Environmental Management.

Dose — The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Dose Commitment — The dose an organ or tissue would receive during a specified period of time (e.g., 50 to 100 years) as a result of intake (by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time.

Dose Equivalent — The product of absorbed dose in rad (or Gray) and a quality factor, which quantifies the effect of this type of radiation in tissue. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert.

Dosimeter — A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., film badge or ionization chamber).

Drift — Effluent mist or spray carried into the atmosphere from cooling towers.

Drinking Water Standards — The level of constituents or characteristics in a drinking water supply specified in regulations under the Safe Drinking Water Act as the maximum permissible.

Dual Use/Dual Benefit — Projects that have uses in or benefits for the defense sector and the private industry or civilian sector.

Effective Dose Equivalent — The sum of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk to the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body. Effective dose equivalent is expressed in units of rem or Sievert.

Effluent — A gas or fluid discharged into the environment.

Effluent (liquid) — Wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall; generally refers to wastes discharged into surface waters.

Electromagnetic Fields — Two types of energy fields which are emitted from any device that generates, transmits, or uses electricity.

Emergency Condition — For a nuclear facility, occurrences or accidents that might occur infrequently during startup testing or operation of the facility. Equipment, components, and structures might be deformed by these conditions to the extent that repair is required prior to reuse.

Emission — A material discharged into the atmosphere from a source operation or activity.

Emission Standards — Legally enforceable limits on the quantities and/or kinds of air contaminants that may be emitted into the atmosphere.

Empirical — Something that is based on actual measurement, observation, or experience rather than on theory.

Endangered Species — Any species which is in danger of extinction throughout all or significant portions of its range. The Endangered Species Act of 1973, as amended, establishes procedures for placing species on the Federal lists of endangered or threatened species.

Endangered Species Act of 1973 — The Act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions likely will not jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Engineered Safety Features — For a nuclear facility, features that prevent, limit, or mitigate the release of radioactive material from its primary containment.

Enriched Uranium — Uranium in which the abundance of the isotope uranium-235 is increased above the normal (naturally occurring) level of 0.711 weight percent.

Entrainment — The involuntary capture and inclusion of organisms in streams of flowing water; a term often applied to the cooling water systems of power plants/reactors. The organisms involved may include phyto- and zooplankton, fish eggs and larvae (ichthyoplankton), shellfish larvae, and other forms of aquatic life.

Environment, Safety, and Health Program — In the context of the U.S. Department of Energy (DOE), encompasses those DOE requirements, activities, and functions in the conduct of all DOE and DOE-controlled operations that are concerned with: impacts to the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both the operating personnel and the general public; and protecting property against accidental loss or damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, process and facilities safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

Environmental Assessment — A written environmental analysis prepared pursuant to the National Environmental Policy Act. This assessment is performed to determine whether a Federal action could significantly affect the environment and thus require preparation of a more detailed environmental impact statement. If the action will not significantly affect the environment, then a Finding of No Significant Impact is prepared.

Environmental Impact Statement (EIS) — A document required of Federal agencies by the National Environmental Policy Act for major proposals or legislation significantly affecting the environment. A tool for decisionmaking, it describes the positive and negative effects of the undertaking and alternative actions.

Environmental Justice — The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic influence.

Environmental Survey — A documented, multidisciplined assessment (with sampling and analysis) of a facility to determine environmental conditions and to identify environmental problems requiring corrective action.

Epidemiology — The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population.

Equivalent Sound (Pressure) Level — The equivalent steady sound level that, if continuous during a specified time period, would contain the same total energy as the actual time varying sound. For example, L_{eq} (1-h) and L_{eq} (24-h) are the 1-hour and 24-hour equivalent sound levels, respectively.

Exposure Limit — The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

(1) Reference dose is the chronic exposure dose (milligrams or kilograms per day) for a given hazardous chemical at which or below which adverse human noncancer health effects are not expected to occur.

(2) Reference concentration is the chronic exposure concentration (milligrams per cubic meter) for a given hazardous chemical at which or below which adverse human noncancer health effects are not expected to occur.

Fault — A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Finding of No Significant Impact — A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and will not require an environmental impact statement under the National Environmental Policy Act.

Fissile Materials — Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning, namely, any material fissionable by thermal (slow) neutrons. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

Fission (Fissioning) — The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

Fission Products — Nuclei formed by the fission of heavy elements (primary fission products); also, the nuclei formed by the decay of the primary fission products, many of which are radioactive.

Fissionable Material — Material that could undergo fission by fast neutrons.

Floodplain — The lowlands adjoining inland and coastal waters and relatively flat areas.

Flux — Rate of flow through a unit area; in reactor operation, the apparent flow of neutrons in a defined energy range (see neutron flux).

Formation — In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

Fuel Assembly — A cluster of fuel rods (or plates). Also called a fuel element. Approximately 200 fuel assemblies make up a reactor core.

Fuel Rod — Nuclear reactor component that includes the fissile material.

Fugitive Emissions — Emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, piles of stored material, and exposed soil.

Fusion — Nuclear reaction in which light nuclei are fused together to form a heavier nucleus, accompanied by the release of energy and fast neutrons.

Gamma Rays **—** High-energy, short-wavelength, electromagnetic radiation accompanying fission and either emitted from the nucleus of an atom or emitted by some radionuclide or fission product. Gamma rays are very penetrating and can be stopped only by dense materials (such as lead) or a thick layer of shielding materials.

Gaussian Plume **—** The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

Genetic Effects **—** The outcome resulting from exposure to mutagenic chemicals or radiation which results in genetic changes in germ line or somatic cells.

(1) Effects on genetic material in reproductive cells cause trait modifications that can be passed from parents to offspring.

(2) Effects on genetic material in nonreproductive cells result in tissue or organ modifications (e.g., liver tumors) that do not pass from parents to offspring.

Geology **—** The science that deals with the Earth: the materials, processes, environments, and history of the planet, including the rocks and their formation and structure.

Getter **—** Material that absorbs free tritium gas and chemically binds it within its own structure. One such structure is zirconium alloy.

Global Warming **—** The theory that certain gases such as carbon dioxide, methane, and chlorofluorocarbon in the Earth's atmosphere effectively restrict radiation cooling, thus elevating the Earth's ambient temperatures.

Groundshine **—** The radiation dose received from an area on the ground where radioactivity has been deposited by a radioactive plume or cloud.

Groundwater **—** The supply of water found beneath the Earth's surface, usually in aquifers, which may supply wells and springs.

Habitat **—** The environment occupied by individuals of a particular species, population, or community.

Half-Life **—** The time in which half the atoms of a radioactive isotope decay to another nuclear form. Half-lives vary from millionths of a second to billions of years.

Hazardous Chemical **—** Under 29 CFR 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

Hazard Index **—** A sum of the Hazard Quotients for all chemicals now being used at a site and those proposed to be added to yield cumulative levels for a site. A Hazard Index value of 1.0 or less means that no adverse human health effects (noncancer) are expected to occur.

Hazard Quotient — The value used as an assessment of noncancer–associated toxic effects of chemicals, e.g., kidney or liver dysfunction. It is a ratio of the estimated exposure to that expected to produce no adverse health effects. It is independent of a cancer risk, which is calculated only for those chemicals identified as carcinogens.

Hazardous Material — A material, including a hazardous substance, as defined by 49 CFR 171.8, which poses a risk to health, safety, and property when transported or handled.

Hazardous/Toxic Air Pollutants — Air pollutants known or suspected to cause serious health problems such as cancer, poisoning, or sickness, and may have immunological, neurological, reproductive, developmental, or respiratory effects.

Hazardous/Toxic Waste — Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the Resource Conservation and Recovery Act and identified or listed in 40 CFR 261 or by the Toxic Substances Control Act.

Hazardous Waste — A by-product of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special U.S. Environmental Protection Agency lists.

Heat Exchanger — A device that transfers heat from one fluid (liquid or gas) to another.

Heavy Metals — Metallic or semimetallic elements of high molecular weight, such as mercury, chromium, cadmium, lead, and arsenic, that are toxic to plants and animals at known concentrations.

Heavy Water — A form of water in which the hydrogen atoms are replaced by deuterium atoms. Deuterium is an isotope of the element of hydrogen with one neutron and one proton in the nucleus.

Heavy Water Reactor — A nuclear reactor in which circulating heavy water is used to cool the reactor core and to moderate (reduce the energy of) the neutrons created in the core by the fission reactions.

Helium-3 — A nonradioactive isotope of the element helium, that is produced as a tritium decay product.

Helium-4 — The naturally occurring isotope of the element helium, that is also a by-product in the atomic conversion of lithium to tritium.

High Efficiency Particulate Air Filter (HEPA) — A filter used to remove very small particulates from dry gaseous effluent streams.

High-Level Waste — The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Historic Resources — Archaeological sites, architectural structures, and objects produced after the advent of written history dating to the time of the first Euro-American contact in an area.

Hold-Down Assembly — The mechanical device that integrates the tritium-producing burnable absorber rods into an assembly and secures this assembly into the reactor fuel assembly.

HT — Tritiated hydrogen molecule which emits a low-energy beta particle and has a half-life of 12.3 years.

Hydrology — The science dealing with the properties, distribution, and circulation of natural water systems.

Hydrodynamics — The study of the motion of a fluid and of the interactions of the fluid with its boundaries, especially in the case of an incompressible inviscid fluid.

Ignition — Self-sustained fusion burn of light nuclei.

Impingement — The process by which aquatic organisms too large to pass through the screens of a water intake structure become caught on the screens and are unable to escape.

Implosion — With respect to nuclear weapons, the sudden inward compression and reduction in volume of fissionable material with chemical explosives in a nuclear weapon.

Incident-Free Risk — The radiological or chemical impacts resulting from emissions during normal commercial light water reactor operations and from packages aboard vehicles in normal transport. This includes the radiation or hazardous chemical exposure of specific population groups and workers.

Indirect Economic Effects — Indirect effects result from the need to supply industries experiencing direct economic effects with additional outputs to allow them to increase their production. The additional output from each directly affected industry requires inputs from other industries within a region (i.e., purchases of goods and services). This results in a multiplier effect to show the change in total economic activity resulting from a new activity in a region.

Indirect Jobs — Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

Induced Economic Effects — The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.

Injection Wells — A well that takes water from the surface into the ground, either through gravity or by mechanical means.

Ion — An atom that has too many or too few electrons, causing it to be electrically charged; an electron that is not associated (in orbit) with a nucleus.

Ion Exchange — A unit physiochemical process that removes anions and cations, including radionuclides, from liquid streams (usually water) for the purpose of purification or decontamination.

Ionizing Radiation — Alpha particles, beta particles, gamma rays, neutrons, high-speed electrons, high-speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.

Isotope — An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons, but different numbers of neutrons and different atomic masses.

Joule — A metric unit of energy, work, or heat, equivalent to 1 watt-second, 0.737 foot-pound, or 0.239 calories.

Lacustrine — Found or formed in lakes; also, a type of wetland situated on or near a lake.

Landscape Character — The arrangement of a particular landscape as formed by the variety and intensity of the landscape features (land, water, vegetation, and structures) and the four basic elements (form, line, color, and texture). These factors give an area a distinctive quality that distinguishes it from its immediate surroundings.

Large Release — A release of radioactive material that would result in doses greater than 25 rem to the whole body or 300 rem to the thyroid at 1.6 kilometer (1 mile) from the control perimeter (security fence) of a reactor facility.

Latent Fatalities — Fatalities associated with acute and chronic environmental exposures to chemical or radiation that occur within 30 years of exposure.

Lead Test Assembly — Tritium-producing burnable absorber rods (TPBARs) assembled and inserted in limited quantities into the Watts Bar 1 commercial light water reactor to confirm the TPBARs' performance.

Lentic — Pertaining to or living in still water.

Licensee Amendment — Changes to an existing reactor's operating license that are approved by the U. S. Nuclear Regulatory Commission.

Light Water — The common form of water (a molecule with two hydrogen atoms and one oxygen atom, H_2O) in which the hydrogen atom consists completely of the normal hydrogen isotope (one proton).

Light Water Reactor — A nuclear reactor in which circulating light water is used to cool the reactor core and to moderate (reduce the energy of) the neutrons created in the core by the fission reactions.

Lithium-6 — The isotope of the element lithium that changes to tritium and helium-4 when a neutron is absorbed by the lithium nucleus.

Long-Lived Radionuclides — Radioactive isotopes with half-lives greater than about 30 years.

Loss-of-Coolant Accident — An accident that results from the loss of reactor coolant because of a break in the reactor coolant system.

Low-Level Waste — Waste that contains radioactivity, but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or by-product material as defined by Section 11e (2) of the Atomic Energy Act of 1954, as amended. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because of the nature of the generating process and/or constituents, because the waste would tell too much about the process.

Macrophyte — A member of the macroscopic plant life, especially in a body of water.

Maximum Contaminant Level — The maximum permissible level of a contaminant in water delivered to any user of a public drinking water system. Maximum contaminant levels are enforceable standards under the Safe Drinking Water Act.

Maximally Exposed Offsite Individual — A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

Megajoule — A unit of heat, work, or energy equal to 1 million joules. See "Joule."

Megawatt (MW) — A unit of power equal to 1 million watts. "Megawatt-thermal" is commonly used to define heat produced, while "megawatt-electric" defines electricity produced.

Meteorology — The science dealing with the atmosphere and its phenomena, especially as relating to weather.

Migration — The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Migratory Bird Treaty Act — This act states that it is unlawful to pursue, take, attempt to take, capture, possess, or kill any migratory bird, or any part, nest, or egg of any such bird, other than permitted activities.

Mississippian — Artifacts from the North American archaeological period dating from 500 AD to 1200 AD.

Mixed Waste — Waste that contains both "nonradioactive hazardous waste" and "radioactive waste" as defined in this glossary.

Moderator — A material used to decelerate neutrons in a reactor from high energies to low energies.

Mollusks — Unsegmented, invertebrate animals including gastropods, pelecypods, and cephalopods.

National Ambient Air Quality Standards (NAAQS) — Uniform, national air quality standards established by the Environmental Protection Agency under the authority of the Clean Air Act that restrict ambient levels of criteria pollutants to protect public health (primary standards) or public welfare (secondary standards), including plant and animal life, visibility, and materials. Standards have been set for ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen, nitrogen dioxide, and lead.

National Emission Standards for Hazardous Air Pollutants — A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources.

National Environmental Policy Act of 1969 (NEPA) — This Act is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decisionmakers so their actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

National Historic Preservation Act — This Act provides that property resources with significant national historic value be placed on the national Register of Historic Places. It does not require any permits, but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES) — Federal permitting system required for water pollution effluents under the Clean Water Act, as amended.

National Register of Historic Places — A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance under Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a) (1) (A) of the National Historic Preservation Act of 1966, as amended.

Neutron — An uncharged elementary particle with a mass slightly greater than that of the proton, found in the nucleus of every atom heavier than hydrogen-1. A free neutron is unstable and decays with a half-life of about 13 minutes into an electron and a proton; used in the fission process.

***Neutron Flux* —** The product of neutron number density and velocity (energy), giving an apparent number of neutrons flowing through a unit area per unit time.

***Neutron Poison* —** A chemical solution (e.g., a boron or component sheet or a burnable absorber rod) inserted into a nuclear reactor or spent fuel pool to absorb neutrons and end criticality. Any material with a strong affinity for absorbing neutrons without generating new neutrons that can be used to control the nuclear chain reaction.

***Nitrogen (N_2)* —** A colorless, odorless gaseous element that constitutes about four-fifths of the volume of the atmosphere.

***Nitrogen Oxides* —** Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and NO_2 (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. Nitrogen dioxide emissions contribute to acid deposition and formation of atmospheric ozone.

***Noise* —** Any sound that is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying (unwanted sound).

***Nonattainment Area* —** An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed national ambient air quality standards for one or more criteria pollutants.

***Notice of Intent* —** Announces the scoping process. The Notice of Intent is usually published in the Federal Register and a local newspaper. The scoping process includes holding at least one public meeting and requesting written comments on what issues and environmental concerns an environmental impact statement should address.

***Nuclear Assembly* —** Collective term for the primary, secondary, and radiation case of a nuclear warhead.

***Nuclear Component* —** A part of a nuclear weapon that contains fissionable or fusionable material.

***Nuclear Criticality* —** (See "criticality.")

***Nuclear Fuel Cycle* —** The path followed by the nuclear fuel in its various states from mining the ore to waste disposal. The basic fuel materials for the generation of nuclear power are the elements uranium and thorium.

***Nuclear Grade* —** Material of a quality adequate for use in a nuclear application.

***Nuclear Material* —** Composite term applied to: (1) special nuclear material; (2) source material such as uranium, thorium, or ores containing uranium or thorium; and (3) by-product material, which is any radioactive material that is made radioactive by exposure to a radiation incident or to the process of producing or using special nuclear material.

***Nuclear Nonproliferation Treaty* —** An international treaty signed in 1968 and extended in 1996 that seeks to limit nuclear weapons capabilities to the five countries (United States, France, England, Russia, and China) that possessed such weapons before 1967.

***Nuclear Power Plant* —** A facility that converts nuclear energy into electrical power. In a commercial light water reactor, heat produced in the nuclear reactor is used to make steam, which drives a turbine connected to an electric generator.

***Nuclear Radiation* —** Particles (alpha, beta, neutrons) or photons (gamma) emitted from the nucleus of unstable radioactive atoms as a result of radioactive decay.

***Nuclear Reaction* —** A reaction in which an atomic nucleus is transformed into another isotope of that respective nuclide, or into another element altogether; it is always accompanied by the liberation of either particles or energy.

***Nuclear Reactor* —** A device that sustains a controlled nuclear fission chain reaction that releases energy in the form of heat.

***Nuclear Regulatory Commission (NRC)* —** The Federal agency that regulates the civilian nuclear power industry in the United States.

***Nuclear Weapon* —** The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei; either fission, fusion, or both.

***Nuclear Weapons Complex* —** The sites supporting the research, development, design, manufacture, testing, assessment, certification, and maintenance of the nation's nuclear weapons and the subsequent dismantlement of retired weapons.

***Nuclide* —** A species of atom characterized by the constitution of its nucleus and, hence, by the number of protons, the number of neutrons, and the energy content.

***Numerical Simulation* —** The use of mathematical algorithms and models of physical processes to calculationally simulate the behavior or performance of a device or complex system.

***Occupational Safety and Health Administration* —** Oversees and regulates workplace health and safety, created by the Occupational Safety and Health Act of 1970.

***Off Site* —** As used in the environmental impact statement, the term denotes a location, facility, or activity occurring outside of the boundary of the reactor facility.

***Outfall* —** The discharge point of a drain, sewer, or pipe as it empties into a body of water.

***Ozone* —** The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere, ozone is considered an air pollutant.

***Packaging* —** With regard to hazardous or radionuclide materials, the assembly of components necessary to ensure compliance with Federal regulations. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle tie-down system and auxiliary equipment may be designated as part of the packaging.

***Palustrine* —** Found or formed in marshes; also, a type of wetland situated in or near a marsh.

***Particulate Matter* —** Air pollutants including dust, dirt, soot, smoke, or liquid droplets emitted into the air. "Total suspended particulate" was first used as the indicator for particulate concentrations. Current standards use the indicators "PM_{10}" and "$PM_{2.5}$," which include only those particles with an aerodynamic diameter smaller than or equal to 10 micrometers and 2.5 micrometers, respectively. The smaller particles are more responsible for adverse health effects because they reach further into the respiratory tract.

***Permeability* —** In geology, the ability of rock or soil to transmit a fluid.

Permutation — Changing the order of elements arranged in a particular order.

Person-Rem — The unit of collective radiation dose to a given population; the sum of the individual doses received by a population segment.

Plume — A flowing, often somewhat conical, trail of emissions from a continuous point source.

Plume Immersion — With regard to radiation, the situation in which an individual is enveloped by a cloud of radiation gaseous effluent and receives an external radiation dose.

Plutonium — A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially in a reactor by bombardment of uranium with neutrons and is used in the production of nuclear weapons.

Pounds per Square Inch — A measure of pressure; atmospheric pressure is about 14.7 pounds per square inch.

Pressurized Water Reactor — A light water reactor in which heat is transferred from the core to an exchanger by water kept under pressure in the primary system. Steam is generated in a secondary circuit. Many reactors producing electric power are pressurized water reactors.

Prevention of Significant Deterioration — An Environmental Protection Agency program, mandated by the Clean Air Act, in which state or Federal permits are required that are intended to limit increases in air pollutant concentrations by restricting emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

Primary System — With regard to nuclear reactors, the system that circulates a coolant (e.g., water) through the reactor core to remove the heat of reaction.

Prime Farmland — Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oil-seed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (Farmland Protection Act of 1981, 7 CFR 7, paragraph 658).

Probabilistic Risk Assessment — A comprehensive, logical, and structured methodology to identify and quantitatively evaluate significant accident sequences and their consequences.

Probable Maximum Flood — Flood levels predicted for a scenario having hydrological conditions that maximize the flow of surface waters.

Programmatic Environmental Impact Statement — A legal document prepared in accordance with the requirements of 102(2)(C) of the National Environmental Policy Act which evaluates the environmental impacts of proposed Federal actions that involve multiple decisions potentially affecting the environment at one or more sites.

Proliferation (Nuclear) — The spread of nuclear weapons and the materials and technologies used to produce them.

Qualitative Environmental Impacts — 10 CFR 51, Appendix B defines the qualitative terms "small," "moderate," and "large" as follows:

Small	Environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing

radiological impacts, the U.S. Nuclear Regulatory Commission (NRC) has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.

Moderate Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

Large Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

***Quality Factor* —** The principal modifying factor that is employed to derive dose equivalent from absorbed dose.

***Rad* —** See "radiation absorbed dose."

***Radiation* —** The emitted particles or photons from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.

***Radiation Absorbed Dose (rad)* —** The basic unit of absorbed dose equal to the absorption of 0.01 Joule per kilogram of absorbing material.

***Radioactive Waste* —** Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

***Radioactivity* —** The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

***Radioisotopes* —** Radioactive nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons.

***Radionuclide* —** A radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring.

***Radon* —** Gaseous, radioactive element with the atomic number 86 resulting from the radioactive decay or radium. Radon occurs naturally in the environment, and can collect in unventilated enclosed areas, such as basements. Large concentrations of radon can cause lung cancer in humans.

***RADTRAN* —** A computer code that combines user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.

***Reactor Accident* —** See "design-basis accident; severe accident."

***Reactor Coolant System* —** The system used to transfer energy from the reactor core either directly or indirectly to the heat rejection system.

***Reactor Core* —** In a heavy water reactor: the fuel assemblies including the fuel and target rods, control assemblies, blanket assemblies, safety rods, and coolant/moderator. In a light water reactor: the fuel assemblies including the fuel and target rods, control rods, and coolant/moderator. In a modular high-temperature gas-cooled reactor: the graphite elements including the fuel and target elements, control rods, and other reactor shutdown mechanisms, and the graphite reflectors.

***Reactor Facility* —** Unless it is modified by words such as containment, vessel, or core, the term reactor facility includes the housing, equipment, and associated areas devoted to the operation and maintenance of one or more reactor cores. Any apparatus that is designed or used to sustain nuclear chain reactions in a controlled manner, including critical and pulsed assemblies and research, tests, and power reactors, is defined as a reactor. All assemblies designed to perform subcritical experiments that could potentially reach criticality are also to be considered reactors.

***Record of Decision* —** A document prepared in accordance with the requirements of the Council on Environmental Quality and National Environmental Policy Act regulations 40 CFR 1505.2, that provides a concise public record of the decision on a proposed Federal action for which an environmental impact statement was prepared. A Record of Decision identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.

***Recycling* —** With regard to tritium in nuclear weapons, the recovery, purification, and reuse of tritium contained in tritium reservoirs within the nuclear weapons stockpile.

***Refueling Outage* —** The period of time that a reactor is shut down for refueling operations. A refueling outage usually lasts four to eight weeks.

***Regional Economic Area* —** A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. Each regional economic area is defined by the U.S. Bureau of Economic Analysis.

***Region of Influence* —** A site-specific geographic area that includes the counties where approximately 90 percent of the current U.S. Department of Energy and/or contractor employees reside.

***Rem* —** See "roentgen equivalent man."

***Remediation* —** The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

***Resource Conservation and Recovery Act, as amended* —** The Act that provides a "cradle-to-grave" regulatory program for hazardous waste which established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

***Riparian* —** Of, on, or relating to the banks of a natural course of water.

***Risk* —** A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

***Risk Assessment (chemical or radiological)* —** The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

***Roentgen* —** A unit of exposure to ionizing X or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.

Roentgen Equivalent Man (rem) — A measure of radiation dose (i.e., the average background radiation dose is 0.3 rem per year). The unit of biological dose equal to the product of the absorbed dose in rads; a quality factor, which accounts for the variation in biological effectiveness of different types of radiation; and other modifying factors.

Runoff — The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

Safe Drinking Water Act — This Act protects the quality of public water supplies, water supply and distribution systems, and all sources of drinking water.

Safety — With regard to nuclear weapons, minimizing the possibility that a nuclear weapon will be exposed to accidents and preventing the possibility of nuclear yield or plutonium dispersal should there be an accident involving a nuclear weapon.

Safety Analysis Report — A safety document that provides a complete description and safety analysis of a reactor design, normal and emergency operations, hypothetical accidents and their predicted consequences, and the means proposed to prevent such accidents or mitigate their consequences.

Safety Evaluation Report — A document prepared by the U.S. Nuclear Regulatory Commission that evaluates documentation (i.e., technical specifications, safety analysis reports, and special safety reviews and studies) submitted by a reactor licensee for its approval. This ensures that all of the safety aspects of part or all of the activities conducted at a reactor are formally and thoroughly analyzed, evaluated, and recorded.

Sanitary waste — Wastes generated by normal housekeeping activities, liquid or solid (including sludge), which are not hazardous or radioactive.

Scope — In a document prepared pursuant to the National Environmental Policy Act of 1969, the range of actions, alternatives, and impacts to be considered.

Scoping — The solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an environmental impact statement.

Secondary System — The system that circulates a coolant (water) through a heat exchanger to remove heat from the primary system.

Security — With regard to nuclear weapons, minimizing the likelihood of unauthorized access to or loss of custody of a nuclear weapon or weapon system, and ensuring that the weapon can be recovered should unauthorized access or loss of custody occur.

Seismic — Pertaining to any Earth vibration, especially an earthquake.

Seismic Zone — An area defined by the Uniform Building Code (1991), designating the amount of damage to be expected as the result of earthquakes. The United States is divided into six zones: (1) Zone 0: no damage; (2) Zone 1: minor damage, corresponds to intensities V and VI of the modified Mercalli intensity scale; (3) Zone 2A: moderate damage, corresponds to intensity VII of the modified Mercalli intensity scale (eastern U.S.); (4) Zone 2B: slightly more damage than 2A (western U.S.); (5) Zone 3: major damage, corresponds to intensity VII and higher of the modified Mercalli intensity scale; (6) Zone 4: areas within Zone 3 determined by proximity to certain major fault systems.

Severe Accident — An accident with a frequency rate of less than 10^{-6} per year that would have more severe consequences than a design-basis accident, in terms of damage to the facility, offsite consequences, or both. Also called "beyond design-basis reactor accidents" for this environmental impact statement.

Sewage — The total of organic waste and wastewater generated by an industrial establishment or a community.

Shielding — With regard to radiation, any material of obstruction (bulkheads, walls, or other construction) that absorbs radiation in order to protect personnel or equipment.

Short-Lived Activation Products — An element formed from neutron interaction that has a relatively short half-life and which is not produced from the fission reaction (e.g., a cobalt isotope formed from impurities in the metal of the reactor piping).

Short-Lived Nuclides — Radioactive isotopes with half-lives no greater than about 30 years (e.g., cesium-137 and strontium-90).

Shrink-Swell Potential — Refers to the potential for soils to contract while drying and expand after wetting.

Shutdown — For a U.S. Department of Energy (DOE) reactor, that condition in which the reactor has ceased operation and DOE has declared officially that it does not intend to operate it further (see DOE Order 5480.6, *Safety of Department of Energy-Owned Nuclear Reactors*).

Silt — A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Source Term — The estimated quantities of radionuclides or chemical pollutants released to the environment.

Special Nuclear Materials — As defined in Section 11 of the Atomic Energy Act of 1954, special nuclear material means: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material; or (2) any material artificially enriched by any of the above. Tritium is NOT a special nuclear material.

Standardization (Epidemiology) — Techniques used to control the effects of differences (e.g., age) between populations when comparing disease experience. The two main methods are:

(1) Direct method, in which specific diseases rated in the study population are averaged, using as weights the distribution of the comparison population.

(2) Indirect method, in which the specific disease rates in the comparison population are averaged, using as weights the distribution of the study population.

START I and II — Terms which refer to negotiations between the United States and Russia (the former Soviet Union during START I negotiations) aimed at limiting and reducing strategic nuclear weapons. START I discussions began in 1982 and eventually led to a ratified treaty in 1988. The START II protocol, which has not been fully ratified, will attempt to further reduce the acceptable levels of nuclear weapons ratified in START I.

Sulfur Oxides — Common air pollutants, primarily sulfur dioxide (SO_2), a heavy, pungent, colorless gas formed in the combustion of fossil fuels, which is considered a major air pollutant, and sulfur trioxide. SO_2 is involved in the formation of acid rain. It can also irritate the upper respiratory tract and cause lung damage.

Surface Water — Water on the Earth's surface, as distinguished from water in the ground (groundwater).

***Technical Specifications* —** With regard to U.S. Nuclear Regulatory Commission (NRC) regulations, part of an NRC license authorizing the operation of a nuclear reactor facility. A technical specification establishes requirements for items such as safety limits, limiting safety system settings, limiting control settings, limiting conditions for operation, surveillance requirements, design features, and administrative controls.

***Threatened Species* —** Any species designated under the Endangered Species Act as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

***Threshold Limit Values* —** The recommended highest concentrations of contaminants to which workers may be exposed according to the American Conference of Governmental Industrial Hygienists.

***Toxic Substances Control Act of 1976* —** This Act authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

***Transients* —** Events that could cause a change or disruption of plant thermal, hydraulic, or neutronic behavior.

***Tritium* —** A radioactive isotope of the element hydrogen with two neutrons and one proton. Common symbols for the isotope are “H-3" and “T.” Tritium has a half-life of 12.3 years.

***Tritium Extraction Facility* —** A facility used for the extraction of tritium from the TPBARs. This facility is planned for construction at the Savannah River Site in Aiken, South Carolina.

***Tritium-Producing Burnable Absorber Rods (TPBARs)* —** Rods that replace the normally used burnable absorber rods in a reactor for the purpose of producing tritium. TPBARs contain lithium-6.

***Turbine* —** A machine for directly converting the kinetic energy and/or thermal energy of a flowing fluid (air, hot gas, steam, or water) into useful rotational energy.

***Unusual Occurrence* —** Any unusual or unplanned event that adversely affects or potentially affects the performance, reliability, or safety of a facility.

***Uranium* —** A heavy, silvery-white metallic element (atomic number 92) with several radioactive isotopes that is used as fuel in nuclear reactors.

***Viewshed* —** The extent of an area that may be viewed from a particular location. Viewsheds are generally bounded by topographic features such as hills or mountains.

***Visual Resource Management Class* —** A class defines the different degrees of modification allowed to the basic elements of landscape. They are: Class 1 - applied to wilderness areas, wild and scenic rivers, and other similar situations; Class 2 - contrasts are seen, but do not attract attention; Class 3 - contrasts caused by a cultural activity are evident, but remain subordinate to the existing landscape; Class 4 - contrasts that attract attention and are dominant features of the landscape in terms of scale, but repeat the contrast of the characteristic landscape; Class 5 - applied to areas where unacceptable cultural modification has lowered scenic quality (where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to one of the four other classifications).

Volatile Organic Compounds — A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol. With regard to air pollution, any organic compound that participates in atmospheric photochemical reaction, except for those designated by the Environmental Protection Agency administrator as having negligible photochemical reactivity.

Warhead — Collective term for the package of nuclear assembly and nonnuclear components that can be mated with a delivery vehicle or carrier to produce a deliverable nuclear weapon.

Waste Minimization and Pollution Prevention — An action that economically avoids or reduces the generation of waste and pollution by source reduction, reducing the toxicity of hazardous waste and pollution, improving energy use, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

Weighting Factor — With regard to radiation, the fraction of the total health risk resulting from uniform whole-body irradiation that could be contributed to that particular tissue.

Whole-Body Dose — With regard to radiation, the dose resulting from the uniform exposure of all organs and tissues in a human body. (Also see "effective dose equivalent.")

Wind Rose — A depiction of wind speed and direction frequency for a given period of time.

Woodland — Artifacts from the North American archaeological period dating from 1000 BC to 500 AD.

X/Q (Chi/Q) — The relative calculated air concentration due to a specific air release and atmospheric dispersion; units are (seconds per cubic meter). For example (Curies per cubic meter)/(Curies per second)= (seconds per cubic meter) or (grams per cubic meter)/(grams per second) = (seconds per cubic meter).

Zebra Mussel — An imported mussel which interferes with, among other things, water intake structures.

Zircaloy-4 — An alloy of zirconium metal used as getter material in tritium-producing burnable absorber rods.

11. INDEX

APPENDIX A
TRITIUM PRODUCTION OPERATIONS—APPLICATION TO PRODUCTION OF TRITIUM IN COMMERCIAL LIGHT WATER REACTORS

This appendix addresses the operation of a nuclear power plant in relation to its use as a tritium production facility. The first section provides a brief description of the nuclear processes necessary to operate a fission reactor as a nuclear power plant. The next section addresses aspects of the reactor design for commercial light water reactors (CLWRs). The boiling water reactor and the pressurized water reactor are discussed. [Much of the information in this section describes Westinghouse reactors and fuel. Differences between Westinghouse and other operating reactor designs exist, but are not described in detail in this appendix.] Descriptions of the refueling operations at a nuclear facility and some environmentally relevant systems are included in this appendix. Also, a description of the nucleonics of tritium production and the structure of tritium-producing burnable absorber rods (TPBARs) is presented. Finally, the impacts of tritium production on the CLWR fuel cycle are addressed.

A.1 NUCLEAR FISSION REACTORS

Most commercial electric power generation plants produce electricity by converting heat into electricity. Typically, these plants heat water to generate steam, and the steam is used to drive a turbine generator. In the turbine generator, the energy in the steam is first converted into mechanical energy (spinning a turbine shaft), which creates electricity by driving a generator. Fossil plants generate heat through a chemical process—the burning of fuels such as natural gas or coal. When fossil fuels are burned, energy is released when the carbon in the fossil fuel combines with oxygen and burns. Commercial nuclear power plants generate heat through the nuclear fission process. The nuclear fission process occurs at a subatomic level and involves the interaction of some component part of the atoms. The following section describes the fission process and the methods used to control this process in a nuclear reactor.

A.1.1 Nuclear Fission

Nuclear fission is a nuclear reaction caused by the interaction between a free neutron and the nucleus of some atoms such as uranium or plutonium. An atom consists of a relatively heavy, positively charged nucleus with a number of much lighter, negatively charged particles in various orbits around the nucleus. The nucleus is the central part of the atom and consists of subparticles called nucleons. There are principally two types of nucleons: neutrons, which are electrically neutral, and protons, which are positively charged. The number of protons in the nucleus is called the atomic number of that atom; all atoms of the same element have the same number of protons. The total number of nucleons in the nucleus is called the mass number, designated as A. Using X to represent the chemical symbol for the element and Z to represent the atomic number, each element is presented as X^A, $_ZX^A$, or as "the chemical name" - A. When atoms of an element differ in their number of nucleons, they are called isotopes of that element. For example, there are three isotopes of hydrogen: hydrogen with a single proton, deuterium with a single proton and a single neutron, and tritium with one proton and two neutrons. Tritium can be expressed as H^3, $_1H^3$, or hydrogen 3. Uranium has an atomic number of 92; that is, each atom has 92 protons. The more common isotopes of uranium have either 143 or 146 neutrons. These two isotopes are designated as uranium-238, $_{92}U^{238}$, or U^{238} (approximately 99 percent of all naturally occurring uranium), and uranium-235, $_{92}U^{235}$, or U^{235} (approximately 0.7 percent of naturally occurring uranium). These are two of the three naturally occurring isotopes of uranium. In all, there are 18 known isotopes of uranium. Different isotopes of the same element behave identically chemically, but can have significantly different nuclear characteristics.

Fission, as it occurs in a nuclear power plant, is the process by which the atoms of one element (such as uranium or plutonium) are converted into atoms of lighter elements through the capture of a neutron and the subsequent "splitting" of the atom's nucleus (**Figure A–1**). This results in the release of energy fission products (atoms of the lighter elements), and neutrons. Not all isotopes of an element are capable of fission. For uranium, only 4 of the 18 known isotopes are capable of fission. Of these four, the two most important isotopes are uranium-235 and uranium-233.

Fission produces energy in the form of radiation and the kinetic energy of neutrons and fission products. Most of the energy released in the fission process is produced as the kinetic energy of the fission products. Lesser amounts are released as the kinetic energy of the neutrons and the energy produced from the radioactive decay of the fission products generated in the fission process. It is these forms of energy that are used to heat water in the core of a nuclear reactor.

Fission of an atom is initiated with a single neutron, but can result in the creation of many free neutrons (neutrons released from the nucleus). These neutrons can potentially initiate additional fission reactions. When exactly one neutron generated in a fission reaction initiates another fission reaction, the process is said to be a critical chain reaction. Criticality is an important characteristic of the nuclear power reaction. When a reactor is maintained in a critical state, the fission reaction proceeds at a constant rate. Since each fission reaction releases approximately the same amount of power, this condition will result in the reactor constantly operating at a steady power level. Therefore, it is important to control the number of neutrons available for fission. A critical chain reaction is represented in **Figure A–2**. If a series of fission reactions produce, on average, more than one neutron per fission that results in additional fissions, the process is said to be supercritical. In this state, the power level of the reactor increases. If, on the other hand, a series of fission reactions produce, on average, less than one neutron per fission that results in additional fissions, the process is said to be subcritical. In this condition, the power level of the reactor drops until eventually the fission process stops.

A.1.2 Control of Nuclear Reactions in a Reactor

Fission is not the only reaction that can take place when a neutron interacts with the nucleus of an atom. One of three interactions is possible: (1) the neutron is scattered—i.e., it essentially bounces off the nucleus (an elastic collision); (2) the neutron is absorbed—the neutron and atom combine to make the next higher isotope of the element; or (3) the neutron is absorbed and initiates a fission reaction. These different reactions are all important in the operation of a nuclear reactor. The first reaction—scattering—results in a change in the energy of the free neutrons. The second reaction—absorption—results in the loss of neutrons from the reactor. Neutrons that are absorbed are not available to initiate fission reactions. As discussed in the preceding paragraphs, the third reaction, fission, is the process by which energy is produced in a nuclear reactor and additional neutrons are produced to sustain the chain reaction. The likelihood of each of these interactions depends primarily on the following two factors: the energy of the free neutrons and the isotope of the atom being struck by the neutron.

In U.S. commercial nuclear reactors, only uranium-235 is used as the nuclear fuel. Uranium-235 is found naturally in uranium ore, although natural uranium consists predominantly of uranium-238. Enriched uranium is used in U.S. commercial nuclear power plants. This is uranium in which the percentage of uranium-235 has been increased from the less than 1 percent found in natural uranium to 3 to 5 percent. With approximately 100 metric tons of enriched uranium (3 to 5 metric tons of uranium-235) in the reactor core, a nuclear power plant can operate for approximately 18 months without refueling. When the uranium fuel is removed from the reactor, much of the uranium-235 has been consumed, and the spent fuel contains approximately 1 percent uranium-235.

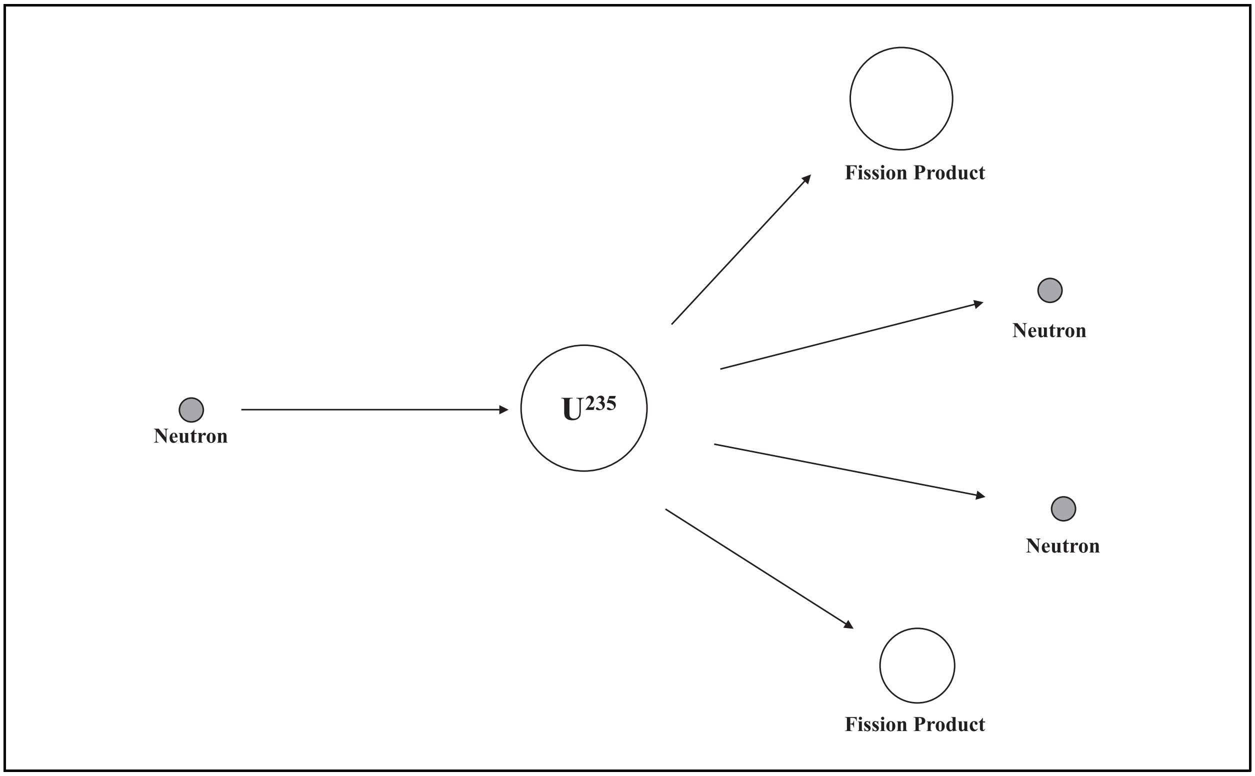

Figure A–1 Fission of Uranium-235 Atom

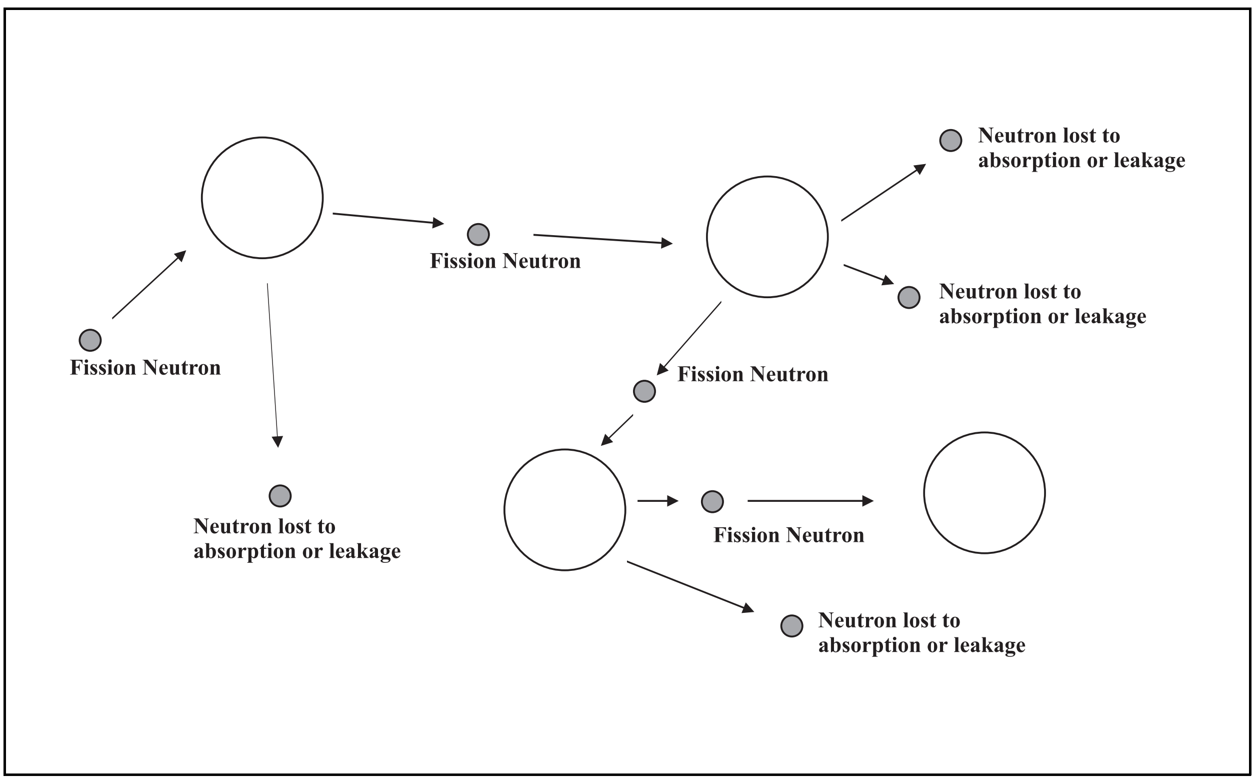

Figure A–2 Critical Chain Reaction

The fission reaction of a uranium-235 atom produces approximately 2.5 neutrons. Neutrons produced in fission are called fast neutrons. This refers to the amount of kinetic energy associated with the neutrons. However, the fission process using uranium-235 works better with slower-moving neutrons; that is, neutrons with significantly less energy than the neutrons produced from the fission process. These neutrons are called thermal neutrons. Neutrons are slowed via collisions with nuclei of atoms in the reactor core. In the collisions, energy is transferred from the neutron to the atom it collides with. Generally, the closer in weight the neutron and atom are, the more energy is transferred to the atom. This transfer of energy from the neutron to other materials results in the slowing down of the neutron and is called moderation. The moderator in U.S. commercial nuclear power plants, both pressurized and boiling water reactors, is ordinary light water. [Because the moderator used in U.S. commercial power reactors is light water and the fission reaction of uranium-235 requires slower-moving (thermal) neutrons, these types of reactors are referred to as thermal light water reactors.] The hydrogen in light water (with a nucleus containing a single proton) is nearly the same mass as the neutron. Collisions between neutrons and the hydrogen atoms result in a relatively rapid reduction in the energy of the neutrons. After many such collisions, the neutrons travel slow enough to be considered thermal neutrons.

Neutrons that are not lost from the reactor core between the time they are created as fast neutrons and the time they are moderated to thermal energy levels are available for fission. Neutrons are lost from the reactor core in several ways. Some are lost to leakage; that is, they escape from the reactor core and are captured in the reactor vessel or shielding. Some are absorbed by material in the core without producing fission. [Other materials in the core, including uranium-238 and core internal structures, contribute to the absorption of neutrons. Some neutrons that collide with uranium-235 atoms are absorbed without resulting in fission.] Specific materials, referred to as neutron poisons or simply poisons, are inserted in the reactor core to intentionally capture neutrons and provide control over the fission rate by controlling the number of neutrons available for fission. Such poisons, which are contained in control and shutdown rods, are necessary for several reasons. These devices control the rate of fission, thereby controlling the reactor power level. In addition, these devices promptly terminate the fission when the rods are fully inserted into the reactor core, thereby shutting down the reactor. The material used in control and shutdown rods is usually boron; a strong neutron absorber. In a collision between boron and a neutron, there is a high likelihood that the neutron will be absorbed into the boron, thus generating a different boron isotope. Therefore, the position of the control rods determines the power level of the reactor by controlling the number of neutrons available for fission.

Other poisons, called burnable poisons (because during the time the fuel is in the reactor the burnable poisons are used up and gradually become less effective as neutron absorbers), are placed in a reactor core in addition to the poisons that are contained in the control and shutdown rods. These burnable poisons are necessary for a reactor to operate over an extended period without loading fresh fuel into the reactor. Commercial reactors typically load fresh fuel once every one to two years. As the power plant operates during this period, uranium-235 is burned up (consumed in the fission process or by neutron absorption). Since the source of the neutrons is devoured during the generation of power, it is necessary to start the fuel cycle with more uranium-235 than is necessary to sustain a critical reaction at the desired power level. Extra uranium-235 is loaded into the reactor core, necessitating the use of burnable poisons to keep the power at the appropriate level. The reactor's power levels are controlled by using either fixed burnable poisons (burnable poison rods) in areas that would have higher than average free neutron flux, or by adding boron (in the form of boric acid) to the coolant in a pressurized water reactor. As the fuel burns it becomes less reactive because less fissionable uranium is available. Since there are fewer uranium-235 atoms per unit volume, fewer neutrons are produced. With fewer neutrons produced, the percentage of neutrons lost to leakage and absorption must be reduced to maintain the number of neutrons available for fission. Control of neutron loss due to absorption is accomplished by reducing the concentration of boron in the coolant and reducing the burnable poison in the burnable absorber rods placed in the core.

A.2 COMMERCIAL NUCLEAR POWER PLANT DESCRIPTIONS

A.2.1 Commercial Nuclear Reactors

In the United States, there are two types of commercial nuclear power plants currently in operation; the boiling water reactor and the pressurized water reactor.

The boiling water reactor is a single-loop system. The fission energy in the core causes the water to boil in the reactor vessel. In the reactor vessel, above the fuel, the steam passes through steam separators and steam dryers, which are used to ensure dry steam exits the reactor vessel, and travels through steam pipes to the turbine generator. The steam drives the turbine, which in turn powers the generator to create electricity. As steam passes through the turbine, it loses most of its energy but remains as steam as it passes to the main condenser. In the main condenser, where additional heat is removed by a cooling water system, the steam condenses into water. This water is pumped back to the reactor vessel where it is forced through the reactor core and is again converted to steam. **Figure A–3** provides a simplified representation of a boiling water reactor. Boiling water reactors typically operate at pressures of approximately 70 kilograms per square meter (1,000 pounds per square inch), and the temperature of the water and steam in the reactor vessel approaches 288°C (550°F).

A pressurized water reactor uses a primary and secondary system to transfer heat from the reactor core to the turbine generator (see **Figure A–4** for a simplified representation of a pressurized water reactor). In the primary loop (the reactor coolant system), water is forced up through the core, where it is heated but does not boil. After the water exits the reactor vessel, it passes through steam generators. The number of steam generators used in the power plant depends on the design and power level. Combustion Engineering and Babcock & Wilcox designs have two steam generators. Westinghouse designs can have from two to four steam generators. The more recent (larger power plants) have four steam generators (**Figure A–5** is an isometric of a Representative Reactor Four-Loop Primary System). Each steam generator is connected to the reactor vessel in a separate, independent coolant loop. In the steam generators, the primary coolant heats water in the secondary loop and converts the water to steam. After the primary coolant leaves the steam generator, it is pumped back to the reactor vessel where it is again heated in the reactor core. The primary system has a pressurizer, which is used to control the pressure of the primary system. The pressurizer is connected to one of the primary loops and is located above the reactor core. It contains heaters and sprays that are used to control the water level in the pressurizer which, in turn, controls the pressure of the primary coolant system. The steam in the secondary loop (referred to as the steam and power conversion system) is used to drive the turbine generator and produce electricity. As in the boiling water reactor, after the steam passes through the turbine, it is condensed by cooling water in the main condenser. This cooled water is then pumped back to the secondary side of the steam generator. A pressurized water reactor primary system operates at pressures of about 158 kilograms per square meter (2,250 pounds per square inch) and temperatures of up to approximately 315°C (600°F), with the secondary loop operating at approximately 70 kilograms per square meter (1,000 pounds per square inch) and 288°C (550°F).

In addition to the difference in the number of cooling loops associated with a boiling water reactor and a pressurized water reactor, there are some differences in the design of the reactor cores. In a pressurized water reactor, the control and shutdown rods enter the reactor core from above. In a boiling water reactor, these rods are driven into the core (via a control rod-driven system) from the bottom of the core. Also, pressurized water reactors use soluble neutron poison (a boric acid solution) in the primary coolant to help control reactivity. The concentration of the soluble neutron poison is controlled by the chemical and volume control system. Typically, the concentration of boric acid is highest at the beginning of a fuel cycle, when there is fresh fuel in the core. A boiling water reactor does not use this means of reactivity control.

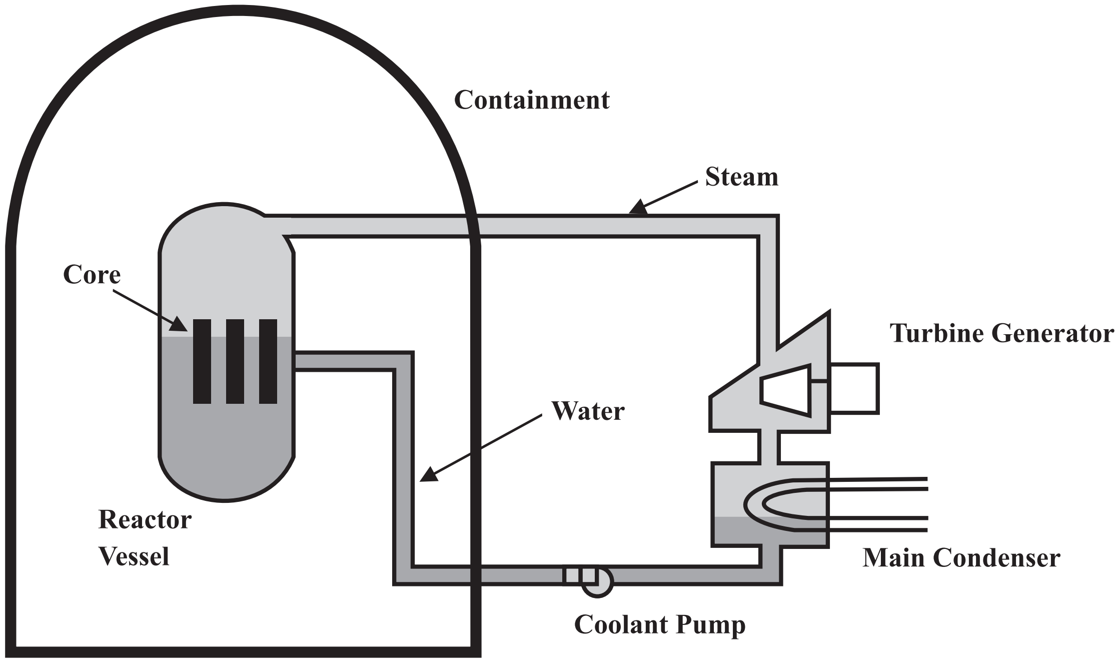

Figure A–3 Boiling Water Reactor Schematic

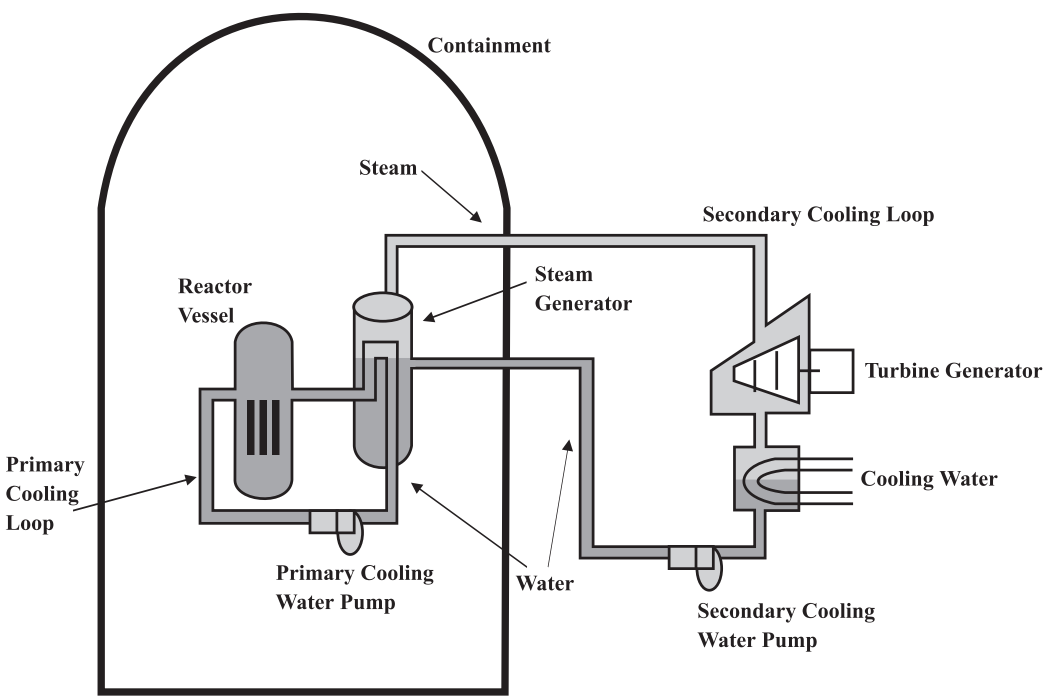

Figure A–4 Pressurized Water Reactor Schematic

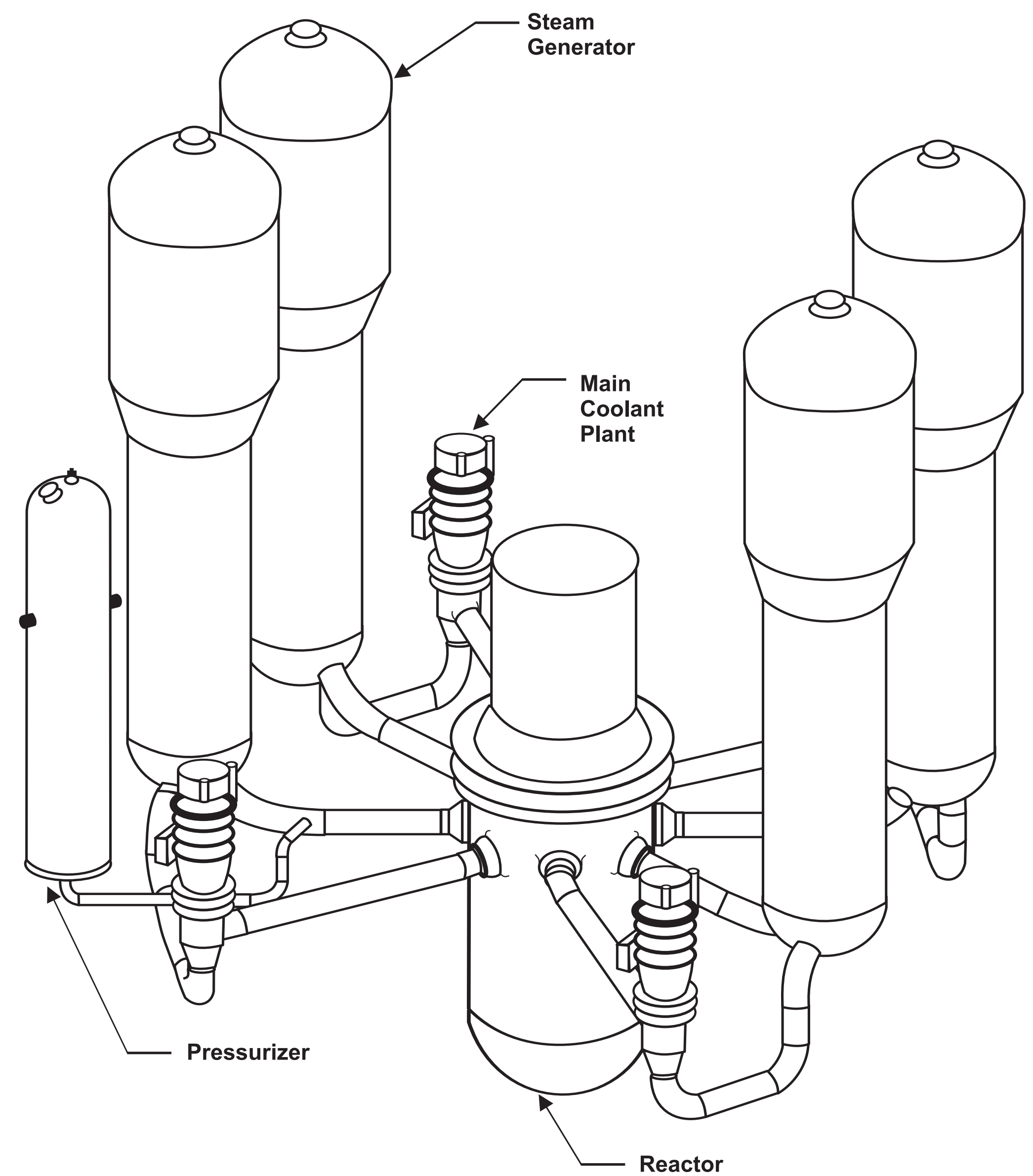

Figure A–5 Representative Four-Loop Reactor Coolant System

A.2.2 Reactor Core Description

Fuel in a nuclear reactor is slightly enriched (up to 5 percent) uranium dioxide and is sealed in fuel rods. These rods are approximately 3.6 to 3.9 meters (12 to 13 feet) long and slightly less than half an inch in diameter. Uranium, in the form of approximately half-inch long cylindrical uranium dioxide pellets, is placed in a fuel rod and enclosed in a zircaloy cladding. This cladding holds the pellets in position and provides a barrier against the release of fission products into the reactor coolant system.

In a pressurized water reactor, the fuel rods are collected in a fuel assembly that also contains several guide tubes and an instrumentation channel (illustrated in **Figure A–6**). The number of fuel rods in an assembly varies depending on the design of the reactor. Assemblies contain fuel rods arranged in 14 × 14, 15 × 15, or 17 × 17 arrays. The more recent reactors tend to use the 17 × 17 array. The guide tubes denote the location where the control rods of the control element assemblies are inserted into the reactor core. The fuel rods, guide tubes, and the instrumentation channel are held in place by a series of grids at several locations along the full length of the fuel assembly. In a reactor core, fuel assemblies are all structurally identical and have space reserved for control element assemblies. In the Westinghouse designs, between a third and a fourth of the fuel assemblies have an associated control element assembly. In a large pressurized water reactor, one with an electrical power rating of over 1,000 megawatts, the core will consist of approximately 200 fuel assemblies. Of these, 50 to 60 fuel assemblies (depending on the reactor design) have associated control element assemblies. The remaining fuel assemblies may have burnable poison rods in the locations used by control element assemblies, or these locations may be empty. The burnable poison rods are rods with the same shape as the control and shutdown rods. However, they are not connected to the control rod-driven mechanism and cannot be removed from the reactor without shutting it down and performing refueling activities that involve removing the fuel assembly containing the burnable poison rods from the reactor core. Loading of the burnable poison rods in these locations for the assemblies without control element assemblies is dictated by the need to balance the power distribution in the core.

The control element assembly consists of a collection of control rods and a spider assembly at the top of the rods. **Figure A–7** shows a control element assembly for a Representative Reactor 17 × 17 fuel assembly design. The spider assembly is connected to a control rod drive mechanism that can be used to move the control element assemblies. These assemblies serve two purposes—to limit the effects of reactivity changes during power operation and to shut down the reactor. The rods are made of a strong neutron absorber (typically a boron or cadmium compound). When not needed, the control element assemblies are pulled out of the core by their control rod drives. For reactivity control during operation, the control rod drive can be used to insert the rods into the core at a controlled pace. If needed, the rods can be rapidly inserted to shut down the reactor. It is possible for the control element assemblies to be inserted into the core using only the force of gravity as the driving force. When fully inserted, the poison in the control rods absorbs enough neutrons to make the nuclear reaction become subcritical, shutting down the reactor.

As mentioned earlier, one of the ways in which neutrons are lost from the core and become unavailable for fission is through leakage. The neutrons leak from the edges of the core, and those that do not hit an atom and reflect back into the core are lost. (Reactor core designs address this problem of neutron loss by incorporating a neutron reflector, a layer of water around the core.) Neutrons generated at the center of the core are less likely to be lost through leakage than those generated at the edge of the core. Therefore, in a reactor with no burnable poisons and a uniform fuel enrichment, the number of neutrons available for fission is greater at the center of the core. The center of the core, which is about 3 meters (10 feet) in diameter and 3.6 to 3.9 meters (12 to 13 feet) tall, has a higher power density than the areas at the top, bottom, and edge of the core.

Designers of the reactor core control the distribution of power within the reactor core by using burnable poisons and varied fuel rod enrichments. **Figure A–8** displays a possible arrangement of fuel assemblies within a reactor core. Other fuel loading patterns also exist, but the concept is fully expressed by a simple loading pattern described here. This figure shows fresh fuel (typically with the highest enrichment of uranium-235) loaded around the core periphery. Fuel in the center of the core is referred to as once- or twice-burned fuel and has been in the core for one or two fuel cycles. A fuel cycle is the period from one refueling outage to another. The older fuel in the reactor core has been producing power for one to two years and has burned up some of its uranium-235. This fuel is no longer as enriched as the fresh fuel. With less material available for fission in this fuel, the extra neutrons present in the center of the core will not result in overly high power levels. While controlling the enrichment level alone is not sufficient to properly shape the core power, burnable poison rods are included in the fuel assemblies.

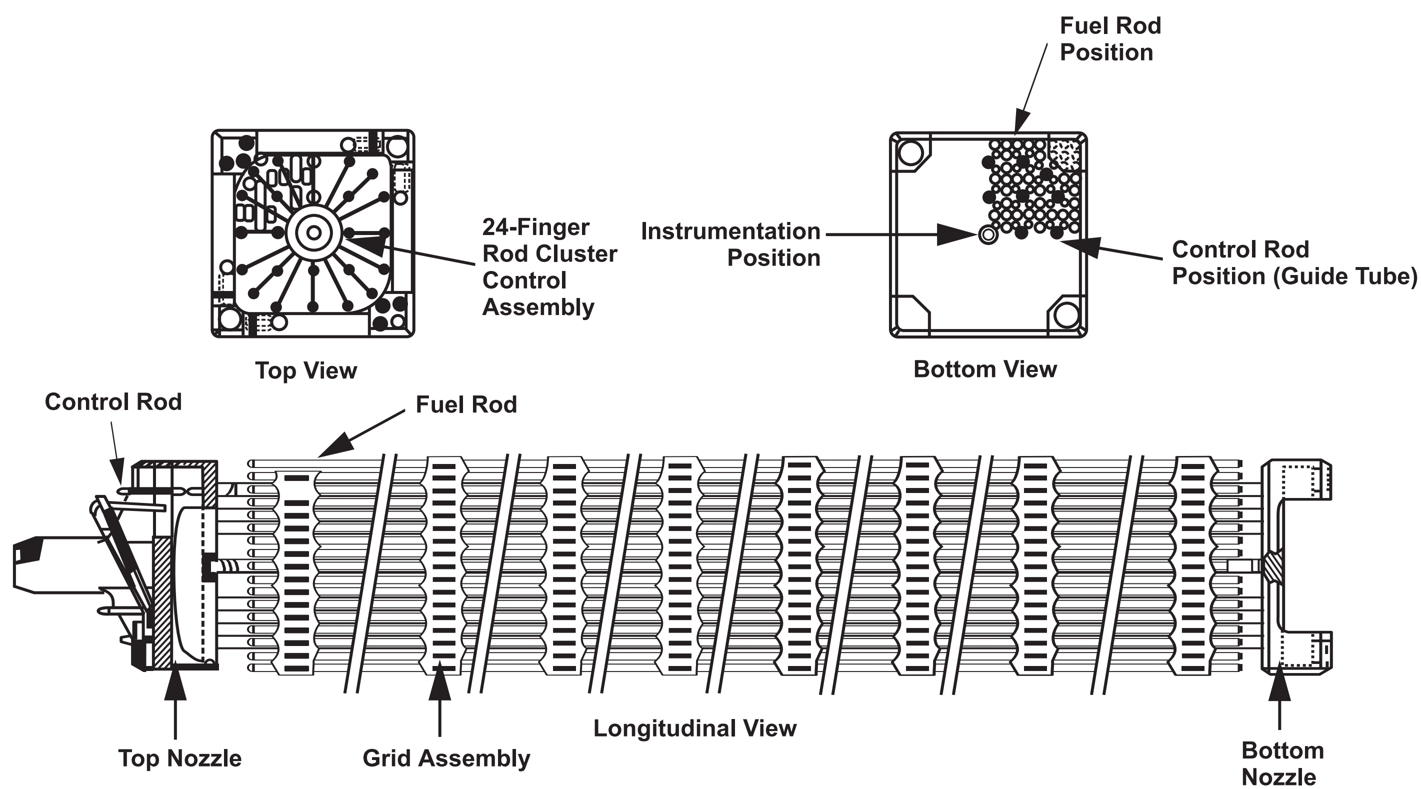

Figure A–6 Typical 17 × 17 Reactor Fuel Assembly

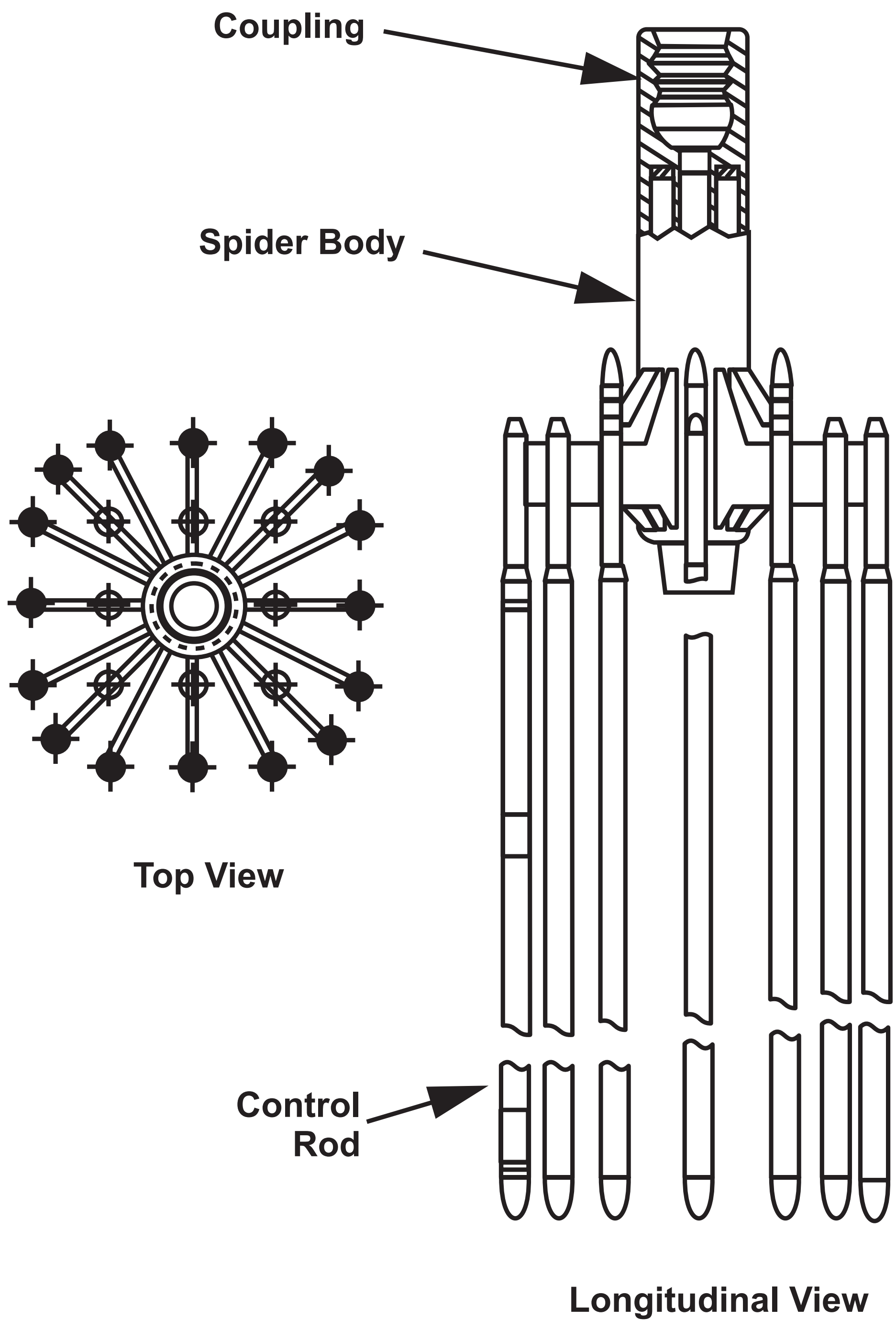

Figure A–7 Representative Reactor Control Element Assembly

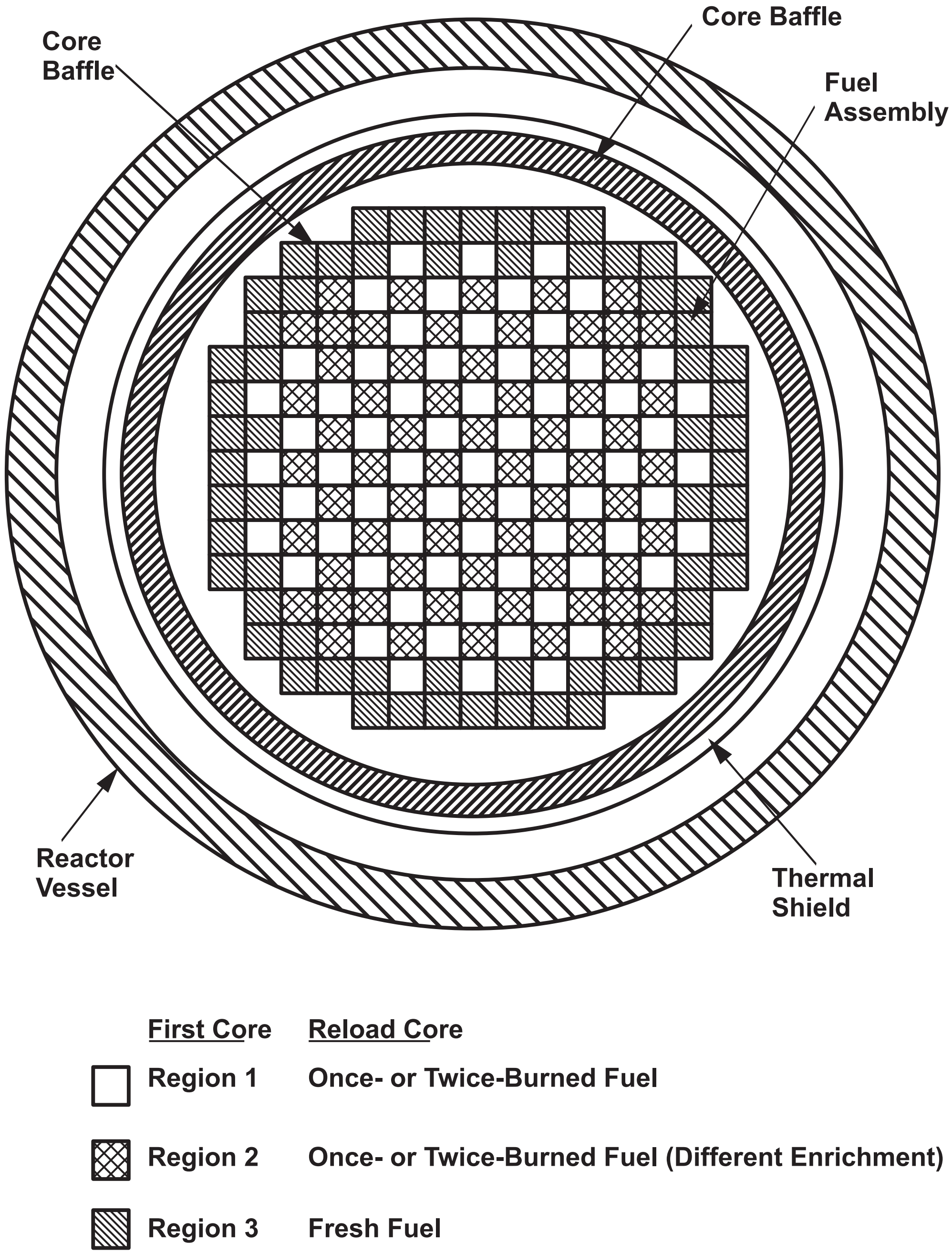

Figure A–8 General Arrangement of a Possible Reactor Core Fuel Loading Pattern

The burnable poison rods will be replaced with TPBARs in a tritium production facility (see Section A.3). The TPBARs act as neutron absorbers in much the same way as the burnable poison, although there are some differences that may result in changes to the fuel management practices at the facility using the TPBARs. The control and shutdown control element assemblies will remain unchanged in a reactor containing TPBARs and will still enable complete shutdown of the reactor at all times during the fuel cycle.

A.2.3 Reactor Refueling

Unlike fossil-fueled electricity-generating plants that are continually fed fuel, nuclear power plants operate over extended periods without the need for fresh fuel. Typically, reactors will operate for 12 to 18 months between refueling outages. As stated earlier, as the uranium-235 burns up, the reactor becomes increasingly less able to maintain a critical condition. Eventually, when enough fuel is burned, the reactor will not be able to remain critical even if all of the neutron poisons are removed from the core. Before this point is reached, the reactor is shut down and refueled. When the power plant is shut down during the refueling outage, some (between one-third and two-fifths) of the fuel assemblies are removed and replaced with fresh fuel, and some of the assemblies are shuffled to different locations within the reactor core. The removed fuel is called spent fuel. The refueling outage usually lasts less than two months, during which various maintenance activities are performed. The reactor refueling is a small fraction of the overall outage.

Spent fuel is stored on site in a spent fuel pool, located in a separate building attached to the containment structure. The spent fuel is stored on site for several years, allowing the assemblies to cool and the radioactivity levels to drop sufficiently so that the spent fuel can be safely transported to a temporary or permanent waste disposal site.

The refueling operation of a nuclear power plant can be divided into four separate phases: preparation, reactor disassembly, fuel handling, and reactor assembly.

Preparation

During preparation, the reactor is shut down; all control and shutdown rods are inserted into the reactor core, and the nuclear chain reaction is stopped. Heat is still generated in the reactor core, principally by the radioactive decay of the fission products. The amount of heat produced during decay gradually decreases, and the reactor is brought to a condition called cold shutdown, where the average reactor coolant temperature is below the boiling point of water at atmospheric pressure.

Reactor Disassembly

The area above the reactor vessel is referred to as the reactor cavity, illustrated in **Figure A–9**. Adjacent to this cavity is the refueling cavity. During reactor disassembly, these two cavities are flooded with borated water to provide a medium for the transfer of spent and new fuel. The water provides a means to remove heat from the spent fuel assemblies and a radiation shield for the plant workers. The reactor vessel is disassembled in stages. Most items connected to the reactor vessel head are removed. The refueling cavity is partially flooded and the reactor vessel head is unbolted and slightly raised. At this time, borated water is added to the reactor coolant system and allowed to flow out of the top of the reactor vessel, ultimately flooding the reactor cavity and the refueling cavity. The reactor vessel head is completely removed, along with the control rod-driven mechanism and the upper core internals. The fuel assemblies are then free of any obstructions and can be removed from the reactor core.

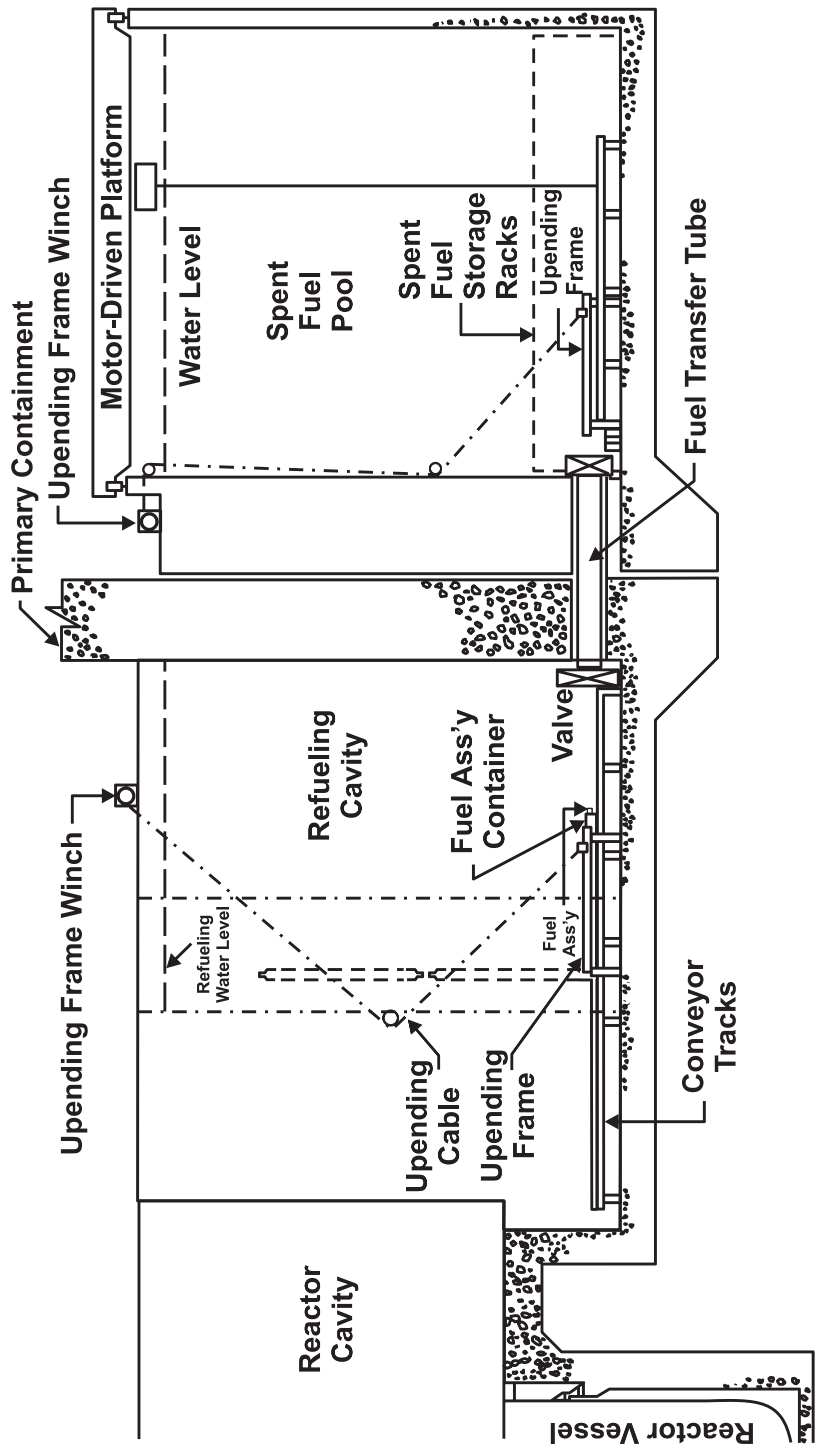

Figure A–9 Typical Fuel Transfer System

Fuel Handling

Fuel is removed from the core, one assembly at a time. Fuel assemblies are lifted out of the core using an overhead crane. If the spent fuel assembly contains a control element assembly, it is placed in a control element assembly changing device upon its removal from the core; otherwise it is moved to a fuel transfer system. In this device, the control element assembly is removed from the spent fuel assembly and transferred to another fuel assembly placed in the reactor core. Once the control element assembly is removed from the spent fuel assembly, it is transferred to the spent fuel pool.

The fuel transfer system lowers the fuel to a horizontal position and passes the fuel through a fuel transfer tube (which penetrates the containment structure) and into the spent fuel pool. Here, the fuel transfer system lifts the spent fuel assembly into a vertical position, and another crane places the spent fuel assembly into its location within the spent fuel racks in the pool. Spent fuel is stored in the spent fuel pool beneath over 20 feet of water. Storage under this amount of water provides two functions: the spent fuel pool has a cooling system to remove decay heat after it is transferred to the pool water, and the water provides a radiation protection barrier for the plant workers.

Fresh fuel is brought into the reactor core using the same equipment used to remove the spent fuel. New fuel handling equipment is used to unload, inspect, and prepare the fuel for insertion into the reactor. It is then transferred to the fuel transfer machine.

Reactor Assembly

After all of the spent fuel is removed from the reactor, some of the remaining fuel is moved to new locations in the core; fresh fuel is added to the reactor core, and the reactor is reassembled. This is essentially the reverse of the reactor disassembly phase. After some startup tests, the reactor is ready to begin power operations.

A.2.4 Commercial Light Water Reactor Systems Important to Environmental Impacts

The sections below describe the plant systems that are directly associated with environmental impacts from plant operation. These are the cooling water systems and radioactive and nonradioactive waste treatment systems.

A.2.4.1 Cooling and Auxiliary Water Systems

Water use at a nuclear power plant is predominantly for removing excess heat generated in the reactor by condenser cooling. The quantity of water used for condenser cooling is a function of several factors, including the capacity rating of the plant and the increase in cooled water temperature from the intake to the discharge. The larger the plant, the greater the quantity of waste heat and cooling water required to dissipate the waste heat.

In addition to removing heat from the reactor, cooling is also provided to the service and auxiliary cooling water systems. The volume of water required for once-through cooling is usually less than 15 percent of the volume required for condenser cooling. In closed-cycle cooling, the additional water needed is usually less than 5 percent of that needed for condenser cooling. Of all the CLWR plants operating in the United States, approximately 40 percent use closed-cycle cooling systems and 60 percent use once-through (open-cycle) cooling systems.

In closed-cycle systems, the cooled water is recirculated through the condenser after the waste heat is removed by dissipation to the atmosphere, usually by circulating the water through large cooling towers constructed for that purpose. Several types of closed-cycle cooling systems are currently used by the nuclear power industry.

Recirculating cooling systems consist of either natural-draft or mechanical-draft cooling towers, cooling ponds, cooling lakes, or cooling canals. Because the predominant cooling mechanism associated with closed-cycle systems is evaporation, most of the water used for cooling is consumed and not returned to a water source.

In a once-through cooling (open-cycle) system, circulating water for condenser cooling is drawn from an adjacent body of water, such as a lake or river, passed through the condenser tubes, and returned at a higher temperature to the adjacent body of water.

For both once-through and closed-cycle cooling systems, the water intake and discharge structures are of various configurations to accommodate the source water body and to minimize impact to the aquatic ecosystem. The intake structures are generally located along the shoreline of the body of water and are equipped with fish protection devices. The discharge structures are most often the jet or diffuser outfall type and are designed to promote rapid mixing of the effluent stream with the receiving body of water. Biocides and chemicals used for corrosion control and other water treatment purposes are mixed with the condenser cooling water and are discharged from the system.

In addition to surface water sources, some nuclear power plants use groundwater as a source for service water, makeup water, or potable water. Other plants operate dewatering systems to intentionally lower the groundwater table, either by pumping or by a system of drains, in the vicinity of building foundations.

A.2.4.2 Radioactive Waste Treatment Systems

During the fission process, a large inventory of radioactive fission products will build up within the fuel rods. A small fraction of these fission products escape the fuel rods and contaminate the reactor coolant. The primary system coolant also has radioactive contaminants as a result of neutron activation. These contaminants are removed from the coolant by a radioactive waste treatment system prior to any release to the environment. Typically, the plants include treatment systems for gaseous, liquid, and low-level radioactive solid waste.

The impacts to the environment are driven by gaseous emissions, liquid effluent, or generation of solid low-level radioactive waste after treatment.

Gaseous Radioactive Emissions

CLWRs have three primary sources of gaseous radioactive emissions:

- Discharges from the gaseous waste management system
- Discharges associated with the exhaust of noncondensable gases at the main condenser (in the event of leakage between primary and secondary cooling systems)
- Discharges from the building ventilation exhaust, including the reactor building, reactor auxiliary building, and fuel-handling building

The gaseous waste management system collects fission products, mainly noble gases, that accumulate in the primary coolant. A small portion of the primary coolant flow is continually diverted to the primary coolant purification, volume, and chemical control system to remove contaminants and adjust the coolant chemistry and volume. During this process, noncondensable gases are stripped and routed to the gaseous waste management system, which consists of a series of gas storage tanks. The storage tanks allow the short half-life radioactive gases to decay, leaving only relatively small quantities of long half-life radionuclides to be released to the atmosphere via the plant vent at a controlled rate. These releases pass through both high-efficiency particulate air and charcoal filters before entering the environment.

Discharges from the condenser vacuum exhaust and building ventilation exhaust are released to the environment with no filtration. All potentially significant release points are monitored.

Liquid Radioactive Effluents

Radionuclide contaminants in the primary coolant are the source of liquid radioactive waste in CLWRs. Liquid wastes resulting from CLWR plant operation are classified into the following categories: clean wastes, dirty wastes, detergent wastes, turbine building floor drain water, and steam generator blowdown. Clean wastes include all liquid wastes with a normally low conductivity and variable radioactivity content. They consist of reactor-grade water, which is amenable to processing for reuse as reactor coolant makeup water. Clean wastes are collected from equipment leaks and drains, certain valve and pump seal leakoffs not collected in the reactor coolant drain tank, and other aerated leakage sources. In addition, these wastes include primary coolant. Dirty wastes include all liquid wastes with a moderate conductivity and variable radioactivity content that, after processing, may be used as reactor coolant makeup water. Dirty wastes consist of liquid wastes collected in the containment building sump, auxiliary building sumps and drains, laboratory drains, sample station drains, and other miscellaneous floor drains. Detergent wastes consist principally of laundry wastes and personnel and equipment decontamination wastes and normally have a low radioactivity content. Turbine building floor drain wastes usually have a high conductivity and low radionuclide content. Steam generator blowdown can have relatively high concentrations of radionuclides, depending on the amount of primary-to-secondary leakage. After processing, the water may be reused or discharged.

Each source of liquid waste receives varying degrees and types of treatment before storage for reuse or discharge to the environment under the site National Pollutant Discharge Elimination System permit. The extent and types of treatment depend on the chemical radionuclide content of the waste. To increase the efficiency of waste processing, wastes of similar characteristics are batched before treatment.

The degree of processing, storing, and recycling of liquid radioactive waste has steadily increased among operating plants. For example, extensive recycling of steam generator blowdown is now the typical mode of operation, and secondary side wastewater is routinely treated. In addition, the plant systems used to process wastes are often augmented with the use of commercial mobile processing systems. As a result, radionuclide releases in liquid effluent from CLWR plants have generally declined or remained the same.

Solid Waste

Solid low-level radioactive waste from commercial nuclear power plants is generated by removal of radionuclides from liquid waste streams, the filtration of airborne gaseous emissions, and the removal of contaminated material from various reactor areas. Liquid waste contaminated with radionuclides comes from primary and secondary coolant systems, spent fuel pools, decontaminated wastewater, and laboratory operations. Concentrated liquid, filter sludge, waste oil, and other liquid sources are segregated by type, flushed to storage tanks, stabilized for packaging in a solid form by dewatering, slurried into 55-gallon steel drums, and stored on site in shielded Butler-style buildings or other facilities until suitable for offsite disposal. These buildings usually contain volume reduction and solidification facilities to prepare low-level radioactive waste for disposal at a certified low-level radioactive waste disposal facility.

High-efficiency particulate air filters are used to remove radioactive material from gaseous plant effluents. These filters are compacted and are disposed of as solid waste.

Solid low-level radioactive waste consists of contaminated protective clothing, paper, rags, glassware, compactible and noncompactible trash, and irradiated and nonirradiated reactor components and equipment. Most of this waste comes from plant modifications and routine maintenance activities. Additional sources include tools and other materials exposed to the reactor environment. Before disposal, compactible trash is usually taken to onsite or offsite volume-reduction facilities. Compacted dry active waste is the largest single form of low-level radioactive waste disposed from commercial nuclear plants, comprising one-half of the total average annual volume from pressurized water reactors.

Volume reduction efforts have been undertaken in response to increased disposal costs and the passage of the Low-Level Radioactive Waste Policy Act of 1980 and the Low-Level Radioactive Waste Policy Amendments Act of 1985, both of which require low-level radioactive waste disposal allocation systems for nuclear plants. Volume reduction is performed both on and off site. The most common onsite volume-reduction techniques are ultra-high-pressure compaction of waste drums, monitoring waste streams to segregate wastes, minimizing the exposure of routine equipment to contamination, and decontaminating and sorting of radioactive or nonradioactive batches before offsite shipment. Offsite waste management vendors incinerate dry-activated waste; separate and incinerate oily, organic wastes; solidify the ash; and occasionally undertake supercompaction, waste crystallization, and asphalt solidification of resins and sludges.

A.2.4.3 Nonradioactive Waste Systems

Nonradioactive wastes from commercial nuclear power plants include steam generator blowdown, water treatment wastes (sludges and high saline streams that have residues that are disposed of as solid wastes and biocides), steam generator metal cleaning, floor and yard drains, and stormwater runoff. Principal chemical and biocide waste sources include the following:

- Hydrazine, which is used for corrosion control (it is released in steam generator blowdown)
- Sodium hydroxide and sulfuric acid, which are used to regenerate resins that capture wastes (these are discharged after neutralization)
- Phosphates in cleaning solutions
- Biocides used for condenser defouling

Other small volumes of wastewater are released from plant systems and depend on the design of each plant. These are discharged as the service water and auxiliary cooling systems, water treatment plant, laboratory and sampling wastes, floor drains, stormwater runoff, and metal treatment wastes. These waste streams are discharged as separate point sources or are combined with the cooling water discharges.

A.3 TRITIUM-PRODUCING BURNABLE ABSORBER RODS

A.3.1 Nucleonics of Tritium-Producing Burnable Absorber Rods

TPBARs serve two functions in a nuclear power reactor: (1) they absorb excess neutrons and help make the power distribution more even in the reactor core, and (2) they produce tritium. The neutron absorber material in a TPBAR is lithium, in the form of lithium aluminate, enriched in lithium-6 (Li^6). When lithium-6 absorbs a neutron, as would happen in the core of an operating power reactor, the neutrons and protons in the lithium would recombine into two parts: tritium (hydrogen-3 or H^3) and helium-4. This process would result in the release of 4.8 million electron volts (MeV) of energy. This process can be written:

$$\text{Lithium-6} + \text{neutron} \rightarrow \text{Helium-4} + \text{Hydrogen-3} + 4.8\ \text{MeV}$$

or

$$Li^6 + n^1 \rightarrow He^4 + H^3 + 4.8\ \text{MeV}$$

Once the tritium (H^3) is produced inside the TPBAR, it is captured and held in a getter, as described in Section A.3.2. However, the tritium, itself unstable, slowly decays by emitting a beta particle (an electron), and becomes helium-3:

$$\text{Hydrogen-3} \rightarrow \text{Helium-3-} + \text{electron}$$

or

$$H^3 \rightarrow He^3 + \text{electron}$$

Tritium's rate of decay, or "half-life," is 12.3 years, which means that every 12.3 years, half of the tritium will decay and become helium-3. Helium-3 is stable, but it has a strong affinity for neutrons and is a good neutron absorber. As the inventory of tritium accumulates in the TPBARs during irradiation in the core, the amount of helium-3 increases as a result of the decay of tritium. This has the effect of adding a material to the reactor core that is a strong neutron absorber.

Both lithium-6 and helium-3 are considered neutron poisons. The amount of lithium-6 in the TPBARs is reduced or "burned" (hence the term "burnable") during its irradiation in the core, effectively reducing its poisonous effect. However, an increase in the amount of the helium-3 poison during irradiation in the reactor core somewhat balances the reduction of the amount of lithium-6. As a result, the effectiveness of the TPBARs in absorbing neutrons during the 18 months (one fuel cycle) they are in the core is only slightly reduced from the start of the fuel cycle to its finish.

In a normal burnable absorber rod, the rod that TPBARs will replace, the neutron absorber is boron-10, which absorbs a neutron and promptly decays into lithium-7 and helium-4:

$$\text{Boron-10} + \text{neutron} \rightarrow \text{Lithium-7} + \text{Helium-4}$$

or

$$B^{10} + n^1 \rightarrow Li^7 + He^4$$

Boron-10 is a strong poison, but lithium-7 has little capacity to absorb neutrons. Therefore, as the boron-10 is converted to lithium-7 during irradiation in the core, the burnable absorber rod absorbs fewer neutrons and loses its poisonous effect on the reactor core. By design, at the end of an 18-month fuel cycle, the burnable absorber rods are no longer effective neutron absorbers.

Therefore, the result of using TPBARs instead of boron-10 burnable absorber rods is that, over the 18-month fuel cycle, the TPBARs act as a stronger overall poison than the burnable absorber rods that they replace. This, coupled with the fact that there will be many more TPBARs than there were burnable absorber rods, results in a significant increase in neutron poison in the core of the tritium production CLWR compared to the nontritium production CLWR.

To compensate for the added TPBAR poison, the core may need to have more new fuel assemblies loaded during each refueling, and the enrichment of those assemblies may need to be increased. As described previously, enrichment of the fuel is the amount of uranium-235 contained in the fuel. The higher the uranium-235 content in the fuel, the more fissions the fuel is capable of producing. Enrichment of the new fuel placed in the core of a tritium production CLWR may need to be increased to just under 5 percent, compared to the 4.2 to 4.5 percent currently being used in CLWRs. Five percent enrichment is the upper limit for reactor licensing by the U.S. Nuclear Regulatory Commission (NRC).

A.3.2 Physical Description of the Tritium-Producing Burnable Absorber Rod

Lithium, the active ingredient in tritium production, is in the form of an annular-shaped ceramic lithium-aluminate pellet. The pellets are contained in subassemblies called pencils. Each pencil is about 30 centimeters (12 inches) long and consists of a stack of pellets, a zircaloy inner liner inside of the pellets, and a nickel-plated zircaloy tube or getter outside of the pellets. Inside the zirconium liner is a gas plenum. The components of a TPBAR are illustrated in **Figures A–10 and A–11**.

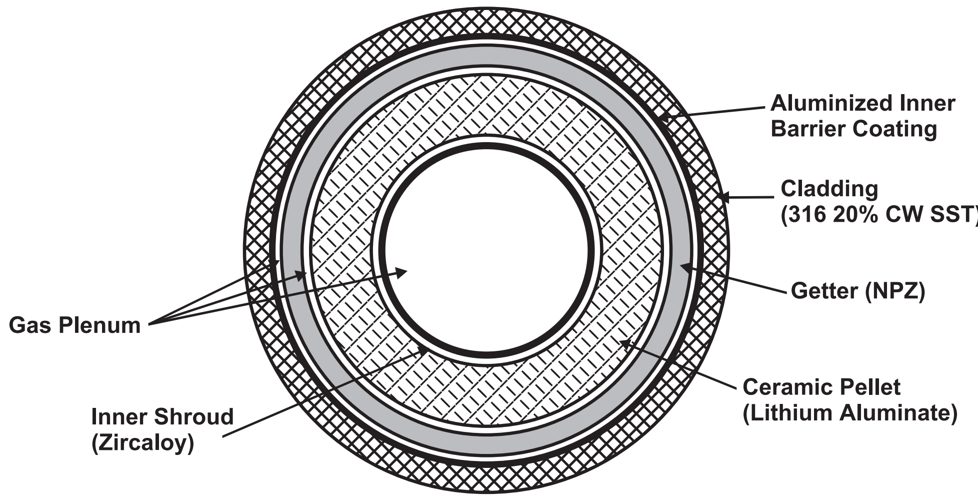

Figure A–10 TPBAR Transverse Cross Section

Tritium is generated as a gas, almost all of which is captured by the nickel-plated zircaloy getter as a tritide (ZrT_x). Tritium that becomes tritiated water vapor before it can be absorbed by the getter is disassociated by the zircaloy inner liner. The getter is nickel-plated to protect it from tritiated water vapor, which would oxidize its surface and block further absorption of tritium gas. The zircaloy inner liner also serves to maintain the overall geometry of the pellets.

Twelve pencils, getter discs at the top and bottom of the twelve pencils, and a spring loaded inside a stainless steel tube create a TPBAR. The spring holds the pencils in place during handling and allows for thermal expansion during operation. The inside surface of the stainless steel tube, or cladding, has an aluminized barrier coating to retard the permeation of hydrogen into and tritium out of the TPBAR. Loss of tritium through the cladding would increase the tritium released into the reactor coolant and, therefore, reduce the amount of tritium available for processing. Ingress of hydrogen into the TPBAR would be absorbed by the getter, diminishing the ability of the getter to absorb tritium. A less effective getter would increase the partial pressure of tritium inside the TPBAR, which would increase tritium loss through the cladding. The TPBARs are evacuated, backfilled with helium at one atmosphere pressure, and seal-welded. TPBARs would be put in the fuel assembly's nonfuel positions designed for burnable poison rods. Therefore, the exterior dimensions of the TPBARs are the same as those of burnable absorber rods. For the Westinghouse 17 × 17 design fuel assembly, the TPBARs would have an outside diameter of 0.381 inches, which is exactly that of a burnable

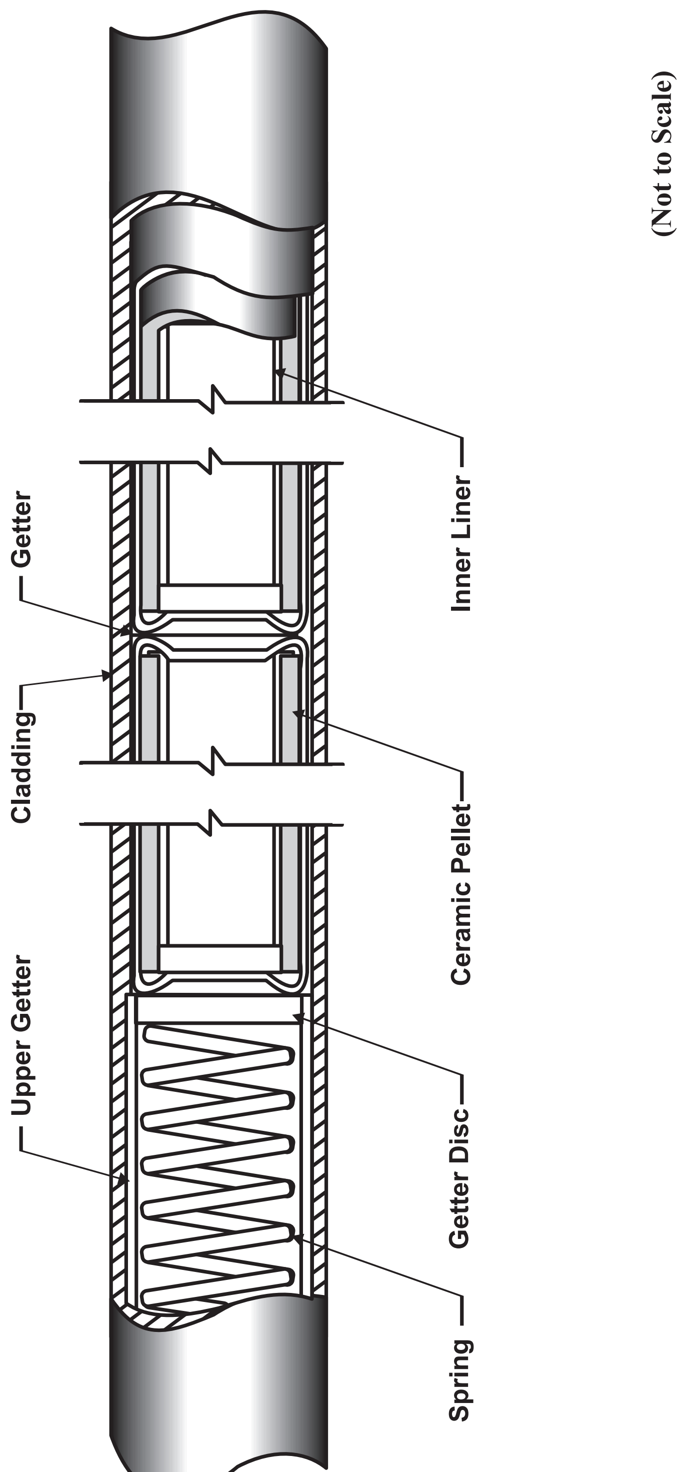

Figure A–11 TPBAR Longitudinal Cross Section

absorber rod. The cladding of the TPBAR would be stainless steel, type 316. The cladding of absorber rods would be either 304-type stainless steel or zircaloy 4.

All of the TPBARs inserted into a given fuel assembly are attached to a base plate, forming a TPBAR assembly. The base plate is part of the hold-down assembly, which also includes a spring and a locking device. The base plate not only maintains the spacing of the TPBARs for insertion and withdrawal, but also allows the TPBARs to be handled in groups, rather than one at a time. **Figure A–12** illustrates the base plate as part of the hold-down assembly.

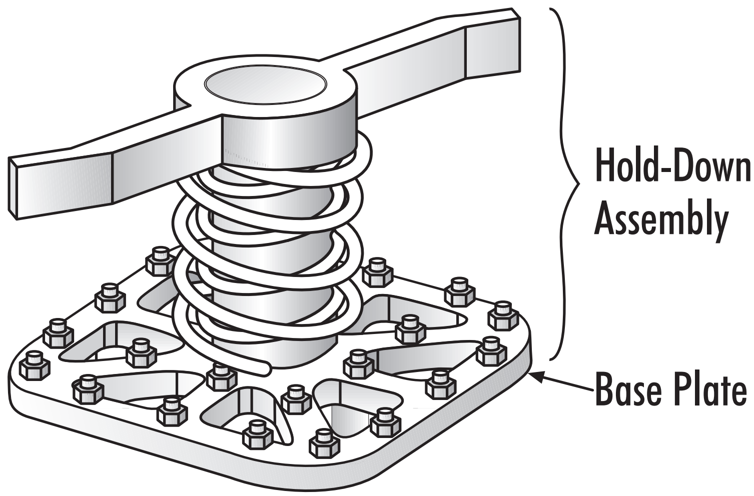

Figure A–12 TPBAR Hold-Down Assembly

A.3.3 Handling of Tritium-Producing Burnable Absorber Rods

The individual TPBARs would be mounted on the hold-down assembly through holes in the base plate and locked in place. The TPBAR assemblies would then be inserted into new fuel assemblies at the fuel manufacturer's site. The TPBARs would be transported to the reactor site and loaded into the reactor core as an integral part of the new fuel assembly. After irradiation in the core for approximately 18 months (one fuel cycle), the spent fuel, along with their TPBARs, would be removed from the core. In a normal refueling of a reactor core used for tritium production, some of the fuel assemblies would be re-inserted into the core for use during the second fuel cycle, while the rest of the fuel assemblies would go to the spent fuel pool. The TPBARs in fuel assemblies destined for the spent fuel pool would be left in their host fuel assemblies until after the refueling.

Some TPBARs could reside in fuel assemblies that would be re-inserted in the core and used during a second fuel cycle. Each of the fuel assemblies that are to be re-inserted in the core would be moved to the spent fuel pool and placed in a stand where the TPBAR assembly would be remotely removed. These fuel assemblies would then be returned to the reactor core. The removed TPBARs would be placed in other spent fuel assemblies in the spent fuel pool, where they would be stored under water until transported from the site.

After a short period of time following refueling, all of the TPBARs would be removed from the storage position in their host spent fuel assemblies and placed in a handling stand. In the handling stand, the individual TPBARs would be separated from the base plate and moved to the consolidation rack, where they would be inserted in the consolidation assemblies. The consolidation assemblies are essentially square cans with a 17 × 17 array of positions capable of accepting TPBARs. Once loaded, a handling fixture would be placed on the ends of the assemblies, and the assemblies would be handled with the same tools as fuel assemblies. The consolidation assemblies would then be placed in transportation cask positions designed for fuel assemblies and transported to the Department of Energy (DOE) Tritium Extraction Facility at the Savannah River Site in South Carolina.

A.4 IMPACT OF TRITIUM PRODUCTION ON THE FUEL CYCLE

The introduction of TPBARs into the fuel assemblies used in a CLWR would impact the fuel management strategy currently in use by the operator of the CLWR. The replacement of burnable poison rods with the TPBARs affects the core physics (the utilization of neutrons to produce power and tritium) and could alter the design of the core. Because the TPBARs have a large residual reactivity penalty, the tritium production core designs require higher enrichments and may require larger feed (fresh fuel) regions than the commercial core designs with a comparable power level and cycle length. These two fuel cycle characteristics were assumed to be unchanged with the introduction of TPBARs into the commercial core. Several core parameters were identified that could be impacted by the replacement of burnable poison rods with TPBARs. The most important among these are the power peaking factors. The distribution of power within the core is limited so that no single area produces significantly more than the average amount of power generated throughout the core. The differences between the average power and local power are quantified in several power peaking factors. By limiting the values of these peaking factors, the plant operator and the NRC ensure that the power plant operates within safety limits and would respond to accidents as described in the accident analysis required of all licensed nuclear power plants. With limitations on the number and distribution of TPBARs in the core used in this environmental impact statement (EIS), the power peaking factors in the commercial power production core and the tritium production core are very similar and the safety limits are not expected to be exceeded. Therefore, tritium production can be performed without the need to modify the CLWR core design, and only changes in the fuel enrichment would be required.

The maximum number of TPBARs that could be placed in the core (or irradiated) at each reactor unit without significantly disturbing the normal electricity-producing mode of reactor operation is approximately 3,400 (the exact number depends on the specific design of the reactor). This section evaluates the impact of tritium production on the fuel cycle by irradiating a range of 1,000 TPBARs to a maximum of 3,400 TPBARs at each reactor unit. The fuel cycle would be assumed to remain unchanged at 18 months. Irradiating a maximum number of TPBARs in each reactor core would require each nonfuel position (guide tube location) inside the core that is not reserved for the control element to be filled by a TPBAR, and the number of fresh fuel assemblies loaded into the core at each refueling to be increased. Irradiation of 1,000 TPBARs can be accomplished by placing the TPBARs in positions currently occupied by burnable poison rods. This action would not change the number of fresh fuel assemblies that are currently loaded into the core during refueling for commercial operation with no TPBARs.

Power Operation with Maximum Number of TPBARs

As stated earlier, irradiation of a maximum number of TPBARs requires their insertion in every possible guide tube location. For Watts Bar 1, this means that TPBARs would be located in the 24 guide tubes of 136 fuel assemblies (141 in Bellefonte 1 or Bellefonte 2 and 140 in Sequoyah 1 or Sequoyah 2) that do not have a control assembly (TVA 1991, TVA 1995, TVA 1996, TVA 1998). Commercial operation of Watts Bar 1 without tritium production consists of an 18-month fuel cycle and replacement of 80 spent fuel assemblies (72 for Bellefonte 1 or Bellefonte 2 and 80 for Sequoyah 1 or Sequoyah 2) at each refueling.

The main premise of using a CLWR to produce tritium is that the reactor power would remain unchanged. Since TPBARs use lithium (a strong neutron absorber) to produce tritium and the reactor power level is dependent on the number of neutrons available for fission, additional neutrons must be generated to maintain the reactor power level when the CLWR is used for tritium production. To meet the increased demand for neutrons, the enrichment of the reactor fuel would need to be increased. This would result in more uranium-235 in the reactor core. The maximum fuel enrichment for the fresh fuel is limited to 5 percent. Because of limitations on the distribution of power and the limits on the maximum enrichment of uranium fuel (5 percent), tritium production would require more fresh fuel to be loaded into the reactor at each refueling to maintain the same fuel cycle. For Watts Bar 1, these factors would result in the need to replace 136 of the 193 fuel assemblies (141 of 205 for Bellefonte 1 or Bellefonte 2 and 140 of 193 for Sequoyah 1 or Sequoyah 2) with fresh fuel every fuel cycle. The remaining 57 fuel assemblies (64 for Bellefonte 1 or Bellefonte 2 and 53 for Sequoyah 1 or Sequoyah 2) that have been burned once would be moved to the positions where the control element assemblies are located. Fresh fuel assemblies would contain the TPBARs and be positioned in the locations without a control element assembly.

Based on the above discussion and the consideration that each CLWR unit would operate to produce tritium for 40 years, Watts Bar 1 would generate 1,512 additional spent fuel assemblies (1,863 by Bellefonte 1 or Bellefonte 2 and 1,620 by Sequoyah 1 or Sequoyah 2); see also **Table A-1**.

Power Operation with 1,000 TPBARs

The operation of CLWRs with 1,000 TPBARs would not affect the number of fuel assemblies replaced during each refueling. As stated earlier, TPBARs are scattered in the core in place of burnable absorber rods. Production of tritium in a CLWR with less than 2,000 TPBARs is not expected to increase spent fuel generation per fuel cycle (WEC 1999). However, to maintain an 18-month fuel cycle similar to the maximum TPBAR loading, a higher fuel enrichment is required.

Table A–1 Summary of Increase in Spent Fuel Generation From 40 Years of Tritium Production with Maximum Number of TPBARs

Data Parameters	*Watts Bar 1*	*Sequoyah 1 or Sequoyah 2*	*Bellefonte 1 or Bellefonte 2*
Operating cycle (months)	18	18	18
Fresh fuel assemblies per cycle–no tritium production	80	80	72
Fresh fuel assemblies per cycle–maximum TPBARs	136	140	141
Increase in fresh fuel assemblies per cycle due to tritium production	56	60	69
Number of operating cycles in 40 years (rounded up)	27	27	27
Number of additional fuel assemblies for 40 years of tritium production	1,512	1,620	1,863

A.5 References

TVA (Tennessee Valley Authority), 1991, *Bellefonte Nuclear Plant Final Safety Analysis Report*, through Amendment 30, Chattanooga, Tennessee, December 20.

TVA (Tennessee Valley Authority), 1995, *Watts Bar Nuclear Plant Final Safety Analysis Report*, through Amendment 91, Chattanooga, Tennessee, October 24.

TVA (Tennessee Valley Authority), 1996, *Sequoyah Nuclear Plant Updated Final Safety Analysis Report*, through Amendment 12, Chattanooga, Tennessee, December 6.

TVA (Tennessee Valley Authority), 1998, data collected from TVA personnel by Science Applications International Corporation personnel, January—August.

WEC (Westinghouse Electric Company), 1999, letter from M. L. Travis to Dr. John E. Kelly, Sandia National Laboratory, Albuquerque, New Mexico, "Transmittal of Information to Support the CLWR Tritium Production Environmental Impact Statement," NDP-MLT-98-156 (Rev. 1), February.

APPENDIX B
METHODS FOR ASSESSING ENVIRONMENTAL IMPACTS—APPLICATION TO PRODUCTION OF TRITIUM IN COMMERCIAL LIGHT WATER REACTORS

This appendix describes the methods for assessing environmental impacts and addresses the application of those methods to the production of tritium in commercial light water reactors (CLWRs). The methods and applications are designed to comply with the Council on Environmental Quality and U.S. Department of Energy (DOE) regulations implementing the National Environmental Policy Act (NEPA). A summary of Federal environmental, safety, and health statutes, regulations, and orders applicable to relevant resource/issue areas is provided in Section B.13, **Table B–1**, and a list of relevant DOE Orders and U.S. Nuclear Regulatory Commission (NRC) guides is given in Section B.13, **Table B–2** at the end of this appendix.

The following resources and issues are covered in this environmental impact statement (EIS):

- Land resources
- Air quality and noise
- Water resources
- Geology and soils
- Ecology
- Archaeological and historic resources
- Socioeconomics
- Public and occupational health and safety
- Waste management
- Transportation
- Spent fuel management
- Environmental justice.

The *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* covers CLWR production of tritium in one or more of the following reactors:

- Watts Bar Nuclear Plant Unit 1 (Watts Bar 1)
- Sequoyah Nuclear Plant Units 1 and 2 (Sequoyah 1 and 2)
- Bellefonte Nuclear Plant Units 1 and 2 (Bellefonte 1 and 2).

The level of detail for the assessment of environmental impacts on each resource depends on the status of each reactor. For the currently operating reactors (Watts Bar 1 and Sequoyah 1 and 2), only the resources that would be affected by activities associated with tritium production are discussed and these impacts are evaluated in detail. For the partially completed reactors (Bellefonte 1 and 2), the impacts on all resources are evaluated in detail.

The assessment of the environmental impacts from the production of tritium in CLWRs is based on the following general assumptions:

- For Watts Bar 1 and Sequoyah 1 and 2, the impacts attributed to the production of tritium are those associated with the additional activities required to produce tritium that are beyond the current power operation activities.

- For Bellefonte 1 and 2, the impacts attributed to the production of tritium are: (1) impacts from the completion of construction of the facilities; and (2) full impacts from the operation of the reactors.

B.1 LAND RESOURCES

B.1.1 Land Use

The analyses of the impacts on land resources are based on the type and extent of land affected, the degree to which activities alter the land (including irretrievable usages), and the existing Federal, state, and local land use ordinances and policies (e.g., zoning).

B.1.2 Visual Resources

Visual resource assessments are based on the Bureau of Land Management's visual resource management method. A qualitative visual resource analysis, adapted from the Bureau of Land Management's visual contrast rating system (DOI 1986a, DOI 1986b), is conducted, as applicable, to:

- Identify key viewing positions (such as public travel routes, nearby residential/commercial areas, and public use facilities such as parks, recreation areas, and scenic areas)

- Assess the degree of visibility of new or modified facilities (buildings, stacks, access roads, parking areas, facility and perimeter lighting, steam and emission plumes) from these key viewing positions

- Assess the compatibility of such facilities with the existing setting

Sensitivity is assessed based on the potential for public concern about adverse effects on specific views within the affected environment.

B.2 AIR QUALITY AND NOISE

B.2.1 Air Quality

In currently operating reactors where the production of tritium is expected to result in some additional release of tritium to the atmosphere, the additional release is quantified and the expected concentration in air is calculated and compared with existing conditions and standards.

In partially completed reactors where construction activities would take place and the impacts of the full reactor operations are attributed to the production of tritium, assessments of air quality impacts include identification of applicable criteria for assessing impacts, development of emission inventories, and estimation of air pollutant concentrations. Ambient air monitoring data is used to determine background concentrations of pollutants for the specific site. The assessment of impacts is based on estimated pollutant concentrations, data on the existing environment, and assessment criteria. Human health effects due to air pollutant emissions are discussed in Section B.8; potential impacts of airborne radioactive and chemical releases are included.

Assessment criteria for pollutants include the U.S. Environmental Protection Agency's (EPA) primary and secondary National Ambient Air Quality Standards for criteria pollutants specified in 40 CFR 50 and those established by each state. The more stringent of either the EPA or state standards serves as the assessment criteria. The hazardous and toxic air pollutants include those listed in Title III of the 1990 Clean Air Act amendments, in the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61, and in standards and guidelines proposed or adopted by the respective states. Site-specific emissions are modeled using the EPA-recommended ISCST3 model and the EPA's Guidelines on Air Quality Models (40 CFR 51, Appendix W).

B.2.2 Noise

Noise impacts are assessed on the basis of the potential change at residences near the site boundary. The potential for exposure of workers to noise and the measures taken to protect worker hearing are qualitatively discussed.

B.3 WATER RESOURCES

In currently operating CLWRs, tritium production is expected to result in some additional release of tritium as a liquid effluent. This additional release is quantified in the EIS, and the expected concentrations in the liquid environment are calculated and compared to existing conditions and standards. In partially completed CLWRs where construction activities would be required and the impacts of the full operation of the reactor are attributed to tritium production, comprehensive water resource and quality assessments are performed. As part of this assessment, water resource impacts (surface water, groundwater, and floodplain) are reviewed in relation to: the Clean Water Act, specifically Sections 402 (National Pollutant Discharge Elimination System [NPDES]), 307(b) (toxic and pretreatment effluent standards), and 316 (thermal discharge); the Safe Drinking Water Act; DOE Regulation 10 CFR 1022; Compliance with Flood Plains/Wetlands Environmental Review Requirements; Executive Order 11988, Floodplain Management; and applicable state water quality standards. Potential effects on surface water and groundwater availability and quality are assessed by considering whether the proposed action or alternatives can significantly affect the quantity or quality of water available for local consumption, as well as compliance with legislative or regulatory requirements, and the risk of flooding.

Surface Water

Impact assessments to surface water include the following factors:

- Changes in rate of water consumption and wastewater discharges for operation and construction phases (as applicable)
- Changes in chemical, physical, and thermal characterization of all wastewater discharges
- Changes in the annual low flows of surface water resulting from proposed withdrawals and discharges
- Existing water supply to support the demand [This is assessed by comparing projected increases with the capacity of the supplier and by considering existing water rights, agreements, and allocations.]

Water quality impacts are determined by reviewing current monitoring data reports for nonradiological effluents. Potential radiological impacts from the discharge of tritium are discussed in the Public and Occupational Health and Safety Section (see Section B.8). Water quality management practices at each site also are reviewed. Monitoring reports for discharges permitted under the NPDES program are examined for compliance with permit limits and requirements. In most cases, current available data in the monitoring reports include information on the constituents present or the rate of discharge. A qualitative assessment of water quality impacts from wastewater (sanitary and process), stormwater runoff, stream channel erosion and sedimentation, stream bank flooding, and thermal impacts are identified.

Where possible, the proposed location is compared with the 500-year floodplain.

Groundwater

Tritium production is not expected to affect groundwater quality or groundwater resources for any of the alternatives. However, effluents are analyzed for effects on aquifers, groundwater usage, and groundwater quality within the regions. Available data on existing groundwater quality conditions are compared to Federal and state groundwater quality standards, effluent limitations, and safe drinking water standards. Additionally, Federal and state permitting requirements for groundwater withdrawal and discharge are identified. Impacts of groundwater withdrawals on existing contaminant plumes due to construction and facility operation are assessed to determine the potential for changes in their rates of migration and the effects of any changes in the plumes on groundwater users. Impacts are assessed by the degree to which groundwater quality, drawdown of groundwater levels, and groundwater availability to other users is affected.

B.4 GEOLOGY AND SOILS

Soil types at construction sites are described, and the capability for supporting construction is assessed. Shrinking or swelling of the ground as a result of landscaping, irrigation, or construction-related dewatering and soil erosion susceptibility also is addressed.

B.5 ECOLOGY

Ecological impacts are addressed as applicable for terrestrial resources, wetlands, aquatic resources, and threatened and endangered species. Sources of impacts considered include land use changes, salt drift (residual salts left behind as a result of the evaporation of cooling tower water), chemical or radionuclide emissions, water withdrawal, wastewater discharges, and human disturbance and noise. Potential impacts are assessed based on both the Federal and state protection regulations and standards and on the degree to which various habitats or species can be affected by the project.

Terrestrial Resources

The key considerations in assessing the effects on terrestrial resources are the presence and regional importance of affected habitats and the size of the habitat area to be disturbed by construction or operations. Impacts to wildlife are based on plant community loss, which is closely associated with animal habitat. The potential for disturbance, displacement, or loss of wildlife, in accordance with wildlife protection laws such as the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, is evaluated.

Wetlands

Most impacts on wetlands are related to displacement of wetlands by filling, draining, or clearing activities. Operational impacts to wetlands may occur from effluents, surface or groundwater withdrawals, or creation of new wetlands. The loss of wetlands resulting from construction and operation are addressed in the same way as for terrestrial plant communities—by comparing data on onsite wetlands to proposed land requirements. Sedimentation impacts are evaluated based on the nearness of wetlands to project areas, assuming standard construction erosion and sedimentation control measures. Impacts resulting from increased flows are evaluated based on a comparison of expected discharge rates with present stream flow rates.

Aquatic Resources

Impacts to aquatic resources are assessed for sedimentation, increased flows, effluent discharge, impingement, entrainment, loss of spawning habitat, and introduction of waste heat and chemicals.

Threatened and Endangered Species

Potential impacts to threatened and endangered species are determined in a manner similar to that described for terrestrial and aquatic resources, since the impact sources are similar.

B.6 ARCHAEOLOGICAL AND HISTORIC RESOURCES

The archaeological and historic resources impact analyses determine the potential effects on prehistoric, historic, Native American, and paleontological resources.

B.7 SOCIOECONOMICS

Socioeconomic impacts are assessed for the region of influence in the areas of:

- Demographics (population growth)
- Economics (employment and income)
- Housing
- Public finance
- Public infrastructure (schools, transportation, hospitals, recreational facilities, etc.).

The region of influence is the area containing roughly 90 percent of the current and potential employees at the site. Local impacts from a concentration of activity or a relatively large change in activity are noted. Changes are projected over 40 years. Employment impacts are estimated using the Bureau of Economic Analysis' Regional Input-Output Multiplier System.

B.8 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

For the currently operating CLWRs where the production of tritium is expected to result only in some additional release of tritium to the environment under either normal operations or accident conditions, the incremental impacts to the public and facility workers are assessed by using the method in the facilities' environmental reports and the associated NRC final environmental statements, and by adding the effects of the increase in the amounts of released tritium.

For the partially completed CLWRs, the impacts of full reactor operations would be attributed to the production of tritium; therefore, the impacts to the public and facility workers are assessed using current NRC guidelines and practices.

The public and occupational health and safety analysis determines the potential adverse effects on human health from exposure to ionizing radiation and hazardous chemicals. Health effects are determined by identifying the types and quantities of additional material (radioactive and chemical) to which one may be exposed, estimating doses, and then calculating the resultant health effects (latent cancer fatalities). The impacts from various releases during normal operation and the postulated accidents on the human health of workers and the public residing within 80 kilometers (50 miles) of each site are assessed. This assessment uses site-specific factors such as meteorology, population distribution, and agricultural production. Models are used to project the impacts on the health of workers and the public due to radiological and chemical releases during normal operation and postulated accidents. These models include:

- MACCS2 (SNL 1997) for radioactive material releases during beyond design-basis accidents

- GENII (PNL 1988) for all radioactive material releases during normal operations and other accidents (design-basis and TPBAR handling accidents)

- ISCST3 (EPA 1995) and ALOHA (NSC 1990) for hazardous chemical releases during normal operation and accident conditions

Health Impacts on Plant Workers During Normal Operation—Because radiation workers are individually monitored, experiences from past and current operations that are similar to future operation are used to estimate the radiological health impacts to workers. Health impacts from chemicals, if any, are discussed qualitatively. There are no individual exposure data on workers for chemicals. Therefore, it is assumed that individuals are exposed to low air chemical emission concentrations during an 8-hour day for a 40-hour week at a point (about 100 meters per 330 feet) downstream from the release point.

Health Impacts on the General Public During Normal Operation—Public health impacts from exposure to radiological or hazardous chemical materials released during operations are calculated. The effect is the sum of: (1) internal exposure resulting from breathing, eating, and drinking; and (2) external exposure resulting from standing on contaminated ground, being exposed to the air, and being submerged in water. The type and amount of material released are estimated, and the associated radiological and chemical doses are determined. These doses are converted to health effects using appropriate health risk estimators, both radiological (NRC/NAS 1990, NCRP 1993) and chemical (EPA 1997).

Accident Analyses for Postulated Accident Scenarios—Risks to both an individual member of the public and the general population residing within the affected area are calculated. The magnitude and consequences of impacts associated with each alternative are determined using site-specific and/or reactor-specific safety analyses. Although the concepts used are analogous to a formal probabilistic risk assessment, the accident analyses involve less detail and only address a spectrum of beyond design-basis accidents (severe core disruptive reactor accidents) that represent high consequence events with a low probability of occurrences (often $\leq 1.0\times10^{-6}$ per year), and a spectrum of possible design-basis and other operational accidents that represent low-consequence events with a high probability of occurrences (frequency greater than 1.0×10^{-6} per year). These accidents are similar to those that have been postulated in the plant's environmental report and the corresponding NRC final environmental statement.

The accident risk to a noninvolved[1] worker is calculated for a hypothetical worker at 0.64 kilometers (0.4 mile) (or the site boundary, whichever is closer) from the facility release point. The risk to facility workers from radiological accidents is addressed qualitatively, since precise placement of the workers during accidents cannot be known.

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[1]*Noninvolved workers are only applicable to DOE sites, since each DOE site usually contains many facilities. At a CLWR, there are no facilities that do not directly support reactor operation. Therefore, noninvolved workers, as defined in DOE documents, do not exist. For consistency, however, this calculation will be performed.*

Uncertainties—The sequence of analyses needed to generate the radiological impact estimates from normal operations and facility accidents includes: (1) a selection of normal operational modes and accident sequences, (2) estimation of source terms, (3) estimation of environmental transport and uptake of radionuclides, (4) calculation of radiation doses to exposed individuals, and (5) estimation of health effects.

The analyses use conservative models and scenarios to bound the risks. As a result, even though the range of uncertainty in a quantity may be large, the value calculated for the quantity is close to the upper extreme in the range, so the chance of the actual quantity being greater than the calculated value (or the chance of the quantity being less than the calculated value if the criteria are such that the quantity has to be maximized) is low.

For the partially completed CLWRs, the impacts are evaluated using the total source terms (as opposed to incremental) associated with each accident.

B.8.1 Emergency Preparedness

Emergency preparedness plans exist for all operating reactor sites and are summarized in the EIS for each site. For nonoperating reactor sites, approximate plans need to be developed.

B.9 Waste Management

The volumes of each waste type (low-level radioactive, low-level mixed, hazardous, nonhazardous, and high-level radioactive) are estimated. Methods of minimizing each of the waste streams are discussed. Impacts are assessed in the context of site practices for treatment, storage, and disposal. Wastes related to decontamination and decommissioning are also discussed. Decontamination and decommissioning can range from performing a simple radiological survey to completely dismantling and removing a radioactively contaminated facility.

B.10 Transportation

The impacts of transporting program-related materials are described. The packages required for the shipment of materials are also described. For transporting irradiated TPBARs and radioactive waste, the following elements are considered: transport mode, weight of material, Curies, proximity dose rates (transport index), type of package, number of shipments, and distance. Road and railroad routes are identified using HIGHWAY (ORNL 1993a) and INTERLINE (ORNL 1993b) codes, respectively. Radiological transportation health impacts are calculated using RADTRAN and TICLD (SNL 1993) codes for both the incident-free and accident conditions. In addition to the radiological risks posed by the transportation activities, vehicle-related risks are assessed for nonradiological causes (i.e., causes related to the transport vehicles and not the TPBAR packages). Nonradiological risks during incident-free transportation conditions are caused by potential exposure to increased vehicle exhaust emissions. Nonradiological risks resulting from accident conditions unrelated to the shipment cargo are assessed using state-specific transportation fatality rates.

B.11 Spent Fuel Management

"Spent fuel" is the terminology used for nuclear reactor fuel that has been irradiated to the point that it no longer contributes to the continued operation of the reactor. The spent fuel is removed from the reactor core and stored in the spent fuel storage pool or basin. The Nuclear Waste Policy Act of 1982, as amended, assigned the Secretary of Energy the responsibility for developing a repository for the disposal of high-level radioactive waste and spent fuel. When such a repository is available, spent fuel is transported for disposal from the nuclear power reactors to the repository. Until a repository is available, spent fuel is stored in the reactor pools or in other acceptable, NRC-licensed storage locations. Because of the uncertainty associated with opening a repository, this EIS assumes that spent fuel is stored at the reactor facility for the 40-year duration of the proposed action.

B.12 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Action to Address Environmental Justice in Minority Populations and Low Income Populations, requires an assessment of incidence and mitigation related to disproportionately high and adverse human health or environmental effects on minority and low-income populations. In May 1996, the Council on Environmental Quality released its initial guidance on environmental justice (CEQ 1996). This guidance forms the basis of the environmental justice analysis. The following definitions are used in the analysis:

- *Minority Individuals*—Persons self-designated as Hispanic (of any race), Native American, Asian or Pacific Islander, or Black
- *Minority Population*—The total number of minority individuals residing within a specified area
- *Low-Income Individuals*—Any persons whose income is below the poverty threshold
- *Low-Income Population*—The total number of low-income individuals residing within a specified area

Demographic data provided by the U.S. Bureau of the Census is used to quantify minority and low-income populations in the affected area, i.e., within a radius of 80 kilometers (50 miles) and 16 kilometers (10 miles) from the site. Poverty thresholds, which are a function of family size and the number of unmarried children under 18, are used to identify the low-income populations. To avoid significant uncertainties in the population estimate due to partial inclusions of geographic units (such as census tracts, block groups, and blocks) at the boundaries of potentially affected areas, the unit area of spatial resolution is significantly less than the affected area. Uncertainty bounds are calculated by total inclusion (the upper bound) and total exclusion (the lower bound) of the populations residing within the affected area.

As the analysis found no significant impacts on the general population, no further analyses of impacts on minority populations and low-income populations are required. Instead, the discussion states that no significant impacts are likely for the general population or any particular segment of the population.

B.13 APPLICABLE ENVIRONMENTAL LAWS, REGULATIONS, AND GUIDANCE

Tables B-1 and B-2 provide a summary of all environmental laws, regulations, and guidance applicable to the preparation of the CLWR EIS.

Table B–1 Federal Environmental Statutes, Regulations, and Executive Orders[1]

Resource Category	*Statute/Regulation/ Order*	*Citation*	*Responsible Agency*	*Potential Applicability: Permits, Approvals, Consultations, and Notifications*
Air Resources	The Clean Air Act, as amended	42 U.S.C. §§7401 *et seq.*	Environmental Protection Agency/State	Requires sources to meet standards and obtain permits to satisfy: NAAQS, state implementation plans, the Standards of Performance for New Stationary Sources, NESHAP, and Prevention of Significant Deterioration regulations.
	The National Ambient Air Quality Standards/ State Implementation Plans	42 U.S.C. §§7409 *et seq.*	Environmental Protection Agency/State	Requires compliance with primary and secondary ambient air quality standards governing sulphur dioxide, nitrogen oxides, carbon dioxide, ozone, lead, and PM_{10} and emission limits/reduction measures as designated in each state's implementation plan.
	Standards of Performance for New Stationary Sources	42 U.S.C. §7411	Environmental Protection Agency/State	Establishes control/emission standards and record keeping requirements for new or modified sources specifically addressed by a standard.
	The National Emission Standards for Hazardous Air Pollutants	42 U.S.C. §7412	Environmental Protection Agency/State	Requires sources to comply with emission levels of carcinogenic or mutagenic pollutants; may require preconstruction approval, depending on the process being considered and the level of emissions that will result from the new or modified source.
	Prevention of Significant Deterioration	42 U.S.C. §§7470 *et seq.*	Environmental Protection Agency/State	Applies to areas that are in compliance with NAAQS. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 tons per year) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible state agency setting forth emission limitations to protect the Prevention of Significant Deterioration increment.
	Noise Control Act of 1972	42 U.S.C. §§4901 *et seq.*	Environmental Protection Agency	Requires facilities to maintain noise levels that do not jeopardize the health and safety of the public.
Water Resources	The Clean Water Act	33 U.S.C. §§1251 *et seq.*	Environmental Protection Agency/State	Requires Environmental Protection Agency or state-issued permits and compliance with provisions of permits regarding discharge of effluents to surface waters.
	National Pollutant Discharge Elimination System (Section 402 of the Clean Water Act)	33 U.S.C. § 1342	Environmental Protection Agency/State	Requires permit to discharge effluents to surface waters and stormwaters; permit modifications are required if discharge effluents are altered.
	Dredged or Fill Material (Section 404 of the Clean Water Act)/Rivers and Harbors Appropriations Act of 1899	33 U.S.C. §1344/33 U.S.C. §§401 *et seq.*	U.S. Army Corps of Engineers	Requires permits to authorize the discharge of dredged or fill material into navigable waters or wetlands and to authorize certain structures.
	Wild and Scenic Rivers Act	16 U.S.C. §§ 1271 *et seq.*	FWS/Bureau of Land Management/ Forest Service/ National Park Service	Requires consultation before construction of any new Federal project associated with a river designated or under study as wild and scenic in order to minimize and mitigate any adverse effects on the physical and biological properties of the river.
	Safe Drinking Water Act	42 U.S.C. §§ 300f *et seq.*	Environmental Protection Agency/State	Requires permits for construction/operation of underground injection wells and subsequent discharging of effluents to ground aquifers.

Resource Category	***Statute/Regulation/ Order***	***Citation***	***Responsible Agency***	***Potential Applicability: Permits, Approvals, Consultations, and Notifications***
Water Resources (cont'd)	Executive Order 11988: Floodplain Management	3 CFR, 1977 Comp., p. 117	Water Resources Council/Federal Emergency Management Agency/CEQ	Requires Federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.
	Executive Order 11990: Protection of Wetlands	3 CFR, 1977 Comp., p. 121	U.S. Army Corps of Engineers/ FWS	Requires Federal agencies to avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands.
	Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR 1022	DOE	Requires DOE to comply with all applicable floodplain/wetlands environmental review requirements.
Hazardous Wastes and Land Resources	Resource Conservation and Recovery Act/Hazardous and Solid Waste Amendments of 1984	42 U.S.C. §§6901 *et seq.* PL 98-616	Environmental Protection Agency/State	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities. Changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits involving public hearings.
	Farmland Protection Policy Act of 1981	7 U.S.C. §§4201 *et seq.*	Soil Conservation Service	Requires avoidance of any adverse effects to prime and unique farmlands.
	Federal Facility Compliance Act of 1992	42 U.S.C. §6961	States	Requires waivers of sovereign immunity for Federal facilities under RCRA and requires DOE to develop plans and enter into agreements with states as to specific management actions for specific mixed waste streams.
Ecology (Biotic Re-sources)	Fish and Wildlife Coordination Act	16 U.S.C. §§661 *et seq.*	Fish and Wildlife Service	Requires consultation on the possible effects on wildlife if there is construction, modification, or control of bodies of water in excess of 10 acres in surface area.
	Bald and Golden Eagle Protection Act	16 U.S.C. §§668 *et seq.*	Fish and Wildlife Service	Requires consultations to be conducted to determine if any protected birds are found to inhabit the area. If so, DOE must obtain a permit prior to moving any nests due to construction or operation of project facilities.
	Wilderness Act of 1964	16 U.S.C. §§1131 *et seq.*	Department of Commerce/ Department of Interior	Requires consultations with the Department of Commerce and Department of Interior to minimize impact.
	Migratory Bird Treaty Act	16 U.S.C. §§703 *et seq.*	Fish and Wildlife Service	Requires consultation to determine if there are any impacts on migrating bird populations due to construction or operation of project facilities. If so, DOE will develop mitigation measures to avoid adverse effects.
	Wild Free-Roaming Horses and Burros Act of 1971	16 U.S.C. §§1331 *et seq.*	Department of Interior	Requires consultation with the Department of Interior to minimize impact.
	Endangered Species Act of 1973	16 U.S.C. §§1531 *et seq.*	Fish and Wildlife Service/National Marine Fisheries Service	Requires consultation to identify endangered or threatened species and biological opinions and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operation.
Cultural Resources	National Historic Preservation Act of 1966, as amended	16 U.S.C. §§470 *et seq.*	President's Advisory Council on Historic Preservation	Requires consultation with the State Historic Preservation Office prior to construction to ensure that no historical properties will be affected.
	Archaeological and Historical Preservation Act of 1974	16 U.S.C. §§469 *et seq.*	Department of Interior	Requires authorization for any disturbance of archaeological resources.
	Archaeological Resources Protection Act of 1979	16 U.S.C. §§470aa *et seq.*	Department of Interior	Requires authorization for any excavation or removal of archaeological resources.
	Antiquities Act	16 U.S.C. §§431-33	Department of Interior	Requires compliance with all applicable sections of the Act.

Resource Category	***Statute/Regulation/ Order***	***Citation***	***Responsible Agency***	***Potential Applicability: Permits, Approvals, Consultations, and Notifications***
Cultural Resources (cont'd)	American Indian Religious Freedom Act of 1978	42 U.S.C. §1996	Department of Interior	Requires consultation with local Native American Indian tribes prior to construction to ensure that their religious customs, traditions, and freedoms are preserved.
	Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. §3001	Department of Interior	Requires consultations with local Native American Indian tribes prior to construction to guarantee that no Native American graves are disturbed.
	Executive Order 11593: Protection and Enhancement of the Cultural Environment	3 CFR 154, 1971-1975 Comp., p. 559	Department of Interior	Requires agencies to aid in the preservation of historic and archaeological data that may be lost during construction activities.
Public and Occupational Health and Safety	Occupational Safety and Health Act	5 U.S.C. §5108	Occupational Safety and Health Administration	Requires agencies to comply with all applicable worker safety and health legislation (including guidelines of 29 CFR Part 1960) and to prepare, or have available, Material Safety Data Sheets.
	Standards for Protection Against Radiation	10 CFR 20	Nuclear Regulatory Commission	Establishes standards for protection of workers and the general public against radiation hazards arising out of activities under licenses issued by the Nuclear Regulatory Commission.
	Occupational Radiation Protection	10 CFR Part 835	Department of Energy	Establishes radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from conduct of DOE activities.
	Hazard Communication Standard	29 CFR 1910.1200	Occupational Safety and Health Administration	Requires agencies to ensure that workers are informed of, and trained to handle, all chemical hazards in the workplace.
Other	Atomic Energy Act of 1954	42 U.S.C. §2011	Department of Energy	Requires DOE to follow its own standards and procedures to ensure the safe operation of its facilities.
	National Environmental Policy Act	42 U.S.C. §§4321 *et seq.*	Department of Energy	Requires DOE to comply with NEPA implementing procedures in accordance with 10 CFR Part 1021.
	Toxic Substances Control Act 15	U.S.C. §§2601 *et seq.*	Environmental Protection Agency	Requires compliance with inventory reporting requirements and control provisions of TSCA to protect the public from the risks of exposure to chemicals; TSCA imposes strict limitations on use and disposal of polychlorinated biphenyls-contaminated equipment.
	Hazardous Materials Transport Action Act	49 U.S.C. §§1801 *et seq.*	Department of Transportation	Requires compliance with the requirements governing hazardous materials and waste transportation.
	Hazardous Materials Transportation Uniform Safety Act of 1990	49 U.S.C. §1801	Department of Transportation	Restricts shippers of highway route-controlled quantities of radioactive materials to use only permitted carriers.
	Emergency Planning and Community Right-To-Know Act of 1986	42 U.S.C. §§11001 *et seq.*	Environmental Protection Agency	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency releases, and imposes right-to-know reporting requirements covering storage and use of chemicals which are reported in toxic chemical release forms.
	Pollution Prevention Act of 1990	42 U.S.C. 11001 - 11050	Environmental Protection Agency	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under Section 313 of SARA.

Resource Category	***Statute/Regulation/ Order***	***Citation***	***Responsible Agency***	***Potential Applicability: Permits, Approvals, Consultations, and Notifications***
Other (cont'd)	Executive Order 12843: Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	April 21, 1993	Environmental Protection Agency	Requires Federal agencies to minimize procurement of ozone depleting substances and conform their practices to comply with Title VI of the Clean Air Act Amendments (stratospheric ozone protection) and to recognize the increasingly limited availability of Class I substances until final phaseout.
	Executive Order 12856: Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements	August 3, 1993	Environmental Protection Agency	Requires Federal agencies to achieve 50 percent reduction of agency's total releases of toxic chemicals to the environment and offsite transfers; to prepare a written facility pollution prevention plan not later than 1995; to publicly report toxic chemicals entering any waste stream from Federal facilities, including any releases to the environment; and to improve local emergency planning, response, and accident notification.
	Executive Order 12873: Federal Acquisition, Recycling, and Waste Prevention	October 20, 1993	Environmental Protection Agency	Requires Federal agencies to develop affirmative procurement policies and establishes a shared responsibility between the system program manager and the recycling community to effect use of recycled items for procurement.
	Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	February 11, 1994	Environmental Protection Agency	Requires Federal agencies to identify and address, as appropriate, the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
	Executive Order 12088: Federal Compliance with Pollution Control Standards	3 CFR, 1978 Comp., p. 243	Office of Management and Budget	Requires Federal agency landlords to submit to the Office of Management and Budget an annual plan for the control of environmental pollution and to consult with the Environmental Protection Agency and state agencies regarding the best techniques and methods.
	Executive Order 11514: Protection and Enhancement of Environmental Quality	3 CFR, 1966-1970 Comp., p. 902	Council on Environmental Quality	Requires Federal agencies to demonstrate leadership in achieving the environmental quality goals of NEPA; provides for DOE consultation with appropriate Federal, state, and local agencies in carrying out their activities as they affect the environment.
	Nuclear Waste Policy Act of 1982	42 U.S.C. §§10101 *et seq.*	Department of Energy	Requires DOE to dispose of radioactive waste per 40 CFR 191 standards.
	Low-Level Radioactive Waste Policy Act	42 U.S.C. §§2021b -2021d	Nuclear Regulatory Commission	Requires DOE to dispose of low-level radioactive waste per compacts of the states in which it operates.

PM_{10} = Particulate matter smaller or equal to 10 microns.
[1] The applicability of these may vary depending on the reactor and options under consideration.
Acronyms used in this table are listed below.

CEQ = Council on Environmental Quality
CFR = Code of Federal Regulations
DOE = Department of Energy
FWS = U.S. Fish & Wildlife Service
NAAQS = National Ambient Air Quality Standards
NEPA = National Environmental Policy Act
NESHAP = National Emission Standards for Hazardous Air Pollutants
RCRA = Resource Conservation and Recovery Act
SARA = Superfund Amendments and Reauthorization Act
TSCA = Toxic Substances Control Act
U.S.C. = United States Code

Table B–2 Relevant DOE Orders and NRC Guides

DOE Order	***DOE Order Title***
151.1	Comprehensive Emergency Management System
225.1	Accident Investigation
231.1	Environment Safety and Health Reporting
232.1	Occurrence Reporting and Processing of Operations Information
420.1	Facility Safety
425.1	Startup and Restart of Nuclear Facilities
440.1	Worker Protection Management for DOE Federal and Contractor Employees
451.1	National Environment Policy Act Compliance Program
460.1A	Packaging and Transportation Safety
470.1	Safeguards and Security Program
1230.2	American Indian Tribal Government Policy
5400.5	Radiation Protection of Public and Environment
5480.30	Nuclear Reactor Safety Design Criteria
5610.12	Packaging and Offsite Transportation of Nuclear Components, and Special Assemblies Associated with the Nuclear Explosion
NRC Guide No.	***NRC Guide Title***
1.101	Emergency Planning and Preparedness for Nuclear Power Reactors
1.109	Calculation of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10 CFR Part 50, Appendix I
1.111	Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors
1.112	Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Reactors
1.113	Estimating Aquatic Dispersions of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I
1.145	Atmospheric Dispersion Models for Potential Accident Consequences Assessments at Nuclear Power Plants

B.14 REFERENCES

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NSC (National Safety Council), 1990, *Areal Locations of Hazardous Atmospheres (ALOHA) Software*, Version 5.05, National Safety Council, Washington, DC, December.

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PNL (Pacific Northwest Laboratory), 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, PNL-6584, Richland, Washington, November.

SNL (Sandia National Laboratory), 1993, *RADTRAN 4 Volume II: Technical Manual*, SAND89-2370, Albuquerque, New Mexico, August.

SNL (Sandia National Laboratory), 1997, *Code Manual for MACCS2: Volume 1, User's Guide, MELCOR Accident Consequence Code System for the Calculation of Health and Economic Consequences of Accidental Atmospheric Radiological Releases,* SAND97-0594, Albuquerque, New Mexico, March.

APPENDIX C
EVALUATION OF HUMAN HEALTH EFFECTS FROM NORMAL OPERATIONS

C.1 INTRODUCTION

This appendix provides a brief general discussion on radiation and its associated health effects and describes the method and assumptions used for estimating the potential impacts and risks to individuals and the general public from exposure to the releases of radioactivity and hazardous chemicals during normal operations at the proposed reactor facilities. This information is intended to present the assessment of impacts from normal operation during tritium production in the proposed reactors, as described in Chapter 5 of this environmental impact statement (EIS). Information regarding potential radiological impacts resulting from facility accidents is provided in Appendix D of this EIS.

This appendix presents numerical information using engineering and/or scientific notation. For example, the number 100,000 can also be expressed as 1×10^5. The fraction 0.00001 can also be expressed as 1×10^{-5}. The following chart defines the equivalent numerical notations that may be used in this appendix.

FRACTIONS AND MULTIPLES OF UNITS

Multiple	*Decimal Equivalent*	*Prefix*	*Symbol*
1×10^6	1,000,000	mega-	M
1×10^3	1,000	kilo-	k
1×10^2	100	hecto-	h
1×10	10	deka-	da
1×10^{-1}	0.1	deci-	d
1×10^{-2}	0.01	centi-	c
1×10^{-3}	0.001	milli-	m
1×10^{-6}	0.000001	micro-	μ
1×10^{-9}	0.000000001	nano-	n
1×10^{-12}	0.000000000001	pico-	p
1×10^{-15}	0.000000000000001	femto-	f
1×10^{-18}	0.000000000000000001	atto-	a

C.2 RADIOLOGICAL IMPACTS ON HUMAN HEALTH

Radiation exposure and its consequences are topics of interest to the general public. For this reason, this EIS places much emphasis on the consequences of exposure to radiation, provides the reader with background information on the nature of radiation, and explains the basic concepts used in the evaluation of radiation health effects. In addition, this section provides a brief description of the characteristics of tritium and its potential health effects.

C.2.1 Background Information

C.2.1.1 Nature of Radiation and Its Effects on Humans

What Is Radiation?

Radiation is energy transferred in the form of particles or waves. Globally, human beings are exposed constantly to radiation from the solar system and from the earth's rocks and soil. This radiation contributes to the natural background radiation that always surrounds us. Manmade sources of radiation also exist, including medical and dental x-rays, household smoke detectors, and materials released from nuclear and coal-fired power plants.

All matter in the universe is composed of atoms. Radiation comes from the activity of tiny particles within an atom. As stated earlier in Appendix A, an atom consists of a positively charged nucleus (central part of an atom) with a number of negatively charged electron particles in various orbits around the nucleus. There are two types of particles in the nucleus: neutrons that are electrically neutral and protons that are positively charged. Atoms of different types are known as elements. There are more than 100 natural and manmade elements. An element has equal numbers of electrons and protons. When atoms of an element differ in their number of neutrons, they are called isotopes of that element. All elements have three or more isotopes, some or all of which could be unstable (i.e., decay with time). For example, tritium (also known as hydrogen-3) has two neutrons and is an unstable isotope of hydrogen, which has no neutrons.

Unstable isotopes undergo spontaneous change, known as radioactive disintegration or radioactive decay. The process of continuously undergoing spontaneous disintegration is called radioactivity. The radioactivity of a material decreases with time. The time it takes a material to lose half of its original radioactivity is its half-life. An isotope's half-life is a measure of its decay rate. For example, an isotope with a half-life of eight days will lose one-half of its radioactivity in that amount of time. In eight more days, one-half of the remaining radioactivity will be lost, and so on. Each radioactive element has a characteristic half-life. The half-lives of various radioactive elements may vary from millionths of a second to millions of years.

As unstable isotopes change into more stable forms, they emit electrically charged particles. These particles may be either an alpha particle (a helium nucleus) or a beta particle (an electron), with various levels of kinetic energy. Sometimes these particles are emitted in conjunction with gamma rays. The alpha and beta particles are frequently referred to as ionizing radiation. Ionizing radiation refers to the fact that the charged particle energy force can ionize, or electrically charge, an atom by stripping off one of its electrons. Gamma rays, even though they do not carry an electric charge as they pass through an element, can ionize its atoms by ejecting electrons. Thus, they cause ionization indirectly. Ionizing radiation can cause a change in the chemical composition of many things, including living tissue (organs), which can affect the way they function.

When a radioactive isotope of an element emits a particle, it changes to an entirely different element, one that may or may not be radioactive. Eventually, a stable element is formed. This transformation, which may take several steps, is known as a decay chain. For example, radium, which is a member of the radioactive decay chain of uranium, has a half-life of 1,622 years. It emits an alpha particle and becomes radon, a radioactive gas with a half-life of only 3.8 days. Radon decays first to polonium, then through a series of further decay steps to bismuth, and ultimately to lead, which is a stable element. Meanwhile, the decay products will build up and will eventually die away as time progresses.

The characteristics of various forms of ionizing radiation are briefly described below and in the box at right (see Glossary for further definition):

Radiation Type	Typical Travel Distance in Air	Barrier
α	Couple of centimeters	Sheet of paper or skin's surface
β	Few meters	Thin sheet of aluminum foil or glass
γ	Very Large [a]	Thick wall of concrete, lead, or steel
n	Very Large	Water, paraffin, graphite

[a] *Would be infinite in a vacuum*

Alpha (α)

Alpha particles are the heaviest type of ionizing radiation. They can travel only a couple centimeters in air. Alpha particles lose their energy almost as soon as they collide with anything. They can be stopped easily by a sheet of paper or by the skin's surface.

Beta (β)

Beta particles are much (7,330 times) lighter than alpha particles. They can travel a longer distance than alpha particles in the air. A high energy beta particle can travel a few meters in the air. Beta particles can pass through a sheet of paper, but may be stopped by a thin sheet of aluminum foil or glass. Tritium emits a very low energy beta particle.

Gamma (γ)

Gamma rays (and x-rays), unlike alpha or beta particles, are waves of pure energy. Gamma rays travel at the speed of light. Gamma radiation is very penetrating and requires a thick wall of concrete, lead, or steel to stop it.

Neutrons (n)

Neutrons are particles that contribute to radiation exposure both directly and indirectly. The most prolific source of neutrons is a nuclear reactor. Indirect radiation exposure occurs when gamma rays and alpha particles are emitted following neutron capture in matter. A neutron has about one quarter the weight of an alpha particle. It will travel in the air until it is absorbed in another element.

Units of Radiation Measure

During the early days of radiological experience, there was no precise unit of radiation measure. Therefore, a variety of units were used to measure radiation. These units were used to determine the amount, type, and intensity of radiation. Just as heat can be measured in terms of its intensity or effects using units of calories or degrees, amounts of radiation or its effects can be measured in units of Curies, radiation absorbed dose (rad), or dose equivalent (rem). The following summarizes those units (see also the definition in the Glossary).

Curie

The Curie, named after the French scientists Marie and Pierre Curie, describes the "intensity" of a sample of radioactive material. The rate of decay of 1 gram of radium is the basis of this unit of measure. It is equal to 3.7×10^{10} disintegrations (decays) per second.

Rad

Radiation Units and Conversions to International System of Units

1 Curie = 3.7×10^{10} Becquerel
1 rad = 0.01 Gray
1 rem = 0.01 Sievert
1 Gray = 1 Joule/kilogram
1 Becquerel = 1 disintegration per second

The rad is the unit of measurement for the physical absorption of radiation. The total energy absorbed per unit quantity of tissue is referred to as absorbed dose (or simply dose). As sunlight heats pavement by giving up an amount of energy to it, radiation similarly gives up rads of energy to objects in its path. One rad is equal to the amount of radiation that leads to the deposition of 0.01 Joule of energy per kilogram of absorbing material.

Rem

A rem is a measurement of the dose equivalent from radiation based on its biological effects. The rem is used in measuring the effects of radiation on the body as degrees Centigrade are used in measuring the effects of sunlight heating pavement. Thus, 1 rem of one type of radiation is presumed to have the same biological effects as 1 rem of any other kind of radiation. This allows comparison of the biological effects of radionuclides that emit different types of radiation.

The units of radiation measure in the International Systems of Units are: Becquerel (a measure of source intensity [activity]), Gray (a measure of absorbed dose), and Sievert (a measure of dose equivalent).

An individual may be exposed to ionizing radiation externally (from a radioactive source outside the body) or internally (from ingesting or inhaling radioactive material). The external dose is different from the internal dose because an external dose is delivered only during the actual time of exposure to the external radiation source, but an internal dose continues to be delivered as long as the radioactive source is in the body. The dose from internal exposure is calculated over 50 years following the initial exposure; both radioactive decay and elimination of the radionuclide by ordinary metabolic processes decrease the dose rate with the passage of time.

Sources of Radiation

The average American receives a total of approximately 364 millirem per year from all sources of radiation, both natural and manmade, of which approximately 300 millirem per year are from natural sources (NCRP 1987b). The sources of radiation can be divided into six different categories: (1) cosmic radiation, (2) terrestrial radiation, (3) internal radiation, (4) consumer products, (5) medical diagnosis and therapy, and (6) other sources (NCRP 1987b). These categories are discussed in the following paragraphs.

Cosmic Radiation

Cosmic radiation is ionizing radiation resulting from energetic charged particles from space continuously hitting the earth's atmosphere. These particles and the secondary particles and photons they create comprise cosmic radiation. Because the atmosphere provides some shielding against cosmic radiation, the intensity of this radiation increases with the altitude above sea level. The average dose to people in the United States from this source is approximately 27 millirem per year.

External Terrestrial Radiation

External terrestrial radiation is the radiation emitted from the radioactive materials in the Earth's rocks and soils. The average dose from external terrestrial radiation is approximately 28 millirem per year.

Internal Radiation

Internal radiation results from the human body metabolizing natural radioactive material that has entered the body by inhalation or ingestion. Natural radionuclides in the body include isotopes of uranium, thorium, radium, radon, polonium, bismuth, potassium, rubidium, and carbon. The major contributor to the annual dose equivalent for internal radioactivity are the short-lived decay products of radon, which contribute approximately 200 millirem per year. The average dose from other internal radionuclides is approximately 39 millirem per year.

Consumer Products

Consumer products also contain sources of ionizing radiation. In some products, such as smoke detectors and airport x-ray machines, the radiation source is essential to the products' operation. In other products, such as televisions and tobacco, the radiation occurs as the product's function. The average dose from consumer products is approximately 10 millirem per year.

Medical Diagnosis and Therapy

Radiation is an important diagnostic medical tool and cancer treatment. Diagnostic x-rays result in an average exposure of 39 millirem per year. Nuclear medical procedures result in an average exposure of 14 millirem per year.

Other Sources

There are a few additional sources of radiation that contribute minor doses to individuals in the United States. The dose from nuclear fuel cycle facilities (e.g., uranium mines, mills, and fuel processing plants), nuclear power plants, and transportation routes has been estimated to be less than 1 millirem per year. Radioactive fallout from atmospheric atomic bomb tests, emissions of radioactive material from nuclear facilities, emissions from certain mineral extraction facilities, and transportation of radioactive materials contribute less than 1 millirem per year to the average dose to an individual. Air travel contributes approximately 1 millirem per year to the average dose.

Exposure Pathways

As stated earlier, an individual may be exposed to ionizing radiation both externally and internally. The different ways that could result in radiation exposure to an individual are called exposure pathways. Each type of exposure is discussed separately in the following paragraphs.

External Exposure

External exposure can result from several different pathways, all having in common the fact that the radiation causing the exposure is external to the body. These pathways include exposure to a cloud of radiation passing over the receptor (e.g., an individual member of the public) standing on ground that is contaminated with radioactivity and swimming or boating in contaminated water. If the receptor departs from the source of radiation exposure, the dose rate will be reduced. It is assumed that external exposure occurs uniformly during the year. The appropriate measure of dose is called the effective dose equivalent.

Internal Exposure

Internal exposure results from a radiation source entering the human body through either inhalation of contaminated air or ingestion of contaminated food and water. In contrast to external exposure, once a radiation source enters the body, it remains there for a period of time that varies depending on decay and biological half-life. The absorbed dose to each organ of the body is calculated for a period 50 years following the intake. The dose equivalent of this absorbed dose is called the committed dose equivalent. Various organs have different susceptibilities to harm from radiation. The quantity that takes these different susceptibilities into account is called the committed effective dose equivalent, and it provides a broad indicator of the risk to the health of an individual from radiation. The committed effective dose equivalent is a weighted sum of the committed dose equivalent in each major organ or tissue. The concept of committed effective dose equivalent applies only to internal pathways.

Radiation Protection Guides

Various organizations have issued radiation protection guides. The responsibilities of the main radiation safety organizations, particularly those that affect policies in the United States, are summarized.

International Commission on Radiological Protection

This commission has the responsibility for providing guidance in matters of radiation safety. The operating policy of this organization is to prepare recommendations to deal with basic principles of radiation protection and to leave to the various national protection committees the responsibility of introducing the detailed technical regulations, recommendations, or codes of practice best suited to the needs of their countries.

National Council on Radiation Protection and Measurements

In the United States, this council is the national organization that has the responsibility to adapt and provide detailed technical guidelines for implementing the International Commission on Radiological Protection recommendations. The organization consists of technical experts who are specialists in radiation protection and scientists who are experts in disciplines that form the basis for radiation protection.

National Research Council/National Academy of Sciences

The National Research Council is an organization within the National Academy of Sciences that associates the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the Federal Government.

Limits of Radiation Exposure

Limits of exposure to members of the public and radiation workers are based on International Commission on Radiological Protection recommendations. Each regulatory organization adopts the International Commission on Radiological Protection's recommendations and sets specific annual exposure limits (usually less than those specified by the commission). For nuclear facilities, annual exposure limits to the public are provided by the U.S. Nuclear Regulatory Commission (NRC) in 10 CFR 20, and 10 CFR 50, Appendix I. For accidents of unlikely probability of occurrence, (a likelihood of between 1-in-100 to 1-in-10,000 years), 10 CFR 100 provides the maximum exposure to the public residing at the site boundary. The dose limits for radiation workers are provided in 10 CFR 20. The U.S. Department of Energy (DOE) also has established a set of limits for radiation workers in 10 CFR 835. **Table C–1** provides the various exposure limits set by the NRC, DOE, and the U.S. Environmental Protection Agency (EPA) for radiation workers and members of the public.

Table C–1 Exposure Limits for Members of the Public and Radiation Workers

Guidance Criteria (Organization)	*Public Exposure Limits at the Site Boundary*	*Worker Exposure Limits*
Normal Operations		
10 CFR 20 (NRC)	100[a] millirem per year, all pathways	5,000 millirem per year
10 CFR 50, Appendix I (NRC)[b]	5 millirem per year, air (external); 3 millirem per year, liquid (total body) 15 millirem per year, air (maximum organ) 10 millirem per year, liquid (maximum organ)	-
40 CFR 190 (EPA)	25 millirem per year, all pathways	-
10 CFR 835 (DOE)[c]	-	5,000 millirem per year
DOE Order 5400.5 (DOE)[c]	10 millirem per year (all air pathways) 4 millirem per year (drinking water pathway) 100 millirem per year (all pathways)	-
40 CFR 61 (EPA)	10 millirem per year (all air pathways)	-
Facility Accidents		
10 CFR 100.11 (NRC)[d]	25 rem (total body dose from gamma and beta) 300 rem (thyroid inhalation dose)	-

[a] An NRC licensee may apply for prior NRC authorization to operate up to an annual dose limit of 500 millirem for an individual member of the public.
[b] Design objectives for equipment to control releases of radioactive materials in effluents from nuclear power reactors.
[c] The nuclear facilities are regulated by the NRC. DOE exposure limits are only included for comparison purposes.
[d] This guidance criteria is used to determine the exclusion area and low population zone for a nuclear power plant site.

C.2.1.2 Health Effects

Radiation exposure and its consequences are topics of interest to the general public. To provide the background for discussions of impacts, this section explains the basic concepts used in the evaluation of radiation effects.

Radiation can cause a variety of damaging health effects in people. The most significant effects are induced cancer fatalities. These effects are referred to as “latent” cancer fatalities because the cancer may take many years to develop. In the discussions that follow, all fatal cancers are considered latent; therefore, the term “latent” is not used.

The National Research Council’s Committee on the Biological Effects of Ionizing Radiation (BEIR) has prepared a series of reports to advise the U.S. Government on the health consequences of radiation exposures. *Health Effects of Exposure to Low Levels of Ionizing Radiation*, BEIR V, (NAS 1990), provides the most current estimates for excess mortality from leukemia and cancers other than leukemia that are expected to result from exposure to ionizing radiation. BEIR V provides estimates that are consistently higher than those in its predecessor, BEIR III. This increase is attributed to several factors, including the use of a linear dose response model for cancers other than leukemia, revised dosimetry for the Japanese atomic bomb survivors, and additional follow-up studies of the atomic bomb survivors and other cohorts. BEIR III employs constant, relative, and absolute risk models, with separate coefficients for each of several sex and age-at-exposure groups. BEIR V develops models in which the excess relative risk is expressed as a function of age at exposure, time after exposure, and sex for each of several cancer categories. The BEIR III models were based on the assumption that absolute risks are comparable between the atomic bomb survivors and the U.S.

population. BEIR V models were based on the assumption that the relative risks are comparable. For a disease such as lung cancer, where baseline risks in the United States are much larger than those in Japan, the BEIR V approach leads to larger risk estimates than the BEIR III approach.

The models and risk coefficients in BEIR V were derived through analyses of relevant epidemiologic data that included the Japanese atomic bomb survivors, ankylosis spondylitis patients, Canadian and Massachusetts fluoroscopy (breast cancer) patients, New York postpartum mastitis (breast cancer) patients, Israeli tinea capitis (thyroid cancer) patients, and Rochester thymus (thyroid cancer) patients. Models for leukemia, respiratory cancer, digestive cancer, and other cancers used only the atomic bomb survivor data, although results of analyses of the ankylosis spondylitis patients were considered. Atomic bomb survivor analyses were based on revised dosimetry, with an assumed relative biological effectiveness of 20 for neutrons, and were restricted to doses less than 400 rads. Estimates of risks of fatal cancers other than leukemia were obtained by totaling the estimates for breast cancer, respiratory cancer, digestive cancer, and other cancers.

The National Council on Radiation Protection and Measurements (NCRP 1993), based on the radiation risk estimates provided in BEIR V and the International Commission on Radiological Protection Publication 60 recommendations (ICRP 1991), has estimated the total detriment resulting from low dose[1] or low dose rate exposure to ionizing radiation to be 0.00073 per rem for the general population and 0.00056 per rem for the working population. The total detriment includes fatal and nonfatal cancer and severe hereditary (genetic) effects. The major contribution to the total detriment is from fatal cancer and is estimated to be 0.0004 and 0.0005 per rem for the radiation workers and the general population, respectively. **Table C–2** provides the breakdown of the risk factors for both the workers and the general population.

Table C–2 Nominal Health Effects Coefficients (Risk Factors) from Ionizing Radiation

Exposed Population	*Fatal Cancer* [a,c]	*Nonfatal Cancer* [b]	*Genetic Disorders* [b]	*Total*
Working Population	0.0004	0.00008	0.00008	0.00056
General Population	0.0005	0.0001	0.00013	0.00073

[a] For fatal cancer, the health effect coefficient is the same as the probability coefficient.
[b] In determining a means of assessing health effects from radiation exposure, the International Commission on Radiological Protection has developed a weighting method for nonfatal cancers and genetic effects. Genetic effects only can be applied to a population, not individuals.
[c] For high individual exposures (greater than or equal to 20 rem), the health factors are multiplied by a factor of 2.
Source: NCRP 1993.

The numerical estimates of cancer fatalities presented in this EIS were obtained using a linear extrapolation from the nominal risk estimated for lifetime total cancer mortality, which is 0.1 Gray (10 rad). Other methods of extrapolation to the low-dose region could yield higher or lower numerical estimates of cancer fatalities. Studies of human populations exposed to low doses are inadequate to demonstrate the actual level of risk. There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiologic observation, and the possibility of no risk cannot be excluded (CIRRPC 1992).

[1]The low dose is defined as the dose level where DNA repair can occur in a few hours after irradiation-induced damage. Currently, a dose level of about 0.2 Grays (20 rad), or a dose rate of 0.1 milligrays (0.01 rad) per minute is considered to allow the DNA to repair itself in a short period (EPA 1994).

Health Effect Risk Factors Used in This EIS

Health impacts from radiation exposure, whether from sources external or internal to the body, generally are identified as “somatic” (i.e., affecting the exposed individual) or “genetic” (i.e., affecting descendants of the exposed individual). Radiation is more likely to produce somatic effects than genetic effects. The somatic risks of most importance are induced cancers. Except for leukemia, which can have an induction period (time between exposure to carcinogen and cancer diagnosis) of as little as 2 to 7 years, most cancers have an induction period of more than 20 years.

For a uniform irradiation of the body, the incidence of cancer varies among organs and tissues; the thyroid and skin demonstrate a greater sensitivity than other organs. Such cancers, however, also produce relatively low mortality rates because they are relatively amenable to medical treatment. Because of the readily available data for cancer mortality rates and the relative scarcity of prospective epidemiologic studies, somatic effects leading to cancer fatalities rather than cancer incidence are presented in this EIS. The numbers of cancer fatalities can be used to compare the risks among the various alternatives.

Based on the preceding discussion and the values presented in Table C–2, the fatal cancers to the general public during normal operations and for accidents in which individual doses are less than 20 rem are calculated using a health risk factor of 0.0005 per person-rem. For workers, a risk factor of 0.0004 excess fatal cancer per person-rem is used. This lower value reflects the absence of children (who are more radiosensitive than adults) in the workforce. Nonfatal cancer and genetic disorders among the public are 20 and 26 percent, respectively, of the fatal cancer risk factor. For workers, the health risk estimators are both 20 percent of the fatal cancer risk factor. These factors are not used in this EIS.

The risk factors are used to calculate the statistical expectation of the effects of exposing a population to radiation. For example, in a population of 100,000 people exposed only to natural background radiation (300 millirem per year), it is expected that about 15 latent cancer fatalities per year of exposure would result from this radiation (100,000 persons × 0.3 rem per year × 0.0005 latent cancer fatalities per person-rem = 15 latent cancer fatalities per year).

Calculations of the number of excess cancer fatalities associated with radiation exposure do not always yield whole numbers; calculations may yield numbers less than 1.0, especially in environmental impact applications. For example, if a population of 100,000 were exposed to a total dose of only 0.001 rem per person, the collective dose would be 100 person-rem, and the corresponding estimated number of latent cancer fatalities would be 0.05 (100,000 persons × 0.001 rem × 0.0005 latent cancer fatalities per person-rem = 0.05 latent cancer fatalities). The latent cancer fatality of 0.05 is the *expected* number of deaths that would result if the same exposure situation were applied to many different groups of 100,000 people. In most groups, no person (0 people) would incur a latent cancer fatality from the 0.001 rem dose each member would have received. In a small fraction of the groups, 1 latent cancer fatality would result; in exceptionally few groups, 2 or more latent cancer fatalities would occur. The *average* expected number of deaths over all the groups would be 0.05 latent cancer fatalities (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome is 0 latent cancer fatalities.

These same concepts apply to estimating the effects of radiation exposure on a single individual. Consider the effects, for example, of exposure to background radiation over a lifetime. The “number of latent cancer fatalities” corresponding to a single individual’s exposure over a (presumed) 72-year lifetime to 0.3 rem per year is 0.011 latent cancer fatalities (1 person × 0.3 rem per year × 72 year × 0.0005 latent cancer fatalities/person-rem = 0.011 latent cancer fatalities).

Again, this is a statistical estimate. That is, the estimated effect of background radiation exposure on the exposed individual would produce a 1.1 percent chance that the individual might incur a latent cancer fatality caused by the exposure over his full lifetime. Presented another way, this method estimates that approximately 1.1 percent of the population might die of cancers induced by background radiation.

C.2.2 Tritium Characteristics and Biological Properties

C.2.2.1 Tritium Characteristics

Ordinary hydrogen (also called protium), deuterium, and tritium are the three isotopes of hydrogen. Tritium is the only one of the three isotopes that is radioactive. The nucleus of a hydrogen atom contains one proton, a positively charged particle. Around this nucleus orbits a single electron, a negatively charged particle that has a significantly smaller mass than the proton. Ordinary hydrogen, comprising over 99.9 percent of all naturally occurring hydrogen, has one proton and no neutrons. The nucleus of a deuterium atom contains one proton and one neutron. Deuterium comprises approximately 0.015 percent of all hydrogen. The nucleus of the tritium atom contains one proton and two neutrons. Tritium makes up only 1×10^{-18} percent of natural hydrogen. The chemical symbol for hydrogen is H. When designating the different isotopes, the isotopic number is added to the symbol so that protium becomes H^1, deuterium H^2, and tritium H^3. Deuterium and tritium are also represented as D and T, respectively.

In the radioactive decay of tritium, the nucleus emits a beta particle, a negatively charged particle similar to an electron. Upon emission of the beta particle the tritium atom is transformed into a helium atom, helium-3, with two protons and one neutron. Tritium has a half-life of approximately 12.3 years. Any amount of tritium will be reduced by 10 percent in 2 years, 25 percent in 5 years, 50 percent in 12.3 years, and 90 percent in 42 years.

As stated earlier, the emitted beta particle is a form of ionizing radiation. It will interact with the atoms and molecules in the environment around the tritium atom, ionizing atoms by removing electrons from their orbit. The beta particles emitted from a decaying tritium atom are relatively low energy particles and can be stopped by a sheet of paper or skin. Therefore, health effects on humans may result from ingestion (either eating or drinking), inhalation, or skin absorption of tritium. External exposure to tritium does not pose a significant health risk.

Because tritium undergoes radioactive decay, it must be constantly created through either natural or manmade processes. Natural sources of tritium result from the interaction of cosmic radiation and gases in the upper atmosphere. Nuclear power reactors are one manmade source for producing tritium. In a reactor core, lithium can be transformed into tritium via neutron capture. The lithium atom, with three protons and three neutrons, and the captured neutron combine to form a lithium atom with three protons and four neutrons that will instantaneously split to form an atom of tritium (one proton and two neutrons) and an atom of helium (helium-4, with two protons and two neutrons).

The following information on the biological impact of tritium is taken from the *Primer on Tritium Safe Handling Practices* (DOE 1994).

C.2.2.2 Biological Properties of Tritium

At most tritium facilities, the most commonly encountered forms of tritium are tritium gas and tritium oxide, also called "tritiated water." Other forms of tritium may be present, such as metal tritides, tritiated pump oil, and tritiated gases like methane and ammonia. Deuterated and tritiated compounds generally have the same chemical properties as their protium counterparts, although some minor isotopic differences in reaction rates exist. These various tritiated compounds have a wide range of metabolic properties in humans under similar exposure conditions. For example, inhaled tritium gas is only slightly incorporated into the body during exposure, and the remainder is rapidly removed by exhalation following the exposure. On the other hand, tritiated water vapor is readily taken up and retained in the body water. This discussion is limited to the effects of tritium gas and tritium oxide, the two compounds with the potential to have the most significant impact on workers and the public.

Metabolism of Gaseous Tritium

During a brief exposure to tritium gas, the gas would be inhaled and a small amount would be dissolved in the bloodstream. The dissolved gas would circulate in the bloodstream before being exhaled along with the gaseous waste products (carbon dioxide) and normal water vapor. If the exposure persists, the gas will reach other body fluids. A small percentage of the gaseous tritium would be converted to tritium oxide, most likely by oxidation in the gastrointestinal tract. Early experiments involving human exposure to a concentration of 9 microcuries per milliliter resulted in an increase in the tritium oxide concentration in urine of 7.7×10^{-3} microcuries per milliliter per hour of exposure. Although independent of the breathing rate, this conversion can be expressed as the ratio of the tritium oxide buildup to the tritium inhaled as tritium gas at a nominal breathing rate (20 liters per minute). In this context, the conversion is 0.003 percent of the total gaseous tritium inhaled. More recent experiments with six volunteers resulted in a conversion of 0.005 percent. For gaseous tritium exposures, there are two doses: (1) a lung dose from the tritium in the air inside the lung, and (2) a whole body dose from the tritium gas that has been converted to tritium oxide. The tritiated water converted from the gas in the body behaves as an exposure to tritiated water. Intake of gaseous tritium through the skin has been found to have negligible effects compared with those from inhalation. Small amounts of tritium can enter the skin through unprotected contact with contaminated metal surfaces, which results in organically bound tritium in skin and in urine.

Metabolism of Tritiated Water

The biological incorporation (uptake) of airborne tritium oxide can be extremely efficient—up to 99 percent of inhaled tritium oxide would be taken into the body by the circulating blood. Ingested liquid tritium oxide also would be almost completely absorbed by the gastrointestinal tract and would appear quickly in the bloodstream. Within minutes, it would be found in varying concentrations in the organs, fluids, and tissues of the body. Skin absorption of airborne tritium oxide also is important, especially during hot weather, because of the normal movement of water through the skin. For skin temperatures between 30 and 40°C (86 to 104°F), the absorption of tritium oxide is about 50 percent of that for tritium oxide by inhalation (assuming an average breathing rate associated with light work of 20 liters per minute). No matter how it is absorbed, the tritium oxide would be uniformly distributed in all biological fluids within one to two hours. In addition, a small fraction of the tritium would be incorporated into easily exchanged hydrogen sites in organic molecules. Hence, retention of tritiated water can be described as the sum of several terms: (1) shorter-term retention time associated with the tritium oxide that characteristically behaves like body water, and (2) longer-term retention time that represents the tritium incorporated in body organs.

Biological Half-Life of Tritium Oxide (Tritiated Water)

Biological half-life is a measure of how long tritium would remain in the human body. Studies of biological elimination rates of body water in humans date back to 1934, when the body water turnover rate was measured using deuteriated water, a water molecule containing deuterium (H^2). Since that time, several additional studies have been conducted with deuteriated water and tritiated water. A simple average of the data suggests a value of 9.5 days for the measured biological half-life of water in the body with a deviation of ±50 percent.

Calculations based on total fluid intake indicate a similar value. This is reasonable because the turnover rate of tritiated water should be identical to that of body water. In order words, the biological half-life of tritium is a function of the average daily throughput of water. The biological half-life of tritium oxide has been studied when outdoor temperatures varied at the time of tritium uptake. The data suggest that biological half-lives are shorter in warmer months (a measured 7.5-day half-life in an environment with a mean outdoor temperature of 27°C (~81°F) in contrast to an average measured 9.5-day half-life in an environment with a mean outdoor temperature of 17°C (~63°F)). Such findings are consistent with metabolic pathways involving sensible and insensible perspiration. As such, the skin absorption and perspiration pathways can become an important part of body water exchange routes. It is important to note that a person who is perspiring will have a greater absorption of tritium from contact with tritiated surfaces.

Prolonged exposures can be expected to affect the biological half-life. This results from the longer-term components of the retention of tritium in the body. Tritium's interaction with organic hydrogen can result in additional half-life components ranging from 21 to 320 days and 250 to 550 days. The shorter duration indicates that organic molecules in the body retain tritium relatively briefly. The longer duration indicates long-term retention by other compounds in the body that do not readily exchange hydrogen or that metabolize more slowly. However, the overall contribution from organically bound tritium is relatively small—less than about 5 percent for acute exposures and about 10 percent for chronic exposures. Methods used to compute the annual limits on intake of air and water specify only the body water component and include the assumption of a 10-day biological half-life, as mentioned above.

Bioassay and Internal Dosimetry

Exposure to tritium oxide is by far the most important type of tritium exposure. The tritium oxide enters the body by inhalation or skin absorption. When immersed in tritiated water vapor, the body takes in approximately twice as much tritium through the lungs as through the skin. Once in the body, it is circulated by the blood stream and finds its way into fluids both inside and outside the cells.

According to the International Commission on Radiological Protection (ICRP 1980), the derived air concentration for tritium gas and tritium oxide are 540,000 microcuries per cubic meter and 21.6 microcuries per cubic meter, respectively. The derived air concentration is defined as that concentration of a gas which, if a worker were exposed to it for one working year (2,000 hours), would result in an annual dose of 5 rem. The ratio of these derived air concentrations (25,000) is based on a lung exposure from the gas and a whole body exposure from the oxide. However, as noted earlier, when a person is exposed to tritium gas in the air, an additional dose actually results—one to the whole body. During exposure to tritium gas, a small fraction of the tritium exchanges in the lungs and is transferred by the blood to the gastrointestinal tract where it is oxidized by enzymes. This process results in a buildup of tritium oxide until the tritium gas is removed by exhalation at the end of the exposure. The resultant dose from exposure to this tritium oxide is roughly comparable to the lung dose from exposure to tritium gas. Thus, the total effective dose from a tritium gas exposure is about 10,000 times less than the total effective dose from an equal exposure to airborne tritium oxide.

C.2.2.3 Genetic Effects of Tritium

As stated earlier, tritium moves readily through the bloodstream after uptake in the body. The low energy of tritium beta particle emissions limits its range in tissue and results in a unique radiation dose pattern. The potential genetic hazard of tritium has been studied in a variety of systems using both prokaryotes[2] and eukaryotes[2]. This research, presented at the Workshop on Tritium Radiobiology and Health Physics, has been summarized in the National Council on Radiation Protection and Measurements Report No. 63 (NCRP 1979). A review of these studies, as given in the National Council on Radiation Protection and Measurements Report No. 89 (NCRP 1987a), concluded that, although transmutational effects exist in both whole animals and *in vitro* cell systems, their effects in the whole animal relative to the effect from a beta particle dose from tritium are small and should receive minor consideration in estimating genetic risks from tritium.

[2]*Organisms with one or more cells that have a visible, evident nucleus.*

Additional studies were performed as a result of: (1) allegations of links between tritium releases and deaths from congenital anomalies around Canada's Pickering Nuclear Generating Station and (2) concerns about excess cancers from tritium releases during a 1960's detonation in an underground salt dome in Lamar County, Mississippi.

In the first study (AECB 1991), conducted for the Atomic Energy Control Board of Canada, the analysis did not support the hypothesis of increased rates of stillbirths, neonatal mortality, increased prevalence of birth defects, or significant correlation between tritium release and Down's Syndrome. In the second study (Richter and Stockwell 1998), conducted by the DOE Office of Epidemiological Studies, the investigators found no association between cancer mortality and distance from the center of detonation.

C.3 METHODOLOGY FOR ESTIMATING RADIOLOGICAL IMPACTS

The radiological impacts from normal operation of the reactor facilities were calculated using Version 1.485 of the GENII computer code (PNL 1988). Site-specific input data were used, including location, meteorology, population, food production and consumption, and source terms. Section C.3.1 briefly describes GENII and outlines the approach used for normal operations.

C.3.1 GENII Computer Code

The GENII computer model, developed by Pacific Northwest National Laboratory, is an integrated system of various computer modules that analyze environmental contamination resulting from acute or chronic releases to, or initial contamination in, air, water, or soil. The model calculates radiation doses to individuals and populations. The GENII computer model is well documented for assumptions, technical approach, method, and quality assurance issues (PNL 1988). The GENII computer model has gone through extensive quality assurance and quality control steps, including comparing results from model computations with those from hand calculations and performing internal and external peer reviews. Recommendations given in these reports were incorporated into the final GENII computer model, as appropriate.

For this EIS, only the ENVIN, ENV, and DOSE computer modules were used. The codes are connected through data transfer files. The output of one code is stored in a file that can be used by the next code in the system. The functions of the three GENII computer modules used in this EIS are discussed below.

ENVIN

The ENVIN module of the GENII code controls the reading of input files and organizes the input for optimal use in the environmental transport and exposure module, ENV. The ENVIN code interprets the basic input, reads the basic GENII data libraries and other optional input files, and organizes the input into sequential segments based on radionuclide decay chains.

A standardized file that contains scenario, control, and inventory parameters is used as input to ENVIN. Radionuclide inventories can be entered as functions of releases to air or water, concentrations in basic environmental media (air, soil, or water), or concentrations in foods. If certain atmospheric dispersion options have been selected, this module can generate tables of atmospheric dispersion parameters that will be used in later calculations. If the finite plume air submersion option is requested in addition to the atmospheric dispersion calculations, preliminary energy-dependent finite plume dose factors can be prepared as well. The ENVIN module prepares the data transfer files that are used as input by the ENV module; ENVIN generates the first portion of the calculation documentation—the run input parameters report.

ENV

The ENV module calculates the environmental transfer, uptake, and human exposure to radionuclides that result from the chosen scenario for the user-specified source term. The code reads the input files from ENVIN and then, for each radionuclide chain, sequentially performs the precalculations to establish the conditions at the start of the exposure scenario. Environmental concentrations of radionuclides are established at the beginning of the scenario by assuming decay of preexisting sources, considering biotic transport of existing subsurface contamination, and defining soil contamination from continuing atmospheric or irrigation depositions. For each year of postulated exposure, the code then estimates the air, surface soil, deep soil, groundwater, and surface water concentrations of each radionuclide in the chain. Human exposures and intakes of each radionuclide are calculated for: (1) pathways of external exposure from finite atmospheric plumes; (2) inhalation; (3) external exposure from contaminated soil, sediments, and water; (4) external exposure from special geometries; and (5) internal exposures from consumption of terrestrial foods, aquatic foods, drinking water, animal products, and inadvertent intake of soil. The intermediate information on annual media concentrations and intake rates are written to data transfer files. Although these may be accessed directly, they are usually used as input to the DOSE module of GENII.

DOSE

The DOSE module reads the intake and exposure rates defined by the ENV module and converts the data to radiation dose.

C.3.2 Data and General Assumptions

To perform the dose assessments for this EIS, different types of data were collected and generated. In addition, calculational assumptions were made. This section discusses the data collected and generated (SAIC 1998) for use in performing the dose assessments and the assumptions made for this EIS.

Meteorological Data

The meteorological data used for all normal operational scenarios discussed in this EIS were in the form of joint frequency data files. A joint frequency data file is a table listing the fractions of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The joint frequency data files were based on measurements taken over a period of several years at different locations and heights at each of the sites. Average annual meteorological conditions (averaged over the measurement period) as given in the plant's final safety analysis reports were used for normal operation.

Population Data

Population distributions were based on the *1990 Census of Population and Housing* data (DOC 1992). Projections were determined for the year 2025 (approximate midlife of operations) for areas within 80 kilometers (50 miles) of the release location at the three candidate reactor sites. The site population in 2025, assumed to be representative of the population over the operational period evaluated, was used in the impact assessments. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances up to 80 kilometers (50 miles). The grid was centered at the precise location from which the radionuclides were assumed to be released.

Source Term Data

The tritium-producing burnable absorber rod (TPBAR) source terms (i.e., quantities of tritium [in the form of tritium oxide] released to the environment over a given period) were estimated based on anticipated TPBAR characteristic releases. The source terms used to generate the estimated incremental impacts of normal operations are provided in Section C.3.4 for each of the three candidate reactor sites evaluated in this EIS.

Food Production and Consumption Data

Data from the *1992 Census of Agriculture* (DOC 1993) were used to generate site-specific data for food production. Food production was spatially distributed on the same circular grid used for the population distributions. The consumption rates used in GENII were those for the maximum individual and the average individual. People living within the 80-kilometer (50-mile) assessment area were assumed to consume only food grown in that area.

Calculational Assumptions

Dose assessments were performed for both members of the general public and workers for each reactor site examined in this EIS. These assessments were made to determine the incremental doses that would be associated with the tritium production alternatives addressed in this EIS. Incremental doses for members of the public were calculated (via GENII) for two different types of receptors:

- Maximally Exposed Offsite Individual—The maximally exposed individual was assumed to be located at a position on the site boundary that would yield the highest impacts during normal operations of a given alternative.

- Population—The general population living within 80 kilometers (50 miles) of the facility in the year 2025.

To estimate radiological impacts from normal operations, the following additional assumptions and factors were considered in using GENII:

- Radiological gaseous emissions were assumed to be released to the atmosphere through the plant stack; for Watts Bar 1, Sequoyah 1, or Sequoyah 2, the stack height is 40 meters (131 feet), and for Bellefonte 1 or Bellefonte 2, it is 83 meters (272 feet).

- Ground surfaces were assumed to have no previous deposition of radionuclides.

- The annual external exposure time to the plume and to soil contamination was 0.7 years (16.8 hours per day) for the maximally exposed offsite individual (NRC 1977b).

- The annual external exposure time to the plume and to soil contamination was 0.5 years (12 hours per day) for the population (NRC 1977b).

- The inhalation exposure time to the plume was 1.0 years for the maximally exposed individual and general population.

- The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of an adult human.

- A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure; inhalation; ingestion of food crops and animal products contaminated by either deposition of radioactivity from the air or irrigation; ingestion of fish and other aquatic food raised in contaminated water; swimming and boating in contaminated surface water; and drinking contaminated water. All applicable pathways (e.g., inhalation, drinking water, external exposure) were analyzed at each of the three reactor site locations.

- Reported release heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative, as use of the actual stack height negates plume rise.

- The calculated doses were 50-year committed doses from 1 year of intake.

- Average volumetric river flow rates (measured locally downstream of each site; see Table C–6) were used.

- Individual annual exposure times to swimming, boating, and shoreline recreation were taken from site environmental reports and NRC Regulatory Guide 1.109, as appropriate (TVA 1997, NRC 1995, TVA 1974a, TVA 1974b, NRC 1977b).

- For conservatism, a transit time of zero was assumed for releases to reach aquatic recreation areas.

- The year 2025 drinking water population was estimated by applying the same growth factor as given for the entire 80-kilometer (50-mile) radius population within each respective plant's final environmental statement (NRC 1995, AEC 1974, TVA 1974a). The estimated fish-eating population in year 2025 was conservatively assumed to equal the drinking water population.

- Drinking water treatment was assumed, with a holdup (transit) time of 0.5 days for the Watts Bar and Sequoyah Nuclear Plants and 0.2 days for the Bellefonte Nuclear Plant.

- Annual drinking water quantities for the average and maximally exposed individual were referenced from NRC Regulatory Guide 1.109 (NRC 1977b).

- Fish consumption data were referenced from NRC Regulatory Guide 1.109 (NRC 1977b).

The exposure, uptake, and usage parameters used in the GENII model for normal operations are provided in **Tables C–3, C–4, C–5**, and **C–6**.

Table C–3 GENII Exposure Parameters to Plumes and Soil Contamination (Normal Operations)

Maximally Exposed Offsite Individual				*General Population*			
External Exposure		*Inhalation of Plume*		*External Exposure*		*Inhalation of Plume*	
Plume (hours)	*Soil Contamination (hours)*	*Exposure Time (hours)*	*Breathing Rate (cubic centimeters per second)*	*Plume (hours)*	*Soil Contamination (hours)*	*Exposure Time (hours)*	*Breathing Rate (cubic centimeters per second)*
6,136	6,136	8,766	270	4,383	4,383	8,766	270

Source: PNL 1988.

Table C–4 GENII Usage Parameters for Consumption of Terrestrial Food

Food Type	*Maximally Exposed Offsite Individual*				*General Population*			
	Growing Time (days)	*Yield (kilograms per square meter)*	*Holdup Time (days)*	*Consumption Rate (kilograms per year)*	*Growing Time (days)*	*Yield (kilograms per square meter)*	*Holdup Time (days)*	*Consumption Rate (kilograms per year)*
Leafy Vegetables	90.0	1.5	1.0	30.0	90.0	1.5	14.0	15.0
Root Vegetables	90.0	4.0	5.0	220.0	90.0	4.0	14.0	140.0
Fruit	90.0	2.0	5.0	330.0	90.0	2.0	14.0	64.0
Grains/Cereals	90.0	0.8	180.0	80.0	90.0	0.8	180.0	72.0

Source: PNL 1988.

Table C–5 GENII Usage Parameters for Consumption of Animal Products

Food Type	*Human Consumption Rate (kilograms per year)*	*Holdup Time (days)*	*Animal Stored Feed*				*Animal Fresh Forage*			
			Diet Fraction	*Growing Time (days)*	*Yield (kilograms per square meter)*	*Storage Time (days)*	*Diet Fraction*	*Growing Time (days)*	*Yield (kilograms per square meter)*	*Storage Time (days)*
Maximally Exposed Offsite Individual										
Beef	80.0	15.0	0.25	90.0	0.80	180.0	0.75	45.0	2.00	100.0
Poultry	18.0	1.0	1.00	90.0	0.80	180.0	–	–	–	–
Milk	270.0	1.0	0.25	45.0	2.00	100.0	0.75	30.0	1.50	0.00
Eggs	30.0	1.0	1.00	90.0	0.80	180.0	–	–	–	–
General Population										
Beef	70.0	34.0	0.25	90.0	0.80	180.0	0.75	45.0	2.00	100.0
Poultry	8.5	34.0	1.0	90.0	0.80	180.0	–	–	–	–
Milk	230.0	3.0	0.25	45.0	2.00	100.0	0.75	30.0	1.50	0.00
Eggs	20.0	18.0	1.0	90.0	0.80	180.0	–	–	–	–

Source: PNL 1988.

Incremental worker doses associated with tritium production activities were determined from historical data associated with similar operations (TVA 1998b). Very small incremental doses to reactor facility workers may result from refueling outage activities and increased resin bed handling. Estimated baseline and incremental worker doses at the reactor sites are supplied in referenced data reports (TVA 1998a, NRC 1997). Worker doses are provided in Section 5 of this EIS.

Table C–6 GENII Liquid Pathway Parameters

Parameter	Plant		
	Sequoyah	Watts Bar	Bellefonte
Average river volumetric flow rate (cubic meters per second)	850	940	1,100
Swimming exposure time per year (hours)	918 – Maximum 22 – Average	918 – Maximum 22 – Average	918 – Maximum 22 – Average
Boating exposure time per year (hours)	1,500 – Maximum 104 – Average	1,500 – Maximum 104 – Average	1,500 – Maximum 104 – Average
River shoreline exposure time per year (hours)	500–Maximum 8.3–Average	500–Maximum 8.3–Average	500–Maximum 8.3–Average
Transit time for releases to reach aquatic recreation	0	0	0
Year 2025 population ingesting drinking water and fish	524,000	274,000	230,000
Drinking water holdup time (days)	0.5	0.5	0.2[a]
Drinking water consumption rate (liters per year)	730–Maximum 370–Average	730–Maximum 370–Average	730–Maximum 370–Average
Fish Consumption Rate (pounds per year)	45–Maximum 15.2–Average	45–Maximum 15.2–Average	45–Maximum 15.2–Average

[a] This value is calculated based on average river water velocity and the distance between the plant discharge location to water treatment plant (TVA 1974a).

Sources: NRC 1995, NRC 1977a, AEC 1974, TVA 1974a, TVA 1974b, TVA 1997, TVA 1991, TVA 1995, TVA 1996.

C.3.3 Uncertainties

The sequence of analyses performed to generate the radiological impact estimates from normal operation include: (1) selection of normal operational modes, (2) estimation of source terms, (3) estimation of environmental transport and uptake of radionuclides, (4) calculation of radiation doses to exposed individuals, and (5) estimation of health effects. There are uncertainties associated with each of these steps. Uncertainties exist in the way the physical systems being analyzed are represented by the computational models and in the data required to exercise the models (due to measurement, sampling, or natural variability).

In principle, one can estimate the uncertainty associated with each source and predict the remaining uncertainty in the results of each set of calculations. Thus, one can propagate the uncertainties from one set of calculations to the next and estimate the uncertainty in the final results. However, conducting such a full-scale quantitative uncertainty analysis is neither practical nor a standard practice for a study of this type. Instead, the analysis is designed to ensure—through judicious selection of release scenarios, models, and parameters—that the results represent the potential risks. This is accomplished by making conservative assumptions in the calculations at each step. The models, parameters, and release scenarios used in the calculations are selected in such a way that most intermediate results and, consequently, the final estimates of impacts, are greater than would be expected. As a result, even though the range of uncertainty in a quantity might be large, the value calculated for the quantity would be close to one of the extremes in the range of possible values, so the chance of the actual quantity being greater than the calculated value would be low (or the chance of the quantity being less than the calculated value if the criteria are such that the quantity has to be maximized). The goal of the radiological assessment for normal operation in this study has been to produce results that are conservative.

The degree of conservatism in the calculated results is closely related to the range of possible values the quantity can have. This range is determined by what can be expected to realistically occur. Thus, the only processes considered are those that are credible for the conditions under which the physical system being modeled operates. This consideration has been employed for the normal operation analyses.

Although the radionuclide composition of source terms are reasonable estimates, there are uncertainties in the radionuclide inventory and release reactions that affect estimated impacts.

C.3.4 Radiological Releases to the Environment and Associated Impact

The NRC has assessed the potential radiation doses to individuals and surrounding populations that could result from the operation of the Watts Bar, Sequoyah, and Bellefonte Nuclear Plants in the related facilities' Final Environmental Statements (NRC 1995, AEC 1974, TVA 1974a). To assess the potential radiation dose to the individual and population from the operation of these plants in a tritium-producing mode, this EIS uses the results in those statements and superimposes the doses that would result from additional releases of tritium. The dose assessment uses the method prescribed by the NRC in Regulatory Guides 1.109 (NRC 1977b), 1.111 (NRC 1977a), and 4.2 (NRC 1976), with the adjustments as needed.

Radiological Releases to the Environment

Normal operational radiological assessments were determined (modeled) for two tritium production scenarios at each candidate reactor site: (1) production of tritium via the loading of 1,000 TPBARs into a reactor core, and (2) production of tritium via the loading of a maximum number of TPBARs into a reactor core. The maximum number of TPBARs that can be loaded in each reactor varies among the three candidate sites. For calculational purposes in this EIS, the maximum number of TPBARs was assumed to be 3,400.

During tritium production, some tritium is expected to permeate through the TPBARs, leading to an increase in the quantity of tritium in the reactor's coolant water system. Any tritium that is released from the TPBARs during normal plant operation enters the reactor coolant system and is distributed throughout the reactor coolant, chemical volume control, liquid radwaste, and gaseous radwaste systems. The rate of this accumulation depends on the coolant system capacities and water volume exchanges associated with the plant's required water chemistry and soluble boron adjustments. The tritium released into the reactor coolant system is processed along with the rest of the coolant, and this evolution provides the avenue for the transport and release of tritium outside the reactor coolant system. For the purposes of the analysis, the design tritium permeation per TPBAR, on average, is assumed to be 1 Curie per year (PNNL 1997, PNNL 1999). The anticipated increases in tritium releases (in Curies) to both the atmosphere (air emission) and the water pathways (liquid effluent) as a result of this design permeation rate are shown in **Table C-7.** These values are based on the assumption that about 90 percent of the tritium in the reactor coolant system would be released in the liquid effluent and 10 percent would be released to the atmosphere as tritiated water vapor (air emissions).

Table C–7 Annual Increase in Tritium Releases to the Environment at Each Site

	1,000 TPBARs Irradiation		*3,400 TPBARs Irradiation*	
	Air Emissions	*Liquid Effluents*	*Air Emissions*	*Liquid Effluents*
Tritium Releases (Curies)	100	900	340	3,060

The design of the TPBARs and the required TPBAR cladding quality assurance essentially preclude the potential for TPBAR failure during irradiation. For the purposes of analyses in this EIS, even though it is unlikely to occur, it was assumed that during a 40-year operation two TPBARs could fail in an operating cycle and release all the tritium generated in the failed TPBARs to the reactor coolant system. The potential increases in tritium releases (in Curies) from the two failed TPBARs to both the air emissions and the liquid effluents over an 18-month operating cycle are shown in **Table C-8.** These values represent the additional releases over that of the normal operation given in Table C-7, and are based on the following assumptions:

- Each TPBAR would generate a maximum design limit of 1.2 grams of tritium over an 18-month operating cycle; the specific activity of tritium is 9,640 Curies per gram (CRC 1982).
- Two failed TPBARs could release a total of about 23,150 Curies of tritium to the reactor coolant system. The design maximum of 1.2 grams of tritium per rod could be released to the reactor coolant system.
- About 90 percent of the tritium in the reactor coolant system would be released in the liquid effluents and 10 percent would be released to the atmosphere.

Table C–8 Increases in Tritium Releases to the Environment from Two Failed TPBARs in an 18-Month Operating Cycle

	Air Emissions	***Liquid Effluents***
Tritium Releases (Curies)	2,315	20,835

The current radioactivity releases in the air emissions and the liquid effluents from normal operation (with zero TPBARs) at Watts Bar 1 and Sequoyah 1 or Sequoyah 2 are given in **Tables C-9** and **C-10.** The estimated radioactivity releases during tritium production at Watts Bar and Sequoyah would be the sum of the values given in these tables and those given in Table C-7. For the Bellefonte Nuclear Plant, it is assumed that the releases would be similar to those of Watts Bar.

Table C–9 Average (1996-1997) Annual Radioactivity Releases to the Air and Liquid at Watts Bar 1

Isotopes[a]	***Air Emissions (Curies)***	***Liquid Effluents (Curies)***
Tritium releases	5.6	639
Other radioactive releases:	283	1.32
Argon-41	1.0	-
Krypton-85	2.4	-
Krypton-85m	0.06	-
Xenon-131m	3.2	-
Xenon-133	271	-
Xenon-133m	1.2	-
Xenon-135	3.9	-
Chromium-51	-	0.14
Cobalt-58	-	0.42
Cobalt-60	-	0.020
Iron-55	-	0.12
Iron-59	-	0.096
Rubidium-88	-	0.012
Antimony-124	-	0.077

Isotopes[a]	Air Emissions (Curies)	Liquid Effluents (Curies)
Antimony-125	-	0.10
Antimony-126	-	0.12
Iodine-131	-	0.017
Cesium-134	-	0.050
Cesium-137	-	0.088
Total Releases	288.6	640.3

[a] Only isotopes with values greater than 0.01 were listed in this table.
Source: TVA 1999.

Table C–10 Average (1995-1997) Annual Radioactivity Releases to the Air and Liquid at Sequoyah 1 or Sequoyah 2

Isotopes[a]	Air Emissions (Curies)	Liquid Effluents (Curies)
Tritium releases	25	714
Other radioactive releases:	120	1.15
Argon-41	0.95	-
Krypton-85	0.32	-
Krypton-85m	0.090	-
Krypton-88	0.068	-
Xenon-131m	1.9	-
Xenon-133	113	-
Xenon-133m	1.5	-
Xenon-135	1.9	-
Xenon-135m	0.032	-
Chromium-51		0.035
Cobalt-58	-	0.65
Cobalt-60	-	0.11
Iron-55	-	0.14
Manganese-54	-	0.014
Niobium-95	-	0.014
Antimony-125	-	0.053
Cesium-134	-	0.03
Cesium-137	-	0.046
Total Releases	145	715.2

[a] Only isotopes with values greater than 0.01 were listed in this table.
Source: TVA 1999.

Radiological Impacts

As stated earlier, doses to members of the public from tritium releases during normal operations were calculated using GENII code (PNL 1988). GENII uses "special" transport assumptions in its evaluation of the tritiated water movement through various food chains. The concentration of tritium in each food type is assumed to have the same specific activity as the contaminating medium (PNL 1988). The assumption is approximately valid for situations involving continuous replenishment of tritium in the medium and represents a conservative approximation for residual tritium in soil (NRC 1994). When soil is contaminated with residual tritium and no tritium from air and water is continually added to the soil, the contamination would be expected to rapidly escape (by evaporation) from the soil or plants that had taken up this tritium. GENII, however, conservatively assumes that the soil tritium is retained and remains available for plant uptake over time.

As a result, the effective dose associated with the ingestion pathway calculated by GENII is very conservative. The calculated ingestion dose is between 80 to 95 percent of the total body dose. In addition, the assumption that people living within 80 kilometers (50 miles) of each site would eat all the contaminated food produced within that area makes the dose calculations even more conservative. Even with this overestimation, all calculated doses resulting from tritium releases during normal operation are within the limits set forth for the operation of each reactor (see **Tables C–11, C–12, and C–13**). Tables C–11, C–12, and C–13 present potential radiological impacts to two individual receptor groups that may be exposed to releases associated with incident-free operation and the abnormal event of two TPBAR failures in a given 18-month fuel cycle for each of the three candidate sites. These two groups are the maximally exposed member of the public and the population living within 80 kilometers (50 miles) of each of the sites in the year 2025. Each table presents the estimated doses from gaseous emissions (air) and liquid effluents (liquid) under the No Action Alternative (current plant conditions), and the estimated incremental doses from tritium releases to air and liquid resulting from 1,000 and 3,400 TPBAR irradiations in each reactor. For Watts Bar and Sequoyah, actual air and liquid doses included in their 1997 operation year environmental reports were used for the No Action Alternative (operation with 0 TPBARs). For Bellefonte, since the plant is not yet operational, the estimated dose values given in the final environmental statement (AEC 1974) were used for the plant operation with 0 TPBARs. The air doses provided in the final environmental statement include external exposure due to gamma rays and beta particles emanating from the gaseous radioactive emissions and thyroid organ dose due to inhalation and ingestion of contaminated air and food (milk), respectively. GENII calculates air doses by considering both the external exposure and the internal exposure to all organs and provides the total effective dose equivalent. Therefore, the results presented in the plant final environmental statements were adjusted (i.e., the organ dose was presented in terms of equivalent whole body dose to enable combination with the external dose) before being added to the incremental doses resulting from tritium releases. The No Action liquid doses given in the plant final environmental statements are the total body doses; therefore, no adjustments were needed.

The following text summarizes the calculated doses presented for the two public groups:

No Action

- The maximally exposed offsite individual doses from air releases were taken directly from plant environmental reports for Watts Bar and Sequoyah (TVA 1998a) and from the final environmental statement for Bellefonte (AEC 1974). For Bellefonte, the dose value given for the external air immersion "total body dose" was added to the maximum thyroid organ dose that accounts for exposures via inhalation and ingestion pathways. The thyroid dose was multiplied by the International Commission on Radiological Protection 26 weighting factor of 0.03 (PNL 1988) to get a "weighted committed dose equivalent" prior to being added to the external air immersion dose.

- Liquid doses to the maximally exposed offsite individual were directly cited from the referenced reports (TVA 1998a, AEC 1974).

- Population doses from air releases were cited directly from the referenced reports (TVA 1998a, AEC 1974) and subsequently were adjusted for the projected population in the year 2025 by applying the demographic growth factors presented in the EIS.

- Population dose from liquid releases were cited from the referenced reports and also were adjusted for the projected population in the year 2025.

Tritium Production:

- Incremental doses from tritium releases under incident-free operation (per air and liquid pathways), calculated for 1,000 and 3,400 TPBARs via the method described in Sections C.3.1 and C.3.2, are presented in Tables C–11 through C–13.

- Total doses (No Action doses + Incremental doses) from incident-free operation under tritium production, presented separately for the air and the liquid releases and then combined to demonstrate regulatory compliance with the applicable standards shown in Table C–1, are presented in Tables C–11 through C–13.

- Incremental doses from tritium release from the abnormal event of two TPBAR failures in a given 18-month fuel cycle are presented in **Table C–14.**

C.4 IMPACTS OF EXPOSURES TO HAZARDOUS CHEMICALS ON HUMAN HEALTH

The potential impacts of exposure to hazardous chemicals released to the atmosphere as a result of tritium production were evaluated for the routine operation of the reactor facilities.

The receptors considered in these evaluations are the maximally exposed individual and the offsite population living within an 80-kilometer (50-mile) radius of the facilities. Impacts of exposures to hazardous chemicals for workers directly involved in reactor operation and tritium production were not quantitatively evaluated because the use of personal protective equipment and engineering process controls would limit their exposure to levels within applicable Occupational Safety and Health Administration Permissible Exposure Limits or American Conference of Governmental Industrial Hygienists Threshold Limit Values.

As a result of releases from the routine operation of the reactor facilities, receptors are expected to be potentially exposed to concentrations of hazardous chemicals that are below those that could cause acutely toxic health effects. Acutely toxic health effects generally result from short-term exposure to relatively high concentrations of contaminants, such as those that may be encountered during facility accidents. Long-term exposure to relatively lower concentrations of hazardous chemicals can produce adverse chronic health effects that include both carcinogenic and noncarcinogenic effects. The health effect endpoints evaluated in this analysis include excess incidences of latent cancers for carcinogenic chemicals and a spectrum of chemical-specific noncancer health effects (e.g., headaches, membrane irritation, neurotoxicity, immunotoxicity, liver toxicity, kidney toxicity, developmental toxicity, reproductive toxicity, and genetic toxicity) for noncarcinogens.

Methodology

Estimates of airborne concentrations of hazardous chemicals were developed using ISC3 air dispersion model (EPA 1995). This model was developed by the U.S. Environmental Protection Agency (EPA) for regulatory air dispersion modeling applications. ISC3 is the most recent version of the model and is approved for use for a wide variety of emission sources and conditions. The ISC3 model estimates atmospheric concentrations based on the airborne emissions from the processing facility for each block in a circular grid comprised of 16 directional sectors (e.g., north, north-northeast, northeast) at radial distances out to 80 kilometers (50 miles) from the point of release, producing a distribution of atmospheric concentrations. The maximally exposed offsite individual is located in the block with the highest estimated concentration. The short-term version of the model (ISCST3) was used to estimate potential exposures to offsite populations.

Table C–11 Annual Radiological Impacts to the Public from Incident-Free Tritium Production Operations at Watts Bar 1

	No Action		*Incremental Dose For 1,000 TPBARs*		*Operation with 1,000 TPBARs*			*Incremental Dose for 3,400 TPBARs*		*Operation with 3,400 TPBARs*		
Receptors	***Air***	***Liquid***	***Air***	***Liquid***	***Air***	***Liquid***	***Total***	***Air***	***Liquid***	***Air***	***Liquid***	***Total***
Maximally Exposed Offsite Individual												
Dose (millirem)	0.036	0.25	0.012	0.0014	0.048	0.25	0.30	0.042	0.0050	0.078	0.26	0.34
Fatal Cancer Risk	1.8×10^{-8}	1.3×10^{-7}	6.0×10^{-9}	7.0×10^{-10}	2.4×10^{-8}	1.3×10^{-7}	1.5×10^{-7}	2.1×10^{-8}	2.5×10^{-9}	3.9×10^{-8}	1.3×10^{-7}	1.7×10^{-7}
Population Dose Within 80 Kilometers (50 Miles) for Year 2025												
Dose (person-rem)	0.071	0.48	0.15	0.19	0.22	0.67	0.89	0.50	0.69	0.57	1.2	1.8
Fatal Cancers	0.000036	0.00024	0.000075	0.000095	0.00011	0.00034	0.00045	0.00025	0.00035	0.00029	0.00060	0.00090

Source: TVA 1998a.
Note: The values given in this table are rounded up to two significant figures.

Table C–12 Annual Radiological Impacts to the Public from Incident-Free Tritium Production Operations at Sequoyah 1 or Sequoyah 2

	No Action		*Incremental Dose For 1,000 TPBARs*		*Operation with 1,000 TPBARs*			*Incremental Dose for 3,400 TPBARs*		*Operation with 3,400 TPBARs*		
Receptors	***Air***	***Liquid***	***Air***	***Liquid***	***Air***	***Liquid***	***Total***	***Air***	***Liquid***	***Air***	***Liquid***	***Total***
Maximally Exposed Offsite Individual												
Dose (millirem)	0.031	0.022	0.015	0.0016	0.046	0.024	0.070	0.052	0.0054	0.083	0.027	0.11
Fatal Cancer Risk	1.6×10^{-8}	1.1×10^{-8}	7.5×10^{-9}	8.0×10^{-10}	2.3×10^{-8}	1.2×10^{-8}	3.5×10^{-8}	2.6×10^{-8}	2.7×10^{-9}	4.2×10^{-8}	1.4×10^{-8}	5.6×10^{-8}
Population Dose Within 80 Kilometers (50 Miles) for Year 2025												
Dose (person-rem)	0.49	1.1	0.16	0.41	0.65	1.5	2.2	0.54	1.4	1.0	2.5	3.5
Fatal Cancers	0.00025	0.00055	0.000080	0.00021	0.00033	0.00075	0.0011	0.00027	0.00070	0.00050	0.0013	0.0018

Source: TVA 1998a.
Note: The values given in this table are rounded up to two significant figures.

Table C–13 Annual Radiological Impacts to the Public from Incident-Free Tritium Production Operations at Bellefonte 1

Receptors	No Action		Incremental Dose For 1,000 TPBARs		Operation with 1,000 TPBARs			Incremental Dose for 3,400 TPBARs		Operation with 3,400 TPBARs		
	Air	Liquid	Air	Liquid	Air	Liquid	Total	Air	Liquid	Air	Liquid	Total
Maximally Exposed Offsite Individual												
Dose (millirem)	0[a]	0[a]	0.0020	0.0012	0.25[c]	0.013[c]	0.26	0.0065	0.0042	0.26[c]	0.016[c]	0.28
Fatal Cancer Risk	0	0	1.0×10^{-9}	6.0×10^{-10}	1.3×10^{-7}	6.5×10^{-9}	1.3×10^{-7}	3.3×10^{-9}	2.1×10^{-9}	1.3×10^{-7}	8.0×10^{-9}	1.4×10^{-7}
Population Dose Within 80 Kilometers (50 Miles) for Year 2025												
Dose (person-rem)	0[b]	0[b]	0.13	0.14	0.40[c]	1.2[c]	1.6	0.44	0.47	0.71[c]	1.6[c]	2.3
Fatal Cancers	0	0	0.000065	0.000070	0.00020	0.0006	0.0008	0.00022	0.00024	0.00036	0.0008	0.0012

[a, b] These no action values represent the absence of impacts associated with the nonoperational status of the Bellefonte Nuclear Plant. For a single operational Bellefonte Nuclear Plant unit (operation without tritium production activities), the impacts to the public have been estimated to be: 0.26 millirem (0.25 millirem from the air pathway and 0.012 millirem from the liquid pathway) to the maximally exposed offsite individual and 1.4 person-rem (0.27 person-rem from the air pathway and 1.1 person-rem from the liquid pathway) to the surrounding population within 80 kilometers (50 miles) in the year 2025.

[c] These values are a summation of incremental impacts attributable to TPBAR tritium releases and estimated single Bellefonte Nuclear Plant unit operational impacts.

For Bellefonte 1 and 2 operation, the potential impacts are twice the values given in this table.

Source: AEC 1974.

Note: The values given in this table are rounded up to two significant figures.

Table C–14 Radiological Impacts to the Public from the Failure of Two TPBARs at Each of the Reactor Sites

Receptors	Watts Bar 1			Sequoyah 1 or Sequoyah 2			Bellefonte 1 or Bellefonte 2		
	Air	Liquid	Total	Air	Liquid	Total	Air	Liquid	Total
Maximally Exposed Offsite Individual									
Dose (millirem)	0.29	0.033	0.32	0.36	0.037	0.40	0.045	0.028	0.073
Fatal Cancer Risk	1.5×10^{-7}	1.7×10^{-8}	1.6×10^{-7}	1.8×10^{-7}	1.9×10^{-8}	2.0×10^{-7}	2.3×10^{-8}	1.4×10^{-8}	3.7×10^{-8}
Population Dose Within 80 Kilometers (50 Miles) for Year 2025									
Dose (person-rem)	3.43	4.41	7.84	3.67	9.19	12.86	3.06	3.18	6.24
Risk	0.0017	0.0022	0.0039	0.0018	0.0046	0.0064	0.0015	0.0016	0.0031

This EIS estimates the noncancer health risks by comparing modeled air concentrations of contaminants produced by ISC3 to the EPA Reference Concentrations published in the Integrated Risk Information System. For each noncarcinogenic chemical, potential health risks are estimated by dividing the estimated airborne concentration by the chemical-specific Reference Concentrations value to obtain a noncancer hazard quotient:

Noncancer Hazard Quotient = air concentration/Reference Concentrations

Reference Concentrations are estimates (with an uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of harmful effects during a lifetime. Hazard Quotients are calculated for each hazardous chemical to which receptors may be exposed. Hazard Quotients for each chemical are summed to generate a Hazard Index. The Hazard Index is an estimate of the total noncancer toxicity potential from exposure to hazardous chemicals. According to EPA risk assessment guidelines (EPA 1989), if the Hazard Index value is less than or equal to 1.0, the exposure is unlikely to produce adverse toxic effects. If the Hazard Index exceeds 1.0, adverse noncancer health effects may result from the exposure.

For carcinogenic chemicals, risk is estimated by the following equation:

$$\text{Risk} = \text{CA} \times \text{URF}$$

where:

Risk = a unitless probability of cancer incidence.
CA = contaminant concentration in air (in micrograms/cubic meters).
URF = cancer inhalation unit risk factor (in units of cancers per micrograms/cubic meters).

CA is estimated by multiplying the output of the ISC3 model by the process duration to obtain estimates of total airborne exposure for each process.

Cancer unit risk factors are used in risk assessments to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen.

Assumptions

The airborne pathway is assumed to be the principal exposure route by which the offsite population maximally exposed individual is exposed to hazardous chemicals released from reactor facilities. No synergistic or antagonistic effects are assumed to occur from exposure to the hazardous chemicals released from reactor facilities. Synergistic effects among released contaminants may result in adverse health effects that are greater than those estimated, whereas antagonistic effects among released chemicals may result in less severe health effects than those estimated.

Analysis

The potential impacts of exposure to hazardous chemicals released to the atmosphere during routine operations of the reactor facilities to produce tritium are presented in Chapter 5 for each alternative.

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APPENDIX D
EVALUATION OF HUMAN HEALTH EFFECTS FROM FACILITY ACCIDENTS

This appendix presents the method and assumptions used for estimating potential impacts and risks to individuals and the general public from exposure to releases of radioactive and hazardous chemical materials during hypothetical accidents at the proposed reactor facilities. The impacts from accidental radioactive material releases are given in Section D.1, and the impacts from releases of hazardous chemicals are provided in Section D.2.

D.1 RADIOLOGICAL ACCIDENT IMPACTS ON HUMAN HEALTH

D.1.1 Accident Scenario Selection and Description

D.1.1.1 Accident Scenario Selection

This accident analysis assessment considers a spectrum of potential accident scenarios. The range of accidents considered includes reactor design-basis accidents, nonreactor design-basis accidents, tritium-producing burnable absorber rod (TPBAR) handling accidents, transportation cask handling accidents, and beyond design-basis accidents (i.e., severe reactor accidents).

The spectrum of reactor and nonreactor design-basis accidents presented in the Watts Bar, Sequoyah, and Bellefonte Safety Analysis Reports were reviewed for evaluation in this environmental impact statement (EIS). The large break loss-of-coolant accident was selected as the representative reactor design-basis accident because it has the potential to damage more TPBARs than any other reactor design-basis accident (see Section D.1.1.2). Based on assumptions used in this EIS for the postulated accident scenario, the waste gas decay tank failure accident was selected as the nonreactor design-basis accident for evaluation in this EIS because it has the potential to release more tritium than other nonreactor design-basis accidents.

Following irradiation in the reactor’s tritium production core, the fuel assemblies and the TPBAR assemblies inserted into the fuel assemblies would be removed from the reactor and transferred to the spent fuel pool. There, the TPBAR assemblies would be removed from the fuel assemblies. Next, the TPBARs would be removed from the TPBAR assemblies and inserted in a consolidation container. The consolidation container is a 17 × 17 array of tubes that holds the TPBARs. The consolidation container has the same footprint as a fuel assembly and can accommodate up to 289 TPBARs.

Three TPBAR handling accident scenarios are evaluated. Scenario 1 postulates that the consolidation container with 289 TPBARs is dropped while loading into a transportation cask. The evaluation further postulates that, if the consolidation container lands vertically on the spent fuel pool floor, no TPBARs would be damaged by the impact. If, however, the consolidation container lands on an edge or strikes an object (e.g., an unoccupied fuel rack or the shelf in the cask loading pit), the consolidation container shell and up to one row of tubes containing TPBARs could be damaged, and up to 17 TPBARs possibly could be breached.

Scenario 2 postulates that an irradiated fuel assembly with a TPBAR assembly containing 24 TPBARs is dropped in the spent fuel pool. The evaluation also postulates that, if the fuel assembly lands vertically, no TPBARs would be damaged by the impact. If the assembly lands on an edge or is struck by an object on the side or corner of the fuel assembly, up to 3 TPBARs could be damaged by the impact.

Scenario 3 postulates that a TPBAR assembly containing 24 TPBARs is dropped in the spent fuel pool as it is being removed from an irradiated fuel assembly and all TPBARs are breached by the impact. Scenario 3 was selected for evaluation in this EIS because it has the potential to damage more TPBARs than the other postulated TPBAR handling accidents.

Two truck or rail transportation cask drop accidents that could cause a release of tritium from the casks are evaluated in this EIS. The evaluations consider: (1) cask drops before the cask is sealed, and (2) drops that could breach a sealed cask.

The postulated beyond design-basis reactor accident analyses selected for use in this EIS address core damage accident scenarios leading to the loss of containment integrity. This includes scenarios that fall into three performance categories: (1) early containment failures, (2) late containment failures, and (3) containment bypass. Accident scenarios that do not fall into these categories lead to significantly lower consequences and, therefore, are not evaluated.

D.1.1.2 Reactor Design-Basis Accident

A reactor design-basis accident is designated as a Condition IV occurrence. Condition IV occurrences are faults that are not expected to take place, but are postulated because they have the potential to release significant amounts of radioactive material. The postulated reactor design-basis accident for this EIS is a large break loss-of-coolant accident. This postulated accident has the potential to damage more TPBARs than any other reactor loss-of-coolant design-basis accident (WEC 1998a). This accident scenario postulates a double-ended rupture of a pipe greater than 15 centimeters (6 inches) in diameter in the reactor coolant system. During the initial phase of the accident, the reactor water (coolant) level would drop below the top of the reactor core for a short period of time before the emergency systems would automatically inject additional water to cover the core. During this period the core would overheat, and the cladding on some of the fuel rods and 100 percent of the TPBARs would be breached due to the overheating (WEC 1998b). The analysis assumes that the entire tritium content in the TPBARs would be released to the containment. Each TPBAR produces 1 gram of tritium on average through the 18-month irradiation cycle (DOE 1996). For the purpose of analyses in this EIS, 1 gram of tritium contains 9,640 Curies (CRC 1982). The analysis also assumes that all of the tritium released to the reactor coolant system from the TPBARs during 17 months of normal operation would be released to the containment during the accident. This would include the release of an amount of tritium corresponding to 1 Curie per TPBAR per year (PNNL 1997). The accident consequence calculations consider applicable, reactor site-specific, protective action guidelines.

Table D–1 shows the total source term released to the containment that would be attributable to 1,000 TPBARs and a maximum of 3,400 TPBARs in a tritium production core configuration. **Table D–2** presents the tritium source term released from the containment to the environment. The reduction in the amount of tritium available for release would be the result of post-accident processing of the containment atmosphere to reduce iodine leakage to the environment, operation of hydrogen recombiners, and absorption of elemental and oxidized tritium by water in the containment (WHC 1991). In the design-basis accident, tritium would be released from the containment to the atmosphere through containment leakage. Release pathways from the containment are discussed in Section D.1.2.5.2. The analysis assumes tritiated water vapor would be released to the atmosphere for 30 days following the accident. After 30 days, all the tritiated water vapor in the containment atmosphere would be condensed and, therefore, would not be available for further release. **Table D–3** presents the accident frequency estimates.

Table D–1 Reactor Design-Basis Accident Tritium Inventory

Source Term	Tritium Production	
	1,000 TPBARs (Curies)	Maximum - 3,400 TPBARs (Curies)
TPBARs breached during accident	9.64 × 10^6	3.28 × 10^7
TPBAR leakage during normal operations	1,500	5,100
Total released to containment	9.64 × 10^6	3.28 × 10^7
Total available to be released to environment [a]	964,000	3.28 × 10^6

[a] All tritium released to the environment is in oxide form.

Table D–2 Reactor Design-Basis Accident Tritium Source Term Released to Environment

Accident Site	Tritium Production	Tritium Released (Curies) [a, b]		
		0-24 Hours	24-720 Hours	Total 0-30 Days
Watts Bar	1,000 TPBARs	814	10,700	11,600
	3,400 TPBARs	2,780	36,600	39,400
Sequoyah	1,000 TPBARs	890	11,900	12,800
	3,400 TPBARs	3,040	40,500	43,500
Bellefonte	1,000 TPBARs	338	3,880	4,220
	3,400 TPBARs	1,150	13,200	14,400

[a] All tritium released to the environment is in oxide form.
[b] Source terms for a single reactor.

Table D–3 Reactor Design-Basis Accident Frequency Estimates for Large Break Loss-of-Coolant Accident

Reactor Site	Frequency (per year)
Watts Bar	0.0002[a]
Sequoyah	0.0002[b]
Bellefonte	0.0002[c]

[a] TVA 1992b.
[b] TVA 1992a.
[c] Value currently assigned in Individual Plant Examinations.

D.1.1.3 Nonreactor Design-Basis Accident

The waste gas decay tank rupture, a Condition III occurrence, was selected as the nonreactor design-basis accident for this EIS. The consequences of a Condition III occurrence would be less severe than for a Condition IV occurrence. The release of radioactivity would not be sufficient to interrupt or restrict public use of those areas beyond the exclusion area radius (TVA 1996). The frequency of design-basis accidents is normally expected to be in the range of 0.0001 to 0.01 per year. For the purpose of this EIS, the accident frequency is assumed to be 0.01, the high end of the range.

The gaseous waste processing system is designed to remove fission product gases from the reactor coolant. The maximum storage of waste gases occurs before a refueling shutdown, at which time the gas decay tanks store the radioactive gases that are stripped from the reactor coolant. The accident analysis conservatively assumes that 10 percent of the TPBAR-generated tritium in the reactor coolant, as well as radioactive xenon and krypton fission product gases, would be stripped from the reactor coolant before a refueling shutdown and stored in waste decay tanks. Therefore, it has the potential to release more tritium than other nonreactor design-basis accidents. This assumption is conservative because the analysis postulates that all of the tritium released from the TPBARs to the reactor coolant during the entire fuel cycle would be retained in the coolant.

The postulated nonreactor design-basis accident is defined as an unexpected, uncontrolled release of the gases contained in a single gas decay tank due to the failure of the tank or the associated piping. The analysis assumes that tritium would be released directly to the environment in an oxide form. Accident consequence calculations consider applicable reactor site-specific protective action guidelines. **Table D–4** presents the tritium source term that would be released to the environment.

Table D–4 Nonreactor Design-Basis Accident Tritium Source Term

Source Term (Curies of tritium)	
1,000 TPBARs	***3,400 TPBARs***
150	510

D.1.1.4 TPBAR Handling Accident

The TPBAR handling accident scenario postulates that a TPBAR assembly containing 24 TPBARs was dropped when removing the assembly from an irradiated fuel assembly during the TPBAR consolidation process. The evaluation postulates that all TPBARs would be unprotected and would breach when they impact the spent fuel pool floor. The gaseous tritium in the 24 breached TPBARs would be released into the fuel pool and directly to the environment. The analysis conservatively assumes that the entire tritium inventory in the 24 breached TPBARs (231,360 Curies) would be released into the fuel pool (PNNL 1999). The released tritium would be in oxide form. It also was assumed that all the tritium released to the fuel pool would be released to the environment continuously over a one-year period by evaporation from the fuel pool and would be exhausted by the area ventilation system through the auxiliary building stack. This assumption was made to estimate the maximum dose to the public from this accident. [Release of tritium through liquid effluents would result in a public dose, which is an order of magnitude lower than that from release to the air.] Should a TPBAR handling accident occur, action will be taken to limit the tritium release from the breached TPBARs. However, the analysis took no credit for mitigating actions to limit the release of tritium to the fuel pool (i.e., placing the breached TPBARs in a sealed container) or to reduce the accident consequences to the public (i.e., interdiction of contaminated food and/or drinking water). **Table D–5** presents the accident frequency estimates. The frequency estimates are derived from data presented in NUREG/CR-4982, *Severe Accidents in Spent Fuel Pool in Support of Generic Safety Issue 82* (NRC 1987).

Table D–5 TPBAR Handling Accident Frequency Estimates

Frequency (per year)	
1,000 TPBARs	***3,400 TPBARs***
0.0017	0.0058

D.1.1.5 Truck Transportation Cask Handling Accident at the Reactor Site

The truck cask would be loaded under water in the spent fuel pool cask loading pit. A single TPBAR consolidation container containing a maximum of 289 TPBARs would be loaded into the cask. For the purpose of this EIS, the analysis postulates that, following insertion of the consolidation container, the cask cover would be installed but not tightly sealed. The cask would be raised above the water level where it would be hosed down and drained before moving it to the decontamination area. There it would be sealed, backfilled with inert gas, and decontaminated before loading on the truck trailer bed.

The evaluation also considered an option to seal the cask cover before lifting the cask; in this case the only potential for a tritium release would be if the cask were breached by the drop. The truck cask is designed in accordance with the requirements of 10 CFR 71, and is required to withstand a 9.1-meter (30-foot) drop onto an unyielding surface without loss or dispersal of the radioactive contents of the cask. The cask could drop more than 9.1 meters (30 feet) in the spent fuel pool cask loading pit. It could fall approximately 2.7 meters (9 feet) through the air and approximately 12.2 meters (40 feet) through the water. The terminal velocity of such a fall would exceed that reached in a 9.1 meter (30 foot) drop through air (TVA 1996). The analysis assumes that the cask would be breached by such a fall.

Spent fuel pool designs were reviewed to determine if there were any potential for cascading effects of the cask drop that would initiate releases of additional radionuclides. In the event that the spent fuel pool liner in the cask pit area is breached and the water level in the spent fuel pool drops, the water level would not drop to a level that would uncover the spent fuel in the storage racks. The cask loading area of the spent fuel pool is separated from the storage area by a shelf. The shelf height maintains the water level in the spent fuel pool storage area above the top of the spent fuel when the cask pit area is drained. Additional defense-in-depth is provided when the spent fuel pool gates are installed after loading the cask. With the gates in place, one on each side of the cask loading pit access channel to the spent fuel pool, a breach of the liner in the cask loading pit area would result in a drop in the spent fuel water level to the top of the gates.

The analysis assumed that, in the event the cask is dropped onto the floor of the fuel pool area, the cask would not penetrate the floor or damage equipment located at an elevation below the potential drop zone. Analyses would be performed, if necessary, to verify this assumption during the U.S. Nuclear Regulatory Commission (NRC) operating license process and/or license amendment process.

It is anticipated that no TPBARs would be damaged by the drop. The TPBARs in the cask would be protected from damage not only by the cask, but also by the consolidation container structure. However, the analysis conservatively assumes that the structural loads on the TPBARs resulting from the drop could breach up to 17 TPBARs, the same number considered for a dropped TPBAR consolidation container. The gaseous tritium in the 17 breached TPBARs would be released into the fuel pool and directly to the environment by evaporation. Two accident scenarios are considered. Scenario 1 assumes that the cask drop occurs prior to draining and drying the cask interior. The analysis conservatively assumes that the 17 breached TPBARs release tritium into the flooded cask at the rate of 50 Curies per TPBAR per day (PNNL 1999) until the cask can be drained into the fuel pool and the cask interior can be vacuum-dried. The analysis further assumes that the cask is drained and vacuum-dried within seven days of the accident to limit the release of tritium from the breached TPBARs. The analysis takes no credit for additional mitigating actions to reduce the released tritium to the fuel pool (e.g., draining the cask into a storage tank). A total of 5,950 Curies of tritium, in oxide form, would be released to the fuel pool area and exhausted up the auxiliary building stack over a one-year period.

Scenario 2 assumes that the cask drop of more than 30 feet occurs while loading the cask onto a trailer after it is loaded with TPBARs, sealed, and decontaminated. It is assumed that this accident would result in 17 breached TPBARs and loss of the cask confinement integrity. The breached TPBARs would release tritium, assumed to be in oxide form, to the auxiliary building atmosphere at a rate of 0.00001 grams per breached TPBAR per hour (PNNL 1999). Further, the analysis assumes that the tritium release would be terminated when the TPBARs are placed in a replacement cask within 30 days of the accident. During this period, a total of 1,180 Curies of tritium would be released to the atmosphere through the auxiliary building stack. The consequences for Scenario 1 bound the consequences of Scenario 2.

Table D–6 presents the frequency estimates for the truck transportation cask handling accident (Scenario 1). The frequency estimates are derived from data presented in NUREG/CR-4982, *Severe Accidents in Spent Fuel Pool in Support of Generic Safety Issue 82* (NRC 1987).

Table D–6 Truck Transportation Cask Handling Accident Frequency Estimates

Frequency (per year)	
1,000 TPBARs	***3,400 TPBARs***
5.3×10^{-7}	1.6×10^{-6}

D.1.1.6 Truck Transportation Cask Handling Accident at the Tritium Extraction Facility

Cask handling accidents at the Tritium Extraction Facility are in the scope of the Tritium Extraction Facility EIS and are not within the scope of this EIS.

D.1.1.7 Rail Transportation Cask Handling Accident at the Reactor Site

The rail cask would be loaded under water in the spent fuel pool cask loading pit with 3 to 12 TPBAR consolidation containers. For the purpose of this EIS, the analysis postulates that, following insertion of the consolidation containers, the cask cover would be installed, but not tightly sealed. The cask would be raised above the water level, where it would be hosed down, drained, and the cask interior would be vacuum-dried before moving it to the decontamination area. There it would be sealed, backfilled with inert gas, and decontaminated before loading on the rail car.

The evaluation also considers an option to seal the cask cover before lifting the cask; in this case the only potential for a tritium release would be if the cask were breached by the drop. The rail cask is designed in accordance with the requirements of 10 CFR 71, which requires that the cask withstand a 9.1-meter (30-foot) drop onto an unyielding surface without loss or dispersal of the radioactive contents of the cask. The cask could drop more than 9.1 meters (30 feet) in the spent fuel pool cask loading pit. Here the cask could fall approximately 2.7 meters (9 feet) through air and approximately 12.2 meters (40 feet) through water. The terminal velocity reached in such a fall would exceed that reached in a 9.1-meter (30-foot) drop through air (TVA 1996). The analysis assumes that the cask would be breached by such a fall.

Spent fuel pool designs were reviewed to determine if there were any potential for cascading effects of the cask drop that would initiate releases of additional radionuclides. In the event that the spent fuel pool liner in the cask pit area is breached and the water level in the spent fuel pool drops, the water level would not drop to a level that would uncover the spent fuel in the storage racks. The cask loading area of the spent fuel pool is separated from the storage area by a shelf. The shelf height maintains the water level in the spent fuel pool storage area above the top of the spent fuel when the cask pit area is drained.

The analysis assumes that, in the event the cask is dropped onto the floor of the fuel pool area, the cask would not penetrate the floor or damage equipment located at an elevation below the drop zone. Analyses will be performed to verify this assumption during the NRC operating license process and/or license amendment process.

It is anticipated that no TPBARs would be damaged by the drop. The TPBARs in the cask would be protected from damage not only by the cask, but also by the TPBAR consolidation container structure. However, the analysis conservatively assumes that the structural loads on the TPBARs resulting from the drop could breach up to 17 TPBARs, the same number considered for a dropped TPBAR consolidation container. Two accident scenarios are considered. Scenario 1 assumes that the cask drop occurs prior to draining and drying the cask interior. The analysis conservatively assumes that the 17 breached TPBARs release tritium into the flooded cask at the rate of 50 Curies per TPBAR per day (PNNL 1999) until the cask can be drained into the fuel pool and the cask interior can be vacuum-dried. The analysis further assumes that the cask is drained and dried within seven days of the accident to limit the release of tritium from the breached TPBARs. The analysis takes no credit for additional mitigating actions to reduce the released tritium to the fuel pool (e.g., draining the cask into a storage tank). A total of 5,950 Curies of tritium, in oxide form, would be released to the fuel pool area and exhausted up the auxiliary building stack over a one-year period.

Scenario 2 assumes that the cask drop of more than 30 feet would occur while loading the cask onto a rail car after it is loaded with TPBARs, sealed, and decontaminated. It is assumed that this accident would result in 17 breached TPBARs and loss of the cask confinement integrity. The breached TPBARs would release tritium, assumed to be in oxide form, to the auxiliary building atmosphere at a rate of 0.00001 grams per breached TPBAR per hour (PNNL 1999). Further, the analysis assumes that the tritium release would be terminated when the TPBARs are placed in a replacement cask within 30 days of the accident. During this period, a total of 1,180 Curies of tritium would be released to the atmosphere through the auxiliary building stack. The consequences for Scenario 1 bound the consequences of Scenario 2.

Table D–7 presents the frequency estimates for the rail transportation cask handling accident (Scenario 1). The frequency estimates are derived from data presented in NUREG/CR-4982, *Severe Accidents in Spent Fuel Pool in Support of Generic Safety Issue 82* (NRC 1987), and the assumption that each rail cask would contain three TPBAR consolidation containers.

Table D–7 Rail Transportation Cask Handling Accident Frequency Estimates

Frequency (per year)	
1,000 TPBARs	***3,400 TPBARs***
2.7×10^{-7}	8.0×10^{-7}

D.1.1.8 Rail Transportation Cask Handling Accident at the Savannah River Site Rail Transfer Station

Rail service is provided on DOE's Savannah River Site in South Carolina, but not directly to the Tritium Extraction Facility. Rail casks would be transferred to a truck at an onsite rail transfer station for transport to the Tritium Extraction Facility. The rail cask is designed in accordance with the requirements of 10 CFR 71, which requires that the cask be able to withstand a 9.1-meter (30-foot) drop onto an unyielding surface without loss or dispersal of the radioactive contents of the cask. During transfer of the cask from the rail car to the truck, the cask elevation above the ground would not exceed 9.1 meters (30 feet). Therefore, postulated cask handling accidents at the rail transfer station (i.e., cask drop events) would not cause breach of the cask and release of the radioactive material.

D.1.1.9 Rail Transportation Cask Handling Accident at the Tritium Extraction Facility

Cask handling accidents at the Tritium Extraction Facility are in the scope of the Tritium Extraction Facility EIS and are not within the scope of this EIS. The scope of the Tritium Extraction Facility EIS starts with the delivery of irradiated TPBARs at the Tritium Extraction Facility.

D.1.1.10 Beyond Design-Basis Accident

The beyond design-basis accident is limited to the severe reactor accidents. Severe reactor accidents are less likely to occur than reactor design-basis accidents. The consequences of these accidents could be more serious if no mitigative actions are taken. In the reactor design-basis accidents, the mitigating systems are assumed to be available. In the severe reactor accidents, even though the initiating event could be a design-basis event (e.g., large break loss-of-coolant accident), additional failures of mitigating systems would cause some degree of physical deterioration of the fuel in the reactor core and a possible breach of the containment structure leading to releases of radioactive materials to the environment. For the purposes of this EIS, only the severe reactor accident scenarios that lead to containment bypass or failure are considered. Accident scenarios that do not lead to containment bypass or failure are not presented because the public and environmental consequences would be significantly less in those cases. It should be noted that analyses performed as part of the New Production Reactor program in the late 1980s concluded that severe accident core melts do not lead to uncontrolled recriticality if the core enrichment is less than 7.5 percent. Since CLWR core enrichments are less than 5 percent, recriticality is not considered.

In 1988, the NRC asked all licensees of operating plants to perform individual plant examinations for severe accident vulnerabilities (NRC 1988). In the request, the NRC indicated that a probabilistic risk assessment is an acceptable approach to use in performing the individual plant examination. This analysis evaluates in full detail (quantitatively) the consequences of all potential events caused by the operating disturbances (known as internal initiating events) within each plant. [See the discussion under severe reactor accident scenarios presented below.] The state-of-the-art probabilistic risk assessment uses realistic criteria and assumptions in evaluating the accident progression and the systems required to mitigate each accident.

In 1991, the NRC requested that all licensees of operating plants should conduct individual plant examinations of external events for severe accident vulnerabilities (NRC 1991). This analysis covers the accidents that could be initiated naturally (e.g., earthquakes, tornadoes, floods, strong winds) and/or manmade (e.g., aircraft crash and fire). The individual plant examination of external event analyses are less quantitative and results-oriented than those performed under individual plant examination. The analyses were done to confirm that no vulnerabilities or issues exist and that the plants would have sufficient capacity to continue functioning in beyond design-basis external events.

Currently, plant-specific severe accident analyses are only available for operating plants such as the Sequoyah and Watts Bar Nuclear Plants. No such analyses are available for the Bellefonte Nuclear Plant. However, the results of such studies will be available prior to operation of the Bellefonte Nuclear Plant.

Severe Reactor Accident Scenarios

Before identifying the accident scenarios that lead to failure of the containment, it is important to provide a brief overview of the present severe accident analysis techniques used in plant-specific probabilistic risk assessments or individual plant examinations for severe accident vulnerabilities (NRC 1990b). The analysis starts with identification of initiating events (i.e., challenges to normal plant operation or accidents) that require successful mitigation to prevent core damage. These events are grouped into initiating event classes that have similar characteristics and require the same overall plant response.

For example, a loss of offsite power to a plant could be caused by severe weather events (high wind, tornado, hurricane, and snow and ice storms), power substation breaker faults, instability in the power transmission lines, unbalanced loading of power lines, etc. Each of these events would lead to loss of main generator power and a reactor trip, which would challenge the same safety functions. These events are grouped together and analyzed under the loss of offsite power initiating event.

Event trees are developed for each initiating event class. These event trees depict the possible sequence of events that could occur during the plant's response to each initiating event class. The trees delineate the possible combinations (sequences) of functional and/or system successes and failures that lead to either successful mitigation of the initiator or core damage. Functional and/or system success criteria are developed based on the plant response to the class of accidents. Failure modes of systems that are functionally important to preventing core damage are modeled. This modeling process is usually done with fault trees that define the combinations of equipment failures, equipment outage, and human errors that cause the failure of systems to perform the desired function.

Quantification of the event trees leads to hundreds, or even thousands, of different end states representing various accident sequences that lead to core damage. Each accident sequence and its associated end state has a unique "signature" because of the particular combination of system successes and failures events. These end states are grouped together into plant damage states, each of which collects sequences for which the progression of core damage, the release of fission products from the fuel, the status of containment and its systems, and the potential for mitigating source terms are similar. The sum of all core damage accident sequences then will represent an estimate of plant core damage frequency. The analysis of core damage frequency calculations is called a level 1 probabilistic risk assessment, or front-end analysis.

Next, an analysis of accident progression, containment loading resulting from the accident, and the structural response to the accident loading is performed. The primary objective of this analysis, which is called a level 2 probabilistic risk assessment, is to characterize the potential for, and magnitude of, a release of radioactive material from the reactor fuel to the environment, given the occurrence of an accident that damages the core. The analysis includes an assessment of containment performance in response to a series of severe accidents. Analysis of the progression of an accident (an accident sequence within a plant damage state) generates a time history of loads imposed on the containment pressure boundary. These loads then would be compared against the containment's structural performance limits. If the loads exceed the performance limits, the containment would be expected to fail; conversely, if the containment performance limits exceed the calculated loads, the containment would be expected to survive. Three modes of containment failures are defined: containment bypass, early containment failure, and late containment failure (see **Table D–8**).

The magnitude of the radioactive release to the atmosphere in an accident is dependent on the timing of the reactor vessel failure and the containment failure. To determine the magnitude of the release, a containment event tree representing the time sequence of major phenomenological events that could occur during the formation and relocation of core debris (after core melt), the availability of the containment heat removal system, and the expected mode of containment failures (i.e., bypass, early, and late), is developed. A reduced set of plant damage states are defined by culling the lower frequency plant damage states into higher frequency ones that have relatively similar severity and consequence potential. This condensed set is known as the key plant damage states (a functional sequence that either has a core damage frequency greater than or equal to 10^{-6} per reactor year or leads to containment bypass at a frequency of greater than or equal to 10^{-7} per reactor year (NRC 1988). These key plant states then would become the initiating events for the containment event tree. The outcome of each sequence in this event tree represents a specific release category. Release categories that can be represented by similar source terms are grouped. Source terms associated with various release categories describe the fractional releases for representative radionuclide groups, as well as the timing, duration, and energy of release.

Table D–8 Definition and Causes of Containment Failure Mode Classes

Failure mode	*Definition and Causes*
Containment Bypass	Involves failure of the pressure boundary between the high-pressure reactor coolant and low-pressure auxiliary system. For pressurized water reactors, steam generator tube rupture, either as an initiating event or as a result of severe accident conditions, will lead to containment bypass. In these scenarios, if core damage occurs, a direct path to the environment can exist.
Early Containment Failure	Involves structure failure of the containment before, during, or slightly after (within a few hours) reactor vessel failure. A variety of mechanisms can cause structure failure such as: direct contact of core debris with containment, rapid pressure and temperature loads, hydrogen combustion, and fuel coolant interaction (ex-vessel steam explosion). Failure to isolate containment and an early vented containment after core damage also are classified as early containment failures.
Late Containment Failure	Involves structural failure of the containment several hours after reactor vessel failure. A variety of mechanisms can cause late structure failure such as: gradual pressure and temperature increase, hydrogen combustion, and basemat melt-through by core debris. Venting containment late in the accident also is classified as a late containment failure.

Most of the current plant probabilistic risk assessment analyses end at this stage. Only a limited number of plants have performed an evaluation of resulting consequences to the public and environment from releases of radioactive materials following a core melt and containment failure. This type of analysis, which is known as a level 3 probabilistic risk assessment, was first performed by the NRC in WASH-1400 (NRC 1975). In the late 1980s, the NRC performed a comprehensive, full-scope severe accident analyses for five different plant types and documented the results in NUREG-1150 (NRC 1990b). The analyses provided in this EIS use the insights gained from this NRC report and follow the methods applied and the assumptions made to estimate the consequences to the public and the environment.

Representative Severe Reactor Accident Scenarios for the Sequoyah and Watts Bar Nuclear Plants

As stated earlier, only the plant damage states that lead to containment failure (failure mode defined as bypass, early, and late) and release of radioactive materials to the environment are considered in this EIS. The description of the representative accident scenarios is limited to the dominant sequence (or sequences) within a plant damage state that is a major contributor to the release level categories associated with each of the containment failures defined above. For Watts Bar and Sequoyah, the information is based on the most recent analysis of severe accidents performed by the Tennessee Valley Authority (TVA) under the individual plant examination program that covers both the level 1 and level 2 probabilistic risk assessments in detail. TVA's analyses of the Watts Bar and Sequoyah individual plant examinations were submitted to the NRC in September 1992 (TVA 1992a, TVA 1992b). Both of these analyses have been revised (TVA 1995b, TVA 1994), and the Watts Bar 1 analysis has been revised even further (TVA 1998).

The selected release categories and examples of various accident scenarios leading to containment failure and/or bypass are presented below for the Sequoyah and Watts Bar Nuclear Plants. **Table D–9** shows reactor core inventories for Watts Bar 1 and Sequoyah 1 and 2. **Table D–10** provides important information on time to core damage, containment failure, release duration, and the isotope release fractions associated with each of the release levels. **Table D–11** provides a representation of the dominant accident scenarios that lead to each release category, along with its likelihood of occurrence. Release Category I results from a reactor vessel breach with early containment failure. Release Category II results from a reactor vessel breach with containment bypass. Release Category III results from a reactor vessel breach with late containment failure.

Table D–9 Watts Bar 1 and Sequoyah 1 and 2 Core Inventory

Nuclide	***Isotope***	***Inventory (Curies)***
Cobalt:	Co-58	874,000
	Co-60	668,000
Krypton:	Kr-85	671,000
	Kr-85m	3.14×10^{7}
	Kr-87	5.74×10^{7}
	Kr-88	7.76×10^{7}
Rubidium:	Rb-86	51,200
Strontium:	Sr-89	9.73×10^{7}
	Sr-90	5.25×10^{6}
	Sr-91	1.25×10^{8}
	Sr-92	1.30×10^{8}
Yttrium:	Y-90	5.64×10^{6}
	Y-91	1.19×10^{8}
	Y-92	1.31×10^{8}
	Y-93	1.48×10^{8}
Zirconium:	Zr-95	1.50×10^{8}
	Zr-97	1.56×10^{8}
Niobium:	Nb-95	1.42×10^{8}
Molybdenum:	Mo-99	1.65×10^{8}
Technetium:	Tc-99m	1.43×10^{8}
Ruthenium:	Ru-103	1.23×10^{8}
	Ru-105	8.01×10^{7}
	Ru-106	2.80×10^{7}
Rhodium:	Rh-105	5.55×10^{7}
Antimony:	Sb-127	7.56×10^{6}
	Sb-129	2.68×10^{7}
Tellurium	Te-127	7.30×10^{6}
	Te-127m	966,000
	Te-129	2.51×10^{7}
	Te-129m	6.62×10^{6}
	Te-131m	1.27×10^{7}
	Te-132	1.26×10^{8}
Iodine:	I-131	8.69×10^{7}
	I-132	1.28×10^{8}
	I-133	1.84×10^{8}
	I-134	2.02×10^{8}
	I-135	1.73×10^{8}
Xenon	Xe-133	1.84×10^{8}
	Xe-135	3.45×10^{7}
Cesium:	Cs-134	1.17×10^{7}
	Cs-136	3.57×10^{6}
	Cs-137	6.55×10^{6}
Barium:	Ba-139	1.70×10^{8}
	Ba-140	1.69×10^{8}
Lanthanum:	La-140	1.72×10^{8}
	La-141	1.58×10^{8}
	La-142	1.52×10^{8}
Cerium:	Ce-141	1.53×10^{8}
	Ce-143	1.49×10^{8}
	Ce-144	9.23×10^{7}
Praseodymium:	Pr-143	1.46×10^{8}
Neodymium:	Nd-147	6.54×10^{7}
Neptunium:	Np-239	1.75×10^{9}

Nuclide	*Isotope*	*Inventory (Curies)*
Plutonium:	Pu-238 Pu-239 Pu-240 Pu-241	99,300 22,400 28,200 4.76×10^6
Americium:	Am-241	3,140
Curium:	Cm-242 Cm-244	1.20×10^6 70,400

Source: NUREG/CR-4551 (NRC 1990b)

Table D–10 Release Category Timing and Source Terms

Release Times, Heights, Energies, and Source Terms for Selected Watts Bar and Sequoyah Nuclear Plants Release Categories					
Release Category	***Release Height (meters)***	***Warning Time (hours)***	***Release Time (hours)***	***Release Duration (hours)***	***Release Energy[a] (megawatts)***
I	10.00	8	10	2	28
II	10.00	20	24	4	1
III	10.00	20	30	10	3.5

Fission Product Source Terms (fraction of total inventory)[b]										
Release Category	***NG***	***I***	***Cs***	***Te***	***Sr***	***Ru***	***La***	***Ce***	***Ba***	***Mo***
I	0.90	0.042	0.043	0.044	0.0027	0.0065	0.00048	0.004	0.0046	0.0065
II	0.91	0.21	0.19	0.0004	0.0023	0.07	0.00028	0.00055	0.025	0.07
III	0.94	0.0071	0.011	0.0052	0.00036	0.00051	$\underline{4.2} \times 10^{-6}$	4.0×10^{-6}	0.0013	0.00051

NG = Noble gases.

[a] These values were taken from similar accident scenarios as given in NUREG/CR-4551.

[b] See Table D-9 for explanations of the chemical abbreviations used for the fission products listed above.

Source: TVA 1992a, TVA 1992b.

Table D–11 Release Category Frequencies and Related Accident Sequences for the Watts Bar and Sequoyah Nuclear Plants

Watts Bar Nuclear Plant		
I	6.8×10^{-7}	The major accident contributors to this release event are initiated by loss of offsite power and loss of the essential raw cooling water system with failure of the emergency diesels to start and/or failures in the 125-volt direct current distribution system, in conjunction with loss of secondary cooling and no recovery before core melt.
II	6.9×10^{-6}	The main contributor to this release event is initiated by a steam generator tube rupture in conjunction with either an operator error or random failure of electrical distribution systems, leading to failure of the coolant system and failure to control the affected steam generator before core melt occurs.
III	9.1×10^{-6}	The major accident contributors to this release event are initiated by loss of offsite power with various failures in the alternating current distribution systems and no recovery of power before core melts, and by a reactor coolant system loss-of-coolant accident (large- and medium-sized loss-of-coolant accident) with failure to establish long-term core cooling.

Sequoyah Nuclear Plant		
Release Category	***Release Frequency***	***Representative Accident Scenario(s)***
I	6.8×10^{-7}	The major accident contributors to this release event are initiated by loss of the 125-volt battery boards and loss of all offsite power with the failure of emergency diesels to start (station blackout: loss of all alternating current power to all emergency core cooling systems), as well as the failure of the auxiliary feedwater system (loss of secondary cooling) with no recovery before core melt.
II	4.0×10^{-6}	The accident scenario for this release event is similar to that given for the Watts Bar plant, above.
III	9.2×10^{-6}	The major accident contributors to this release event are initiated by: loss of offsite power with various failures in the alternating current and/or direct current distribution systems and no recovery of power before core melt, and by reactor coolant system small break loss-of-coolant accident (caused by either loss of the component cooling system leading to development of reactor coolant pump seals failure or another nonisolatable break in the reactor coolant system) with failure to depressurize the reactor and/or establish long-term reactor core cooling.

Representative Severe Accident Scenarios for the Bellefonte Nuclear Plant

For the Bellefonte Nuclear Plant, no plant-specific severe accident analysis information is available. This plant will have a complete probabilistic risk assessment covering both the internal and the external initiating events prior to the issuance of an operating license by the NRC. For the purposes of this EIS, a surrogate list of accident scenarios will need to be selected based on the review of accident analyses of similar plants. For this selection process, the publicly available reports on individual plant examination results from Three Mile Island 1 (GPUN 1993); Arkansas Nuclear One Unit 1 (Entergy 1993); and the Oconee Nuclear Station (Duke 1990), as well as a limited scope level 1 probabilistic risk assessment (core damage frequency calculation) report on the uncompleted Washington Nuclear Plant Unit 1 (WHC 1992), were reviewed. The review process identified Washington Nuclear Plant Unit 1 as the most similar in its nuclear steam supply system and containment structure to the Bellefonte Nuclear Plant.

Based on the above review, the Washington Nuclear Plant Unit 1 limited level 1 probabilistic risk assessment report was used as a surrogate for the Bellefonte Nuclear Plant. The core damage frequency calculations in this report include the estimate for the original design as well as that for a modified safety system. For the purposes of this EIS, the core damage frequency associated with the original (as built) design was considered. For the level 2 analysis, e.g., determination of containment performance in severe accidents and corresponding release categories, the analyses presented in WHC-EP-0263 (WHC 1991) were used. Again, the release category frequencies given in this report were modified to reflect that of the original design. In addition, in order to present the release categories consistent with those given for the Watts Bar and Sequoyah Nuclear Plants, the release categories were regrouped (WHC 1991) as Release Category I, II, and III, and the bounding release fractions and the shortest timings in each group were assigned to the new release categories.

The selected release categories and examples of various accident scenarios leading to containment failure and/or bypass are presented below for the Bellefonte plant. **Table D–12** presents the reactor core inventory for the Bellefonte plant. **Table D–13** provides relevant information on time to core damage, containment failure, release duration, and the isotope release fractions associated with each of the release levels. **Table D–14** provides a brief representation of dominant accident scenarios that lead to each release category level, along with its likelihood of occurrence.

Table D–12 Bellefonte Nuclear Plant Reactor Core Inventory

Nuclide	*Isotope*	*Inventory (Curies)*
Cobalt:	Co-58	919,000
	Co-60	703,000
Krypton:	Kr-85	706,000
	Kr-85m	3.30×10^{7}
	Kr-87	6.04×10^{7}
	Kr-88	8.17×10^{7}
Rubidium:	Rb-86	53,800
Strontium:	Sr-89	1.02×0^{8}
	Sr-90	5.53×10^{6}
	Sr-91	1.32×10^{8}
	Sr-92	1.37×10^{8}
Yttrium:	Y-90	5.93×10^{6}
	Y-91	1.25×10^{8}
	Y-92	1.37×10^{8}
	Y-93	1.56×10^{8}
Zirconium:	Zr-95	1.58×0^{8}
	Zr-97	1.64×10^{8}
Niobium	Nb-95	1.49×10^{8}
Molybdenum:	Mo-99	1.74×10^{8}
Technetium:	Tc-99m	1.50×10^{8}
Ruthenium:	Ru-103	1.30×10^{8}
	Ru-105	8.42×10^{7}
	Ru-106	2.94×10^{7}
Rhodium:	Rh-105	5.83×10^{7}
Antimony:	Sb-127	7.95×10^{6}
	Sb-129	2.81×10^{7}
Tellurium	Te-127	7.68×10^{6}
	Te-127m	1.02×10^{6}
	Te-129	2.64×10^{7}
	Te-129m	6.97×10^{6}
	Te-131m	1.33×10^{7}
	Te-132	1.33×10^{8}
Iodine:	I-131	9.14×10^{7}
	I-132	1.35×10^{8}
	I-133	1.93×10^{8}
	I-134	2.12×10^{8}
	I-135	1.82×10^{8}
Xenon:	Xe-133	1.93×10^{8}
	Xe-135	3.63×10^{7}
Cesium:	Cs-134	1.23×10^{7}
	Cs-136	3.75×10^{6}
	Cs-137	6.89×10^{6}
Barium:	Ba-139	1.79×10^{8}
	Ba-140	1.77×10^{8}
Lanthanum:	La-140	1.81×10^{8}
	La-141	1.66×10^{8}
	La-142	1.60×10^{8}
Cerium:	Ce-141	1.61×10^{8}
	Ce-143	1.57×10^{8}
	Ce-144	9.71×10^{7}
Praseodymium:	Pr-143	1.54×10^{8}
Neodymium:	Nd-147	6.88×10^{7}
Neptunium:	Np-239	1.84×10^{9}

Nuclide	Isotope	Inventory (Curies)
Plutonium:	Pu-238 Pu-239 Pu-240 Pu-241	104,000 23,600 29,700 5.00×10^6
Americium:	Am-241	3,300
Curium:	Cm-242 Cm-244	1.26×10^6 74,000

Source: Derived from NUREG/CR-4551 (NRC 1990b) by multiplying the values given in Table D–9 by the 1.055 (core thermal ratio of Bellefonte over Sequoyah Nuclear Plants).

Table D–13 Release Category Timing and Source Term

Release Times, Heights, Energies, and Source Terms for Selected Bellefonte Nuclear Plant Release Categories					
Release Category	*Release Height (meters)*	*Warning Time (hours)*	*Release Time (hours)*	*Release Duration (hours)*	*Release Energy (megawatts)*
I	15	2.0	3.0	5	40
II	30	2.0	3.0	1	30
III	15	10	24	5	40

Fission Product Source Terms (fraction of total inventory) [a]										
Release Category	*NG*	*I*	*Cs*	*Te*	*Sr*	*Ru*	*La*	*Ce*	*Ba*	*Mo*
I	1.0	0.003	0.003	0.006	0.0004	3.0×10^{-6}	3.0×10^{-6}	3.0×10^{-5}	0.0002	0.0002
II	1.0	0.07	0.07	0.1	0.01	6.0×10^{-5}	6.0×10^{-5}	0.0007	0.005	0.004
III	0.7	0.001	0.001	0.007	8.0×10^{-5}	8.0×10^{-7}	8.0×10^{-7}	9.0×10^{-6}	0.0001	3.0×10^{-6}

NG = noble gases.
[a] See Table D-12 for explanations of the chemical abbreviations used for the fission products listed above.
Source: WHC 1991.

Table D–14 Release Category Frequencies and the Related Accident Sequences for the Bellefonte Nuclear Plant

Release Category	*Release Frequency*	*Representative Accident Scenario(s)*
I	9.0×10^{-7}	The major accident contributors to this release event would be initiated by a loss of offsite power with failure of the diesel generators (station blackout) and long-term failure of the auxiliary feedwater system. Containment fails early.
II	9.1×10^{-7}	The major accident contributors to this release event would be initiated by a small loss-of-coolant accident followed by failure of emergency recirculation, containment spray recirculation, and containment isolation, and by a loss of offsite power with failure of the diesel generators (station blackout) and no recovery of power before core melt and containment isolation fails.
III	5.1×10^{-6}	The major accident contributors to this release event are initiated by a loss of offsite power with failure of the diesel generators (station blackout) and long-term failure of the auxiliary feedwater system. Containment fails late.

The information presented in the preceding three tables represents the best available estimate for the core damage frequency and characteristics without a plant-specific probabilistic assessment such as those performed for the Watts Bar and Sequoyah Nuclear Plants. The Washington Nuclear Plant was selected as exhibiting the most representative design, but differences between this plant and the Bellefonte Nuclear Plant are to be expected. The referenced probabilistic analysis is a limited scope analysis and the Washington Nuclear Plant, like the Bellefonte Nuclear Plant, is not in commercial operation. [The lack of operational data results in the use of some more conservative assumptions that impact the analysis results.] However, use of this data with Bellefonte Nuclear Plant site-specific population and weather data does allow a representative calculation of risk to be performed.

D.1.2 Methodology for Estimating Radiological Impacts

D.1.2.1 Introduction

The GENII and MACCS2 computer codes were used to perform probabilistic analyses of radiological impacts. The GENII computer code was used to estimate the consequences of the reactor design-basis, nonreactor design-basis, TPBAR-handling, and cask-handling accidents. The MACCS2 computer code was used for the beyond design-basis accidents. In addition, deterministic analyses, using the method in the reactor facility safety analysis reports, were performed for the release of tritium in the reactor and the nonreactor design-basis accidents. This additional analysis provides a basis for direct comparison between design-basis analysis results with and without the release of tritium from TPBARs.

A discussion of the GENII code is provided in Appendix C. A general discussion of the MACCS2 computer code is provided in Section D.1.2.2. A detailed description of the MACCS model is provided in NUREG/CR-4691 (NRC 1990a). The enhancements incorporated in MACCS2 are described in the MACCS2 User's Guide (SNL 1997).

D.1.2.2 MACCS2 Computer Code

The MACCS2 computer code, Version 1.12, is used to estimate the radiological doses and health effects that could result from postulated accidental releases of radioactive materials to the atmosphere. The specification of the release characteristics, designated a "source term," can consist of up to four Gaussian plumes that are often referred to simply as "plumes."

The radioactive materials released are modeled as being dispersed in the atmosphere while being transported by the prevailing wind. During transport, whether or not there is precipitation, particulate material can be modeled as being deposited on the ground. If contamination levels exceed a user-specified criterion, mitigative actions can be triggered to limit radiation exposures.

There are two aspects of the code's structure that are basic to understanding its calculations: (1) the calculations are divided into modules and phases, and (2) the region surrounding the facility is divided into a polar-coordinate grid. These concepts are described in the following sections.

MACCS2 is divided into three primary modules: ATMOS, EARLY, and CHRONC. Three phases are defined as the emergency, intermediate, and long-term phases. The relationship among the code's three modules and the three phases of exposure are summarized below.

The ATMOS module performs all of the calculations pertaining to atmospheric transport, dispersion, and deposition, as well as the radioactive decay that occurs before release and while the material is in the atmosphere. It utilizes a Gaussian plume model with Pasquill-Gifford dispersion parameters. The phenomena treated include building wake effects, buoyant plume rise, plume dispersion during transport, wet and dry deposition, and radioactive decay and ingrowth. The results of the calculations are stored for use by EARLY and CHRONC. In addition to the air and ground concentrations, ATMOS stores information on wind direction, arrival and departure times, and plume dimensions.

The EARLY module models the time period immediately following a radioactive release. This period is commonly referred to as the emergency phase. The emergency phase begins at each successive downwind distance point when the first plume of the release arrives. The duration of the emergency phase is specified by the user, and it can range between one and seven days. The exposure pathways considered during this period are direct external exposure to radioactive material in the plume (cloudshine), exposure from inhalation of radionuclides in the cloud (cloud inhalation), exposure to radioactive material deposited on the ground (groundshine), inhalation of resuspended material (resuspension inhalation), and skin dose from material deposited on the skin. Mitigative actions that can be specified for the emergency phase include evacuation, sheltering, and dose-dependent relocation.

The CHRONC module performs all of the calculations pertaining to the intermediate and long-term phases. CHRONC calculates the individual health effects that result from both direct exposure to contaminated ground and from inhalation of resuspended materials, as well as indirect health effects caused by the consumption of contaminated food and water by individuals who could reside both on and off of the computational grid.

The intermediate phase begins at each successive downwind distance point upon the conclusion of the emergency phase. The user can configure the calculations with an intermediate phase that has a duration as short as zero or as long as one year. Essentially, there is no intermediate phase and a long-term phase begins immediately upon conclusion of the emergency phase.

These models are implemented on the assumption that the radioactive plume has passed and the only exposure sources (groundshine and resuspension inhalation) are from ground-deposited material. It is for this reason that MACCS2 requires the total duration of a radioactive release be limited to no more than four days. Potential doses from food and water ingestion during this period are not considered.

The mitigative action model for the intermediate phase is very simple. If the intermediate phase dose criterion is satisfied, the resident population is assumed to be present and subject to radiation exposure from groundshine and resuspension for the entire intermediate phase. If the intermediate phase exposure exceeds the dose criterion, then the population is assumed to be relocated to uncontaminated areas for the entire intermediate phase.

The long-term phase begins at each successive downwind distance point upon the conclusion of the intermediate phase. The exposure pathways considered during this period are groundshine, resuspension inhalation, and food and water ingestion.

The exposure pathways considered are those resulting from ground-deposited material. A number of protective measures can be modeled in the long-term phase to reduce doses to user-specified levels such as decontamination, temporary interdiction, and condemnation. The decisions on mitigative action in the long-term phase are based on two sets of independent actions: (1) decisions relating to whether land at a specific location and time is suitable for human habitation (habitability), and (2) decisions relating to whether land at a specific location and time is suitable for agricultural production (farmability).

All of the calculations of MACCS2 are stored on the basis of a polar-coordinate spatial grid with a treatment that differs somewhat between calculations of the emergency phase and calculations of the intermediate and long-term phases. The region potentially affected by a release is represented with an (r,θ) grid system centered on the location of the release. The radius, r, represents downwind distance. The angle, θ, is the angular offset from north, going clockwise.

The user specifies the number of radial divisions as well as their endpoint distances. The angular divisions used to define the spatial grid are fixed in the code and correspond to the 16 points of the compass, each being 22.5 degrees wide. The 16 points of the compass are used in the U.S. to express wind direction. The compass sectors are referred to as the coarse grid.

Since emergency phase calculations use dose-response models for early fatalities and early injuries that can be highly nonlinear, these calculations are performed on a finer grid basis than the calculations of the intermediate and long-term phases. For this reason, the calculations of the emergency phase are performed with the 16 compass sectors divided into three, five, or seven equal, angular subdivisions. The subdivided compass sectors are referred to as the fine grid.

The compass sectors are not subdivided into fine subdivisions for the intermediate and long-term phases because these calculations do not include estimation of the often highly nonlinear early fatality and early injury health effects, being limited to cancer and genetic effects. In contrast to the emergency phase, the calculations for these phases are performed using doses averaged over the full 22.5 degree compass sectors of the coarse grid.

Two types of doses may be calculated by the code: "acute" and "lifetime."

Acute doses are calculated to estimate deterministic health effects that can result from high doses delivered at high dose rates. Such conditions may occur in the immediate vicinity of a nuclear power plant following hypothetical severe accidents where containment failure has been assumed to occur. Examples of the health effects based on acute doses are early fatality, prodromal vomiting, and hypothyroidism.

Lifetime doses are the conventional measure of detriment used for radiological protection. These are 50-year dose commitments to either specific tissues (e.g., red marrow and lungs) or a weighted sum of tissue doses defined by the International Commission on Radiological Protection and referred to as "effective dose." Lifetime doses may be used to calculate the stochastic health effect risk resulting from exposure to radiation. MACCS2 uses the calculated lifetime dose in cancer risk calculations.

D.1.2.3 Data and General Assumptions

To assess the consequences of the accidents, with the exception of the beyond design-basis accidents, data were collected and produced and assumptions were made for incorporation in the GENII analyses. The source terms for the various accidents are described in Section D.1.1. The meteorological and population data are identical to those described in Appendix C. Ingestion parameters are based on Regulatory Guide 1.109 (NRC 1977).

To assess the consequences of beyond design-basis accidents, the following data and assumptions were incorporated into the MACCS2 analysis.

- The **nuclide inventory** at accident initiation (e.g., reactor trip) of those radioactive nuclides important for the calculation of offsite consequences for each reactor is given in Section D.1.1.

- The **atmospheric source term** produced by the accident is described by the number of plume segments released; sensible heat content; timing; duration; height of release for each plume segment; time when offsite officials are warned that an emergency response should be initiated; and for each important radionuclide, the fraction of that radionuclide's inventory released with each plume segment. The source terms for each accident scenario are provided in Section D.1.1.

- **Meteorological data** characteristics of the site region are described by one year of hourly windspeed, atmospheric stability, and rainfall recorded at each site. Although one year of hourly readings contains 8,760 weather sequences, MACCS2 calculations examine only a representative subset of these sequences. The representative subset is selected by sampling the weather sequences after sorting them into weather bins defined by windspeed, atmospheric stability, and intensity and distance of the occurrence of rain.

- The **population distribution information** about each reactor site is based on the 1990 U.S. Census of Population and Housing (DOC 1992). State and county population estimates were examined to extrapolate the 1990 data to the year 2025. This data was fitted to a polar coordinate grid with 16 angular sectors aligned with the 16 compass directions and 29 radial intervals that extend outward to 80 kilometers (50 miles).

- **Habitable land fractions** for the region around each reactor site were determined in a manner similar to the population distribution. The census block group boundary files include polygons that are classified as water features. The percentage of each sector that is covered by water is determined by fitting this data to the polar coordinate grid.

- **Farmland fractions** are the percentage of land devoted to farming (DOC 1993).

- **Emergency response assumptions** for evacuation, including delay time before evacuation, area evacuated, average evacuation speed, and travel distance, are provided in the Tennessee Multi-Jurisdictional Plans. Average evacuation speeds are based on the most conservative general population evacuation times.

- **Shielding and exposure data** must be input to the MACCS2 code. The code requires shielding factors be specified for people evacuating in vehicles (cars, buses); taking shelter in structures (houses, offices, schools); and continuing normal activities either outdoors, in vehicles, or indoors. Because inhalation doses depend on breathing rate, breathing rates must be specified for people who are continuing normal activities, taking shelter, and evacuating. Since indoor concentrations of gas-borne radioactive materials are usually substantially less than outdoor concentrations, MACCS2 also requires that inhalation and skin protection shielding factors (indoor/outdoor concentration ratios) be provided.

  The protection factors presented in **Table D–15** were used in the analyses. The values in Table D–15 are for the Sequoyah Nuclear Plant as stated in NUREG/CR-4551, and were used in the analysis for all three plants.

Table D–15 NUREG/CR–4551 Protection Factors

Protection Factor[a]	***Evacuees***	***Sheltering***	***Normal Activities***
Cloud Shielding Factor	1.0	0.65	0.75
Skin Protection Factor	1.0	0.33	0.41
Inhalation Protection Factor	1.0	0.33	0.41

[a] A protection factor of 1.0 indicates no protection, while a protection factor of 0.0 indicates 100 percent protection.

For this analysis, the evacuation and sheltering region is defined as a 10-mile radial distance centered on the plant. A sheltering period is defined as the phase occurring before the initiation of the evacuation. During the sheltering phase, shielding factors appropriate for sheltered activity are used to calculate doses for the individuals in contaminated areas.

At the end of the sheltering phase, the resident individuals begin their travel out of the region. Travel speeds and delay times are based on the Tennessee Multi-Jurisdictional Plans. The general population evacuation times for the various areas within the 10-mile radius are averaged to determine an overall evacuation delay time and evacuation speed for the Watts Bar and Sequoyah Nuclear Plants. Bellefonte Nuclear Plant evacuation plans were unavailable, so the Bellefonte evacuation parameters were based on the Sequoyah Nuclear Plant data.

- Maximally Exposed Offsite Individual Dose is the total dose estimated to be incurred by a hypothetical individual assumed to reside at a particular location on the spatial grid. Population data, therefore, have no bearing on the generation of this consequence measure. Only direct exposure is considered in these results. Exposures from the ingestion of contaminated food and water are not included. Also, the generation of these results takes full account of any mitigative action models activated by exceeding the dose thresholds. During evacuation, individuals have no protection from direct exposure. Therefore, in certain scenarios, it is possible that an evacuee may incur a larger direct exposure dose than an individual who does not evacuate.

- Long-term protective measures such as decontamination, temporary relocation, contaminated crops, milk condemnation, and farmland production prohibition are based on U.S. Environmental Protection Agency (EPA) Protective Action Guides.

- Mitigative actions (relocation, evacuation, interdiction, condemnation) are implemented for beyond design-basis accidents (vessel breach with containment bypass, vessel breach with early containment failure, and vessel breach with late containment failure).

- Dose conversion factors required by MACCS2 for the calculation of committed effective dose equivalents are cloudshine dose-rate factor; groundshine dose-rate factor; "lifetime" 50-year committed inhalation dose, used for calculation of individual and societal doses and stochastic health effects; and 50-year committed ingestion dose, used for calculation of individual and societal doses and stochastic health effects from food and water ingestion.

The MACCS2 dose conversion factor preprocessor FGRDCF was used to create the dose factors. FGRDCF incorporates the data of Federal Guidance Reports 11 and 12 (EPA 1988, EPA 1993). The inhalation and ingestion dose conversion factors are for the most part identical to the values listed in International Commission on Radiological Protection 30 (ICRP 1980). Revised metabolic models for the following transuranic elements: niobium, plutonium, americium, curium, berkelium, californium, einsteinium, fermium, and mendelevium are used (ICRP 1986). In addition, Federal Guidance Report 11 provides inhalation and ingestion dose conversion factors for a few radionuclides (strontium-82, technetium-95, technetium-95m, antimony-116, plutonium-246, and curium-250) not considered in International Commission on Radiological Protection 30, but for which nuclear decay data were presented in International Commission on Radiological Protection 38 (ICRP 1983). Federal Guidance Report 12 provides external dose-rate factors for the 825 nuclides identified in International Commission on Radiological Protection 38.

The only change made to the dose conversion factors produced by FGRDCF was to the tritium inhalation factor. The 50-year committed inhalation dose for tritium was increased by 50 percent to account for skin absorption (PNL 1988).

D.1.2.4 Health Effects Calculations

The following sections describe the technical approach used to calculate potential consequences to human health from exposure to radionuclides.

The health consequences from exposure to radionuclides from accidental releases were calculated. Total effective dose equivalents were calculated and converted to estimates of cancer fatalities using dose conversion factors recommended by the International Commission on Radiological Protection. For individuals, the estimated probability of a latent cancer fatality occurring is reported for the maximally exposed individual, an average individual in the population within 80 kilometers (50 miles), and a noninvolved worker.

The nominal values of lifetime cancer risk for low dose or low dose rate exposure (less than 20 rad) used in this EIS are 0.0005 per person-rem for a population of all ages and 0.0004 per person-rem for a working population. These dose-to-risk conversion factors are established by the National Council on Radiation

Protection and Measurement (NCRP 1993). See Appendix C for more detail regarding human health risk factors for nonfatal cancers and genetic disorders.

GENII uses a straight line plume method for calculating doses to receptors. The release/plume is assumed to disperse outward from the release point in one direction. Plume dispersion refers to the plume spreading out over a larger area and becoming less concentrated, which leads to lower doses. Certain weather conditions are better for plume dispersion than others. Therefore, it is necessary to analyze the doses to each receptor (e.g., the maximally exposed individual population and the noninvolved worker) for the 16 compass sectors at each site to determine the maximum sector doses. This maximum receptor dose is presented in this EIS. This analysis conservatively assumes that after the accident, the wind would blow towards the sector which produces maximum dosage. In addition, the GENII analyses assume that the accident occurs in autumn, which maximizes the estimated dose from contaminated food ingestion. Doses to each receptor were calculated using 50 percent meteorology. Fifty percent weather indicates a distribution with median weather conditions, (half of the weather conditions are worse and half are better). This meteorology is consistent with the guidance provided in the NRC's Regulatory Guide 4.2 (NRC 1976).

The MACCS2 code was applied in a probabilistic manner using a weather bin sampling technique. The weather bin sampling method sorts weather sequences into categories and assigns a probability to each category according to the initial conditions (wind speed and stability class) and the occurrence of rain. Each of the sampled meteorological sequences was applied to each of the 16 sectors (accounting for the frequency of occurrence of the wind blowing in that direction). Individual doses as a function of distance and direction were calculated for each of the meteorological sequence samples. The mean dose values of the sequences were generated for each of the 16 sectors. The highest of these dose values was used for the maximally exposed individual and the noninvolved worker. Population doses are the sum of the individual doses in each sector.

D.1.2.5 Deterministic Calculations

D.1.2.5.1 Introduction

In addition to the GENII and MACCS2 calculations, deterministic analyses were performed for the reactor and nonreactor design-basis accidents (large break loss-of-coolant accident and waste gas decay tank rupture). The deterministic analyses were performed to provide a comparison of the effect of tritium on the doses calculated in the candidate reactor Final Safety Analysis Reports. The Final Safety Analysis Reports present the thyroid inhalation, whole body beta, and whole body gamma doses at the exclusion area boundary and the low population zone. The deterministic analyses calculate the additional dose attributable to tritium using the same method as the Final Safety Analysis Reports.

D.1.2.5.2 Large Break Loss-of-Coolant Accident

To determine the effects of a tritium release following a postulated design-basis accident, a deterministic analysis based on Regulatory Guide 1.4 (NRC 1974) was adopted. The Regulatory Guide 1.4 analysis was incorporated in the candidate reactor Safety Analysis Reports to calculate the environmental effects resulting from a design-basis large break loss-of-coolant accident event. The following paragraphs describe the release paths from containment to the environment, the conservatisms employed, and the dose calculation method.

The primary containment leak rate used in the Final Safety Analysis Report analyses for the first 24 hours is the design-basis leak rate (as specified in the technical specifications regarding containment leakage), and it is 50 percent of this value for the duration of the accident. The Watts Bar and Sequoyah Final Safety Analysis Reports assume the primary containment (known here as steel containment vessel) leak rates to be 0.25 percent of the containment atmosphere per day for the first 24 hours following the accident and 0.125 percent per day for the remainder of the 30-day period. The Bellefonte Final Safety Analysis Report assumes the leak rate to be 0.2 percent per day for the first 24 hours following the accident and 0.1 percent per day for the remainder of the 30-day period.

For the Watts Bar and Sequoyah Nuclear Plants, the leakage from the steel containment vessel can be grouped into two categories: leakage into the auxiliary building and leakage into the annulus (a space between the steel containment vessel and shield building where leakage from primary containment is collected before it is released). For the Bellefonte Nuclear Plant, the leakage from the primary containment can be grouped into three categories: leakage into the auxiliary building, leakage into the annulus (a space between primary and secondary containment), and leakage directly to the environment.

The Watts Bar and Sequoyah Nuclear Plant analyses assume that 25 percent of the total primary leakage goes to the auxiliary buildings. This value is an estimated upper bound of leakage to the auxiliary buildings based on 10 CFR 50, Appendix J, testing of all containment penetrations. Selecting an upper bound is conservative because an increased leakage fraction to the auxiliary building would result in an increased offsite dose. The Bellefonte Nuclear Plant analysis assumes that 9.5 percent of the total primary leakage goes to the auxiliary building.

At the Watts Bar and Sequoyah Nuclear Plants, the auxiliary building is normally ventilated by the auxiliary building ventilation system. However, following a large break loss-of-coolant accident, the normal ventilation systems to all areas of the auxiliary building would be shut down and isolated. Upon auxiliary building isolation, the auxiliary building gas treatment system would be activated to ventilate the area and filter the exhaust to the atmosphere. At the Bellefonte Nuclear Plant, during both normal and emergency operations, the auxiliary building's engineered safety feature environmental control system provides pressure control and cleanup.

At each plant, fission products that leak from the primary containment to areas of the auxiliary building would be diluted in the room atmosphere and would travel through ducts and other rooms to the areas where the suctions for the auxiliary building gas treatment system or environmental control system are located. The Final Safety Analysis Report analyses allow a holdup time for airborne activity after an initial period of direct release. However, for the tritium analysis, it is conservatively assumed that activity leaking to the auxiliary building would be released directly to the environment through the auxiliary building gas treatment system or environmental control system, neglecting any holdup time in the auxiliary building before being exhausted.

The Watts Bar and Sequoyah Nuclear Plant analyses assume that 75 percent of the primary containment leakage would be to the annulus (TVA 1995a, TVA 1996). The Bellefonte Nuclear Plant analysis assumes that 90 percent of the primary containment leakage would be to the annulus (TVA 1991). The presence of the annulus between the primary containment (or steel containment vessel) and the secondary containment (or shield building) reduces the probability of direct leakage from the containment to the atmosphere and allows holdup and plate-out of fission products in the shield building. For the tritium analysis, plate-out in the annulus is neglected.

Transfer of activity from the annulus volume to the emergency gas treatment system suction for the Watts Bar and Sequoyah Nuclear Plants, or to the secondary containment cleanup system suction for the Bellefonte Nuclear Plant, is assumed to be a statistical process mathematically similar to the decay process (i.e., the rate of removal from the annulus is proportional to the activity in the annulus). This corresponds to an assumption that the activity is homogeneously distributed throughout the mixing volume. Because of the low emergency gas treatment system or secondary containment cleanup system flow rate compared to the annulus volume, the thermal convection due to heating of the containment structure, and the relative location of the emergency gas treatment system or secondary containment cleanup system suctions and the emergency gas treatment system or secondary containment cleanup system recirculation exhausts, a high degree of mixing can be expected.

It is, however, conservatively assumed that only 50 percent of the annulus free volume is available for mixing of the activity.

The emergency gas treatment system and secondary containment cleanup system are essentially annulus recirculation systems with pressure-activated valves that allow part of the system flow to be exhausted to the atmosphere to maintain an adequate annulus pressure. It is conservatively assumed that, for the first hour following the accident, all of the available tritium is exhausted. The holdup time is a function of the emergency gas treatment system or secondary containment cleanup system flow and exhaust rates, as well as the annulus volume. The holdup time before release is defined as 50 percent of the annulus volume divided by the exhaust flow rate of the emergency gas treatment system or secondary containment cleanup system.

The annulus pressure would be maintained at less than the auxiliary building's internal pressure during normal operation; therefore, any leakage between the two volumes following a loss-of-coolant accident would be into the annulus. It is conservatively assumed that there is no leakage via this route.

The Bellefonte Nuclear Plant also has a leakage of 0.5 percent of the total primary containment leak rate directly to the environment. This leakage is assumed to pass directly to the environment without mixing or holdup.

In the Final Safety Analysis Reports, thyroid inhalation and external whole body gamma and beta doses are calculated at the exclusion area boundary and low population zone. The inhalation and beta doses for tritium are calculated; no gamma dose calculation is needed since tritium decays only by beta emission.

The exclusion area boundary is that area surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided these are not so close to the facility that they interfere with normal operations of the facility and appropriate and effective arrangements are made to control traffic and protect public health and safety on the highway, railroad, or waterway in an emergency. Residences within the exclusion area normally would be prohibited. In any event, residents would be subject to ready removal in case of necessity. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety would result.

The low population zone is the area immediately surrounding the exclusion area that contains residents whose total number and density indicate there is a reasonable probability that appropriate protective measures could be taken on their behalf in the event of a serious accident. These guides do not specify a permissible population density or total population within this zone because the situation may vary from case to case. For example, whether a specific number of people can be evacuated from a specific area or instructed to take shelter on a timely basis would depend on many factors such as location, number and size of highways, scope and extent of advance planning, and actual distribution of residents within the area.

Calculations are performed using hourly time steps. This time step size is appropriate because of the large primary containment volume and low leakage rate; the tritium concentration (activity per volume) decreases only a few tenths of a percent per hour. At each time step the activity per hour is calculated and placed in the thyroid inhalation and beta dose formulas shown below to determine the doses. Final Safety Analysis Report time-dependent atmospheric dispersion factors, breathing rates, and dose conversion factors are incorporated. The doses at each time step are summed for a total dose. Doses are calculated separately for each pathway (annulus, auxiliary building, bypass), and then summed.

Thyroid inhalation doses are calculated using the following equation (NRC 1974, AEC 1972).

$$Dose = \left(\frac{X}{Q}\right)_t \cdot BR_t \cdot Q_t \cdot DCF$$

where:

$\left(\frac{X}{Q}\right)_t$	is the average atmospheric dilution factor over a given time interval t
Br_t	is the breathing rate for time interval t
Q_t	is the activity of tritium released during a given time interval t
DCF	is the inhalation dose conversion factor for tritium

Whole body beta doses are calculated using the following equation (NRC 1974, AEC 1972).

$$Dose = 0.23 \cdot \left(\frac{X}{Q}\right)_t \cdot Q_t \cdot \overline{E_\beta}$$

where:

$\left(\frac{X}{Q}\right)_t$	is the average atmospheric dilution factor over a given time interval t
Q_t	is the activity of tritium released during a given time interval t
$\overline{E_\beta}$	is the average beta radiation energy emitted by tritium per disintegration

D.1.2.5.3 Waste Gas Decay Tank Accident

The effects of a tritium release following a postulated waste gas decay tank rupture also are analyzed using a deterministic approach. As in the Final Safety Analysis Reports, this analysis is based on Regulatory Guide 1.24 (AEC 1972). The tritium source term available for release from the waste gas decay tank is described in Section D.1.1. The inventory of the waste gas decay tank is assumed to leak out at ground level over a two-hour time period. Thyroid inhalation and whole-body beta doses are calculated for the exclusion area boundary and the low population zone using the equations described in Section D.1.2.5.2. Final Safety Analysis Report time-dependent atmospheric dispersion factors, breathing rates, and dose conversion factors are incorporated.

D.1.2.6 Uncertainties

The sequence of analyses performed to generate the radiological and hazardous chemicals impacts estimates from normal operation of commercial light water reactor (CLWR) facilities, CLWR facility accidents, and overland transportation include: (1) selection of normal operational modes and accident scenarios and their probabilities, (2) estimation of source terms, (3) estimation of environmental transport and uptake of radionuclides and hazardous chemicals, (4) calculation of radiation and chemical doses to exposed individuals, and (5) estimation of health effects. Health effects are presented in terms of latent cancers and latent cancer fatalities. There are uncertainties associated with each of these steps. Uncertainties exist in the way the physical systems being analyzed are represented by the computational models and in the data required to exercise the models (due to measurement errors, sampling errors, or natural variability).

Of particular interest are the uncertainties in the estimates of cancer deaths from exposure to radioactive materials. The numerical values of the health risk estimates used in this EIS (refer to C.2.1.2) are obtained by the practice of linear extrapolation from the nominal risk estimate for lifetime total cancer mortality resulting from exposures at 10 rad. Other methods of extrapolation to the low-dose region could yield higher or lower estimates of cancer deaths. Studies of human populations exposed at low doses are inadequate to demonstrate the actual level of risk. There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiological observation, and the possibility of no risk or even health benefits (hormesis effects) cannot be excluded. Because the health risk estimators are multiplied by conservatively calculated radiological doses to predict fatal cancer risks, the fatal cancer values presented in this EIS are expected to be overestimates.

For the purposes of presentation in this EIS, the impacts calculated from the linear model are treated as an upper bound case, consistent with the widely used methodologies for quantifying radiogenic health impacts. This does not imply that health effects are expected. Moreover, in cases where the upper bound estimators predict a number of latent cancer deaths that is greater than one, this does not imply that the latent cancer deaths are identifiable to any individual.

Uncertainties are also introduced when accident analyses performed for similar existing facilities have been used as a major source of data. Although the radionuclide composition of source terms are reasonable estimates, there are uncertainties in the radionuclide inventory and release fractions that affect the estimated consequences. Accident frequencies for low probability sequences of events are always difficult to estimate, even for operating facilities, because there is little or no record of historical occurrences. For a new facility, such as Bellefonte 1 or 2, any use of accident frequencies that are estimated from similar exiting facilities would tend to further compound the effects of uncertainties.

In summary, the radiological and hazardous chemical impact estimates presented in this EIS were obtained by:

- Using the latest available data
- Considering the processes, events, and accidents reasonably foreseeable for tritium production in a CLWR and overland transportation of irradiated TPBARs
- Making conservative assumptions when there is doubt about the exact nature of the processes and events taking place, such that the chance of underestimating health impacts is small

D.1.3 Accident Consequences and Risks

D.1.3.1 Reactor Design-Basis Accident

The reactor design-basis accident source term and accident frequency data, presented in Tables D–2 and D–3, were evaluated using two different accident analysis approaches. The first analysis approach used the GENII accident analysis computer code (PNL 1988) to estimate the accident consequences and risks. The second analysis approach was based on published NRC guidance for the assessment of design-basis accident impacts. The NRC requires that the results of an analysis evaluating design-basis accident impacts on a different set of receptors be submitted for evaluation as part of the licensing basis for each reactor.

Analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2 (NRC 1976). This guide recommends using an atmospheric diffusion value (χ/Q value) corresponding to 1/10 of the value determined in Safety Guide No. 4. This safety guide has been revised and reissued as Revision 2, Regulatory Guide 1.4 (NRC 1974). The NRC in 1983 issued Regulatory Guide 1.145, providing guidance in determining 95th percentile χ/Q values using a site meteorological direction-dependent approach (NRC 1983). In these analyses, DOE assumes the 95 percentile direction-dependent χ/Q values are consistent with the guidance provided in Safety Guide No. 4 and Regulatory Guide 1.4. The GENII computer code, which is based on the current NRC's acceptable directional dependent approach, was used to determine 50 percentile and 95 percentile meteorological conditions for each site. The results indicated that the estimated doses using 50 percentile meteorological conditions were more than 0.1 times the 95 percentile meteorological doses. Therefore, the 50 percentile meteorological condition at each site was used to estimate the consequences of design-basis and TPBAR handling accidents.

Table D–16 summarizes the GENII-generated consequences of the reactor design-basis accident to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, a noninvolved worker at the Watts Bar and Bellefonte Nuclear Plant Sites located 640 meters (0.4 miles) from the release point, and a noninvolved worker at the Sequoyah Nuclear Plant located at the site boundary 556 meters (0.35 miles) from the release point. The risks associated with the reactor design-basis accident to the same receptors are summarized in **Table D–17**.

Table D–18 summarizes the consequences of the reactor design-basis accident (estimated using NRC guidance and 95th percentile χ/Q values) to an individual located at the reactor site exclusion area boundary and an individual located at the reactor site low population zone. The 0 TPBAR entries represent total accident dose compared to the 1,000 and 3,400 TPBAR entries, which represent the incremental change to the dose due to the addition of TPBARs. The margin-to-site dose limits (i.e., the difference between the dose estimate and the site dose criteria) associated with the reactor design-basis accident to the same receptors are summarized in **Table D–19**.

D.1.3.2 Nonreactor Design-Basis Accident

The nonreactor design-basis accident source term and accident frequency data presented in Section D.1.1.3 were evaluated using two different accident analysis approaches. The first analysis approach used the GENII accident analysis computer code (PNL 1988) to estimate the accident consequences and risks. The second analysis approach was based on published NRC guidance for the assessment of design-basis accident impacts. The NRC requires that the results of an analysis evaluating design-basis accident impacts on a different set of receptors be submitted for evaluation as part of the licensing basis for each reactor.

Table D–16 GENII-Generated Reactor Design-Basis Accident Consequences

Reactor Site	Tritium Production	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
		Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Watts Bar	1,000 TPBARs	0.0014	7.0×10^{-7}	0.000011	5.5×10^{-9}	0.000024	9.6×10^{-9}
	3,400 TPBARs	0.0047	2.4×10^{-6}	0.000038	1.9×10^{-8}	0.000081	3.2×10^{-8}
Sequoyah	1,000 TPBARs	0.0019	9.5×10^{-7}	0.000022	1.1×10^{-8}	8.1×10^{-6}	3.2×10^{-9}
	3,400 TPBARs	0.0065	3.3×10^{-6}	0.000075	3.8×10^{-8}	0.000028	1.1×10^{-8}
Bellefonte	1,000 TPBARs	0.000085	4.3×10^{-8}	1.7×10^{-6}	8.5×10^{-10}	2.9×10^{-8}	1.2×10^{-11}
	3,400 TPBARs	0.00029	1.5×10^{-7}	5.5×10^{-6}	2.8×10^{-9}	1.0×10^{-7}	4.0×10^{-11}

[a] Increased likelihood of cancer fatality.

Table D–17 Reactor Design-Basis Accident Annual Risks

Reactor Site	Tritium Production	Maximally Exposed Offsite Individual [a]	Average Individual in Population to 80 kilometers (50 miles) [a]	Noninvolved Worker [a]
Watts Bar	1,000 TPBARs	1.4×10^{-10}	1.1×10^{-12}	1.9×10^{-12}
	3,400 TPBARs	4.8×10^{-10}	3.8×10^{-12}	6.4×10^{-12}
Sequoyah	1,000 TPBARs	1.9×10^{-10}	2.2×10^{-12}	6.4×10^{-13}
	3,400 TPBARs	6.6×10^{-10}	7.6×10^{-12}	2.2×10^{-12}
Bellefonte	1,000 TPBARs	8.6×10^{-12}	1.7×10^{-13}	2.4×10^{-15}
	3,400 TPBARs	3.0×10^{-11}	5.6×10^{-13}	8.0×10^{-15}

[a] Increased likelihood of cancer fatality per year.

Table D–18 Reactor Design-Basis Accident Consequences Using the NRC Analysis Approach

Reactor Site	Tritium Production	Dose Description	Individual at Area Exclusion Boundary Dose (rem)	Individual at Low Population Zone Dose (rem)
Watts Bar	0 TPBARs (No Action) [a]	Thyroid Inhalation Dose	34.1	11.0
		Beta + Gamma Whole Body Dose	3.5	3.4
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0018	0.0022
		Beta + Gamma Whole Body Dose	0.00010	0.00018
	3,400 TPBARs [b]	Thyroid Inhalation Dose	0.0060	0.0075
		Beta + Gamma Whole Body Dose	0.00035	0.00061
Sequoyah	0 TPBARs (No Action) [a]	Thyroid Inhalation Dose	145	27
		Beta + Gamma Whole Body Dose	12.2	2.9
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0044	0.0018
		Beta + Gamma Whole Body Dose	0.00026	0.0001
	3,400 TPBARs [b]	Thyroid Inhalation Dose	0.015	0.0060
		Beta + Gamma Whole Body Dose	0.00088	0.00047

Reactor Site	Tritium Production	Dose Description	Individual at Area Exclusion Boundary Dose (rem)	Individual at Low Population Zone Dose (rem)
Bellefonte	0 TPBARs [c, d]	Thyroid Inhalation Dose	5.8	2.7
		Beta + Gamma Whole Body Dose	0.031	0.18
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0041	0.0028
		Beta + Gamma Whole Body Dose	0.00024	0.00021
	3,400 TPBARs [b]	Thyroid Inhalation Dose	0.011	0.0095
		Beta + Gamma Whole Body Dose	0.00082	0.00073

[a] TVA 1995a, TVA 1996.
[b] Only TPBAR contribution to dose.
[c] TVA 1991.
[d] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action radiological dose is 0.

Table D–19 Reactor Design-Basis Accident Consequence Margin to Site Dose Criteria

Reactor Site	Tritium Production	Dose Description [a]	Site Dose Criteria (rem) [b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%) [c]	Dose (rem)	Margin (%) [c]
Watts Bar	0 TPBARs (No Action) [d]	Thyroid Inhalation Dose	300	34.1	88.6	11.0	96.3
		Beta + Gamma Whole Body Dose	25	3.5	86.1	3.4	86.2
	1,000 TPBARs	Thyroid Inhalation Dose	300	34.1	88.6	11.0	96.3
		Beta + Gamma Whole Body Dose	25	3.5	86.1	3.4	86.2
	3,400 TPBARs	Thyroid Inhalation Dose	300	34.1	88.6	11.0	96.3
Sequoyah	0 TPBARs	Beta + Gamma Whole Body Dose	25	3.5	86.1	3.4	86.2
	(No Action) [d]	Thyroid Inhalation Dose	300	145	51.6	27	91.0
	1,000 TPBARs	Beta + Gamma Whole Body Dose	25	12.2	51.1	2.9	88.4
		Thyroid Inhalation Dose	300	145	51.6	27	91.0
		Beta + Gamma Whole Body Dose	25	12.2	51.1	2.9	88.4
	3,400 TPBARs	Thyroid Inhalation Dose	300	145	51.6	27	91.0
		Beta + Gamma Whole Body Dose	25	12.2	51.1	2.9	88.4
Bellefonte	0 TPBARs [e, f]	Thyroid Inhalation Dose	300	5.8	98.1	2.7	99.1
		Beta + Gamma Whole Body Dose	25	0.031	99.9	0.18	99.3
	1,000 TPBARs	Thyroid Inhalation Dose	300	5.8	98.1	2.7	99.1
		Beta + Gamma Whole Body Dose	25	0.031	99.9	0.18	99.3
	3,400 TPBARs	Thyroid Inhalation Dose	300	5.9	98.0	2.7	99.1
		Beta + Gamma Whole Body Dose	25	0.032	99.9	0.18	99.3

[a] Dose is the total dose from the reactor plus the contribution from the TPBARs.
[b] 10 CFR 100.11.
[c] Margin below the site dose criteria.
[d] TVA 1995a, TVA 1996.
[e] TVA 1991.
[f] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action Alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action Alternative radiological dose is 0.

Analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2 (NRC 1976). **Table D–20** summarizes the GENII-generated consequences of the nonreactor design-basis accident with 50 percent meteorological conditions to the maximally exposed offsite individual, an average individual within an 80-kilometer (50-mile) radius of the reactor site, a noninvolved worker at the Watts Bar and Bellefonte Nuclear Plant sites located 640 meters (0.4 miles) from the release point, and a noninvolved worker at the Sequoyah Nuclear Plant located at the site boundary 556 meters (0.35 miles) from the release point. The risks associated with the nonreactor design-basis accident to the same receptors are summarized in **Table D–21.**

Table D–22 summarizes the consequences of the nonreactor design-basis accident to an individual located at the reactor site exclusion area boundary and an individual located at the reactor site low population zone. NRC guidance was used to derive these estimates. The 0 TPBAR entries represent total accident dose as opposed to the 1,000 and 3,400 TPBAR entries, which represent the incremental change to the dose due to the addition of TPBARs. The margin to NRC dose limits (i.e., the difference between the dose estimate and the site dose limit) associated with the reactor design-basis accident to the same receptors are summarized in **Table–23.**

Table D–20 GENII-Generated Nonreactor Design-Basis Accident Consequences

Reactor Site	*Tritium Production*	*Maximally Exposed Offsite Individual*		*Average Individual in Population to 80 kilometers (50 miles)*		*Noninvolved Worker*	
		Dose (rem)	*Cancer Fatality*[a]	*Dose (rem)*	*Cancer Fatality*[a]	*Dose (rem)*	*Cancer Fatality*[a]
Watts Bar	1,000 TPBARs	0.0067	3.4×10^{-6}	0.000079	4.0×10^{-8}	0.00010	4.2×10^{-8}
	3,400 TPBARs	0.022	0.000011	0.00027	1.4×10^{-7}	0.00036	1.5×10^{-7}
Sequoyah	1,000 TPBARs	0.0016	7.9×10^{-7}	0.00012	6.1×10^{-8}	0.000032	1.3×10^{-8}
	3,400 TPBARs	0.0054	2.7×10^{-6}	0.00042	2.1×10^{-7}	0.00011	4.5×10^{-8}
Bellefonte	1,000 TPBARs	0.00016	7.9×10^{-8}	0.000043	2.2×10^{-8}	3.1×10^{-7}	1.2×10^{-10}
	3,400 TPBARs	0.00054	2.7×10^{-7}	0.00015	7.4×10^{-8}	1.1×10^{-6}	4.3×10^{-10}

[a] Increased likelihood of cancer fatality.

Table D–21 Nonreactor Design-Basis Accident Annual Risks

Reactor Site	*Tritium Production*	*Maximally Exposed Offsite Individual*[a]	*Average Individual in Population to 80 kilometers (50 miles)*[a]	*Noninvolved Worker*[a]
Watts Bar	1,000 TPBARs	3.4×10^{-8}	4.0×10^{-10}	4.2×10^{-10}
	3,400 TPBARs	1.1×10^{-7}	1.4×10^{-9}	1.5×10^{-9}
Sequoyah	1,000 TPBARs	7.9×10^{-9}	6.1×10^{-10}	1.3×10^{-10}
	3,400 TPBARs	2.7×10^{-8}	2.1×10^{-9}	4.5×10^{-10}
Bellefonte	1,000 TPBARs	7.9×10^{-10}	2.2×10^{-10}	1.2×10^{-12}
	3,400 TPBARs	2.7×10^{-9}	7.4×10^{-10}	4.3×10^{-12}

[a] Increased likelihood of cancer fatality per year.

Table D–22 Nonreactor Design-Basis Accident Consequences Using the NRC Analysis Approach

Reactor Site	Tritium Production	Dose Description	Individual at Area Exclusion Boundary Dose (rem)	Individual at Low Population Zone Dose (rem)
Watts Bar	0 TPBARs (No Action) [a]	Thyroid Inhalation Dose	0.018	0.0042
		Beta + Gamma Whole Body Dose	0.13	0.031
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0020	0.00048
		Beta + Gamma Whole Body Dose	0.00012	0.000028
	3,400 TPBARs [b]	Thyroid Inhalation Dose	0.0068	0.0016
		Beta + Gamma Whole Body Dose	0.00040	0.000097
Sequoyah	0 TPBARs (No Action) [a]	Thyroid Inhalation Dose	0.000013	1.1×10^{-6}
		Beta + Gamma Whole Body Dose	0.0017	0.00014
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0055	0.00065
	3,400 TPBARs [b]	Beta + Gamma Whole Body Dose	0.00032	0.000039
		Thyroid Inhalation Dose	0.019	0.0022
		Beta + Gamma Whole Body Dose	0.0011	0.00013
Bellefonte	0 TPBARs [a, c]	Thyroid Inhalation Dose	0.0067	0.0019
		Beta + Gamma Whole Body Dose	0.71	0.14
	1,000 TPBARs [b]	Thyroid Inhalation Dose	0.0067	0.0013
		Beta + Gamma Whole Body Dose	0.00039	0.000079
	3,400 TPBARs [b]	Thyroid Inhalation Dose	0.023	0.0045
		Beta + Gamma Whole Body Dose	0.0013	0.00027

[a] TVA 1991, TVA 1995a, TVA 1996.
[b] Only TPBAR contribution to dose.
[c] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action Alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action Alternative radiological dose is 0.

Table D–23 Nonreactor Design-Basis Accident Consequence Margin to Site Dose Criteria

Reactor Site	Tritium Production	Dose Description [a]	Site Dose Criteria (rem) [b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%) [c]	Dose (rem)	Margin (%) [c]
Watts Bar	0 TPBARs (No Action) [d]	Thyroid Inhalation Dose	300	0.018	99.994	0.0042	99.999
		Beta + Gamma Whole Body Dose	25	0.13	99.5	0.031	99.9
	1,000 TPBARs	Thyroid Inhalation Dose	300	0.020	99.993	0.0047	99.998
		Beta + Gamma Whole Body Dose	25	0.13	99.5	0.031	99.9
	3,400 TPBARs	Thyroid Inhalation Dose	300	0.025	99.92	0.0058	99.998
		Beta + Gamma Whole Body Dose	25	0.13	99.5	0.031	99.9

Reactor Site	Tritium Production	Dose Description [a]	Site Dose Criteria (rem) [b]	Individual at Area Exclusion Boundary		Individual at Low Population Zone	
				Dose (rem)	Margin (%) [c]	Dose (rem)	Margin (%) [c]
Sequoyah	0 TPBARs (No Action) [d]	Thyroid Inhalation Dose	300	0.000013	100	1.1×10^{-6}	100
		Beta + Gamma Whole Body Dose	25	0.0017	99.993	0.00014	99.999
	1,000 TPBARs	Thyroid Inhalation Dose	300	0.0055	99.98	0.00065	99.999
		Beta + Gamma Whole Body Dose	25	0.0020	99.992	0.00018	99.999
	3,400 TPBARs	Thyroid Inhalation Dose	300	0.019	99.994	0.0022	99.999
		Beta + Gamma Whole Body Dose	25	0.0028	99.989	0.00027	99.998
Bellefonte	0 TPBARs [e, f]	Thyroid Inhalation Dose	300	0.0067	99.998	0.0019	99.99
		Beta + Gamma Whole Body Dose	25	0.71	97.2	0.14	99.4
	1,000 TPBARs	Thyroid Inhalation Dose	300	0.013	99.996	0.0032	99.999
		Beta + Gamma Whole Body Dose	25	0.71	97.2	0.14	99.4
	3,400 TPBARs	Thyroid Inhalation Dose	300	0.029	99.990	0.0064	99.998
		Beta + Gamma Whole Body Dose	25	0.71	97.2	0.14	99.4

[a] Dose is the total dose from the reactor plus the dose from the TPBARs.
[b] 10 CFR 100.11.
[c] Margin below the site dose criteria.
[d] TVA 1995a, TVA 1996.
[e] Bellefonte Final Safety Analysis Report (TVA 1991), realistic analysis dose estimates. Design analysis dose estimates were also below the site dose limits.
[f] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action Alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action Alternative radiological dose is 0.

D.1.3.3 TPBAR Handling Accident

The TPBAR handling accident source term and accident frequency data presented in Section D.1.1.4 were evaluated using the GENII accident analysis computer code (PNL 1988). Analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2 (NRC 1976). **Table D–24** summarizes the consequences of the TPBAR handling accident to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, a noninvolved worker at the Watts Bar and Bellefonte Nuclear Plant sites located 640 meters (0.4 miles) from the release point, and a noninvolved worker at the Sequoyah Nuclear Plant located at the site boundary 556 meters (0.35 miles) from the release point. The analysis assumes that no action would be taken on the site to reduce the dose to the noninvolved worker, and that the worker is exposed for 2,000 hours during the airborne release over the postulated one-year period. Calculations indicate that routine plant administrative controls and work permits for workers in the fuel pool area would require protective equipment (e.g., supplied air or air packs) and protective clothing for approximately one week after the accident due to the concentration of tritiated water vapor in the work area. The risks associated with the TPBAR handling accident to the same receptors are summarized in **Table D–25**.

Table D–24 TPBAR Handling Accident Consequences

Reactor Site	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Watts Bar	0.028	0.000014	0.00031	1.6×10^{-7}	0.0017	6.8×10^{-7}
Sequoyah	0.036	0.000018	0.00029	1.5×10^{-7}	0.0014	5.6×10^{-7}
Bellefonte	0.0045	2.3×10^{-6}	0.00025	1.3×10^{-7}	0.00007	2.8×10^{-8}

[a] Increased likelihood of cancer fatality.

Table D–25 TPBAR Handling Accident Annual Risks

Reactor Site	Tritium Production	Maximally Exposed Offsite Individual [a]	Average Individual in Population to 80 kilometers (50 miles) [b]	Noninvolved Worker [a]
Watts Bar	1,000 TPBARs	2.4×10^{-8}	2.7×10^{-10}	1.2×10^{-9}
	3,400 TPBARs	8.1×10^{-8}	9.3×10^{-10}	3.9×10^{-9}
Sequoyah	1,000 TPBARs	3.1×10^{-8}	2.6×10^{-10}	9.5×10^{-10}
	3,400 TPBARs	1.0×10^{-7}	8.7×10^{-10}	3.2×10^{-9}
Bellefonte	1,000 TPBARs	3.9×10^{-9}	2.2×10^{-10}	4.8×10^{-11}
	3,400 TPBARs	1.3×10^{-8}	7.5×10^{-10}	1.6×10^{-10}

[a] Increased likelihood of cancer fatality per year.

D.1.3.4 Truck Transportation Cask Handling Accident

The truck transportation cask handling accident source term and accident frequency data presented in Section D.1.1.5 were evaluated using the GENII accident analysis computer code (PNL 1988). Analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2 (NRC 1976). **Table D–26** summarizes the consequences of the truck transportation cask handling accident to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, a noninvolved worker at the Watts Bar and Bellefonte Nuclear Plant sites located 640 meters (0.4 miles) from the release point, and a noninvolved worker at the Sequoyah Nuclear Plant located at the site boundary 556 meters (0.35 miles) from the release point. The analysis assumes that no action would be taken on site to reduce the dose to the noninvolved worker and that the worker is exposed for 2,000 hours during the airborne release over the postulated one-year period. The risks associated with the truck transportation cask handling accident to the same receptors are summarized in **Table D–27**.

Table D–26 Truck Transportation Cask Handling Accident Consequences

Reactor Site	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Watts Bar	0.00072	3.6×10^{-7}	8.0×10^{-6}	4.0×10^{-9}	0.000043	1.7×10^{-8}
Sequoyah	0.00093	4.7×10^{-7}	7.5×10^{-6}	3.8×10^{-9}	0.000036	1.4×10^{-8}
Bellefonte	0.00012	6.0×10^{-8}	6.4×10^{-6}	3.2×10^{-9}	1.8×10^{-6}	7.2×10^{-10}

[a] Increased likelihood of cancer fatality.

Table D–27 Truck Transportation Cask Handling Accident Annual Risks

Reactor Site	Tritium Production	Maximally Exposed Offsite Individual [a]	Average Individual in Population to 80 kilometers (50 miles) [a]	Noninvolved Worker [a]
Watts Bar	1,000 TPBARs	1.9×10^{-13}	2.1×10^{-15}	9.0×10^{-15}
	3,400 TPBARs	5.8×10^{-13}	6.4×10^{-15}	2.7×10^{-14}
Sequoyah	1,000 TPBARs	2.5×10^{-13}	2.0×10^{-15}	7.4×10^{-15}
	3,400 TPBARs	7.5×10^{-13}	6.1×10^{-15}	2.2×10^{-14}
Bellefonte	1,000 TPBARs	3.2×10^{-14}	1.7×10^{-15}	3.8×10^{-16}
	3,400 TPBARs	9.6×10^{-14}	5.1×10^{-15}	1.2×10^{-15}

[a] Increased likelihood of cancer fatality per year.

D.1.3.5 Rail Transportation Cask Handling Accident

The rail transportation cask handling accident source term and accident frequency data presented in Section D.1.1.7 were evaluated using the GENII accident analysis computer code (PNL 1988). Analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2 (NRC 1976). **Table D–28** summarizes the consequences of the rail transportation cask handling accident to the maximally exposed offsite individual, an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site, a noninvolved worker at the Watts Bar and Bellefonte Nuclear Plant sites located 640 meters (0.4 miles) from the release point, and a noninvolved worker at the Sequoyah Nuclear Plant located at the site boundary 556 meters (0.35 mile) from the release point. The risks associated with the rail transportation cask handling accident to the same receptors are summarized in **Table D–29**.

Table D–28 Rail Transportation Cask Handling Accident Consequences

Reactor Site	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Watts Bar	0.00072	3.6×10^{-7}	8.0×10^{-6}	4.0×10^{-9}	0.000045	1.7×10^{-8}
Sequoyah	0.00093	4.7×10^{-7}	7.5×10^{-6}	3.8×10^{-9}	0.000036	1.4×10^{-8}
Bellefonte	0.00012	6.0×10^{-8}	6.4×10^{-6}	3.2×10^{-9}	1.8×10^{-6}	7.2×10^{-10}

[a] Increased likelihood of cancer fatality.

Table D–29 Rail Transportation Cask Handling Accident Annual Risks

Reactor Site	Tritium Production Core Configuration	Maximally Exposed Offsite Individual [a]	Average Individual in Population to 80 kilometers (50 miles) [a]	Noninvolved Worker [a]
Watts Bar	1,000 TPBARs	9.7×10^{-14}	1.1×10^{-15}	4.6×10^{-15}
	3,400 TPBARs	2.9×10^{-13}	3.2×10^{-15}	1.4×10^{-14}
Sequoyah	1,000 TPBARs	1.3×10^{-13}	1.0×10^{-15}	3.8×10^{-15}
	3,400 TPBARs	3.8×10^{-13}	3.0×10^{-15}	1.1×10^{-14}
Bellefonte	1,000 TPBARs	1.6×10^{-14}	8.6×10^{-16}	1.9×10^{-16}
	3,400 TPBARs	4.8×10^{-14}	2.6×10^{-15}	5.8×10^{-16}

[a] Increased likelihood of cancer fatality per year.

D.1.3.6 Beyond Design-Basis Accident

The beyond design-basis accident source term and accident frequency data presented in Tables D–10, D–11, D–13, and D–14 were evaluated using the MACCS2 accident analysis computer code (SNL 1997). **Table D–30** summarizes the consequences of the beyond design-basis accident, with mean meteorological conditions, to the maximally exposed offsite individual and an average individual in the public within an 80-kilometer (50-mile) radius of the reactor site. The assessment of dose and the associated cancer risk to the noninvolved worker are not applicable for beyond design-basis accidents. A site emergency would have been declared early in the beyond design-basis accident sequence, and all nonessential site personnel would have evacuated the site in accordance with site emergency procedures before any radiological releases to the environment occurred. In addition, emergency action guidelines would be implemented to initiate evacuation of the public within 16.1 kilometers (10 miles) of the plant. The location of the maximally exposed offsite individual may or may not be at the site boundary for these accident sequences because emergency action guidelines would have been implemented and the population would be evacuating from the path of the radiological plume released by the accident. The MACCS2 computer code models the evacuation sequence to estimate the dose to the maximally exposed individual and the general population within 80 kilometers (50 miles) of the accident. The risks associated with the beyond design-basis accident to the same receptors are summarized in **Table D–31**.

Table D–30 Beyond Design-Basis Accident Consequences

Reactor Site	Tritium Production	Maximally Exposed Offsite Individual		Average Individual in Population to 80 kilometers (50 miles)		Noninvolved Worker	
		Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]	Dose (rem)	Cancer Fatality [a]
Release Category I - Vessel Breach with Early Containment Failure							
Watts Bar	0 TPBARs (No Action)	19.7	0.0099	0.25	0.00013	Not applicable	Not applicable
	1,000 TPBARs	19.7	0.0099	0.25	0.00013	Not applicable	Not applicable
	3,400 TPBARs	19.8	0.0099	0.25	0.00013	Not applicable	Not applicable
Sequoyah	0 TPBARs (No Action)	25.0	0.025	0.48	0.00024	Not applicable	Not applicable
	1,000 TPBARs	25.0	0.025	0.48	0.00024	Not applicable	Not applicable
	3,400 TPBARs	25.1	0.025	0.48	0.00024	Not applicable	Not applicable
Bellefonte	0 TPBARs [b]	2.3	0.0012	0.023	0.000012	Not applicable	Not applicable
	1,000 TPBARs	2.3	0.0012	0.023	0.000012	Not applicable	Not applicable
	3,400 TPBARs	2.4	0.0012	0.024	0.000012	Not applicable	Not applicable
Release Category II - Vessel Breach with Containment Bypass							
Watts Bar	0 TPBARs (No Action)	6.4	0.0032	0.35	0.00018	Not applicable	Not applicable
	1,000 TPBARs	6.4	0.0032	0.35	0.00018	Not applicable	Not applicable
	3,400 TPBARs	6.4	0.0032	0.35	0.00018	Not applicable	Not applicable
Sequoyah	0 TPBARs (No Action)	10.4	0.0052	0.72	0.00036	Not applicable	Not applicable
	1,000 TPBARs	10.4	0.0052	0.72	0.00036	Not applicable	Not applicable
	3,400 TPBARs	10.4	0.0052	0.73	0.00037	Not applicable	Not applicable
Bellefonte	0 TPBARs [b]	34	0.034	0.20	0.00010	Not applicable	Not applicable
	1,000 TPBARs	34	0.034	0.20	0.00010	Not applicable	Not applicable
	3,400 TPBARs	34	0.034	0.20	0.00010	Not applicable	Not applicable
Release Category III - Vessel Breach with Late Containment Failure							
Watts Bar	0 TPBARs (No Action)	0.51	0.00026	0.024	0.000012	Not applicable	Not applicable
	1,000 TPBARs	0.51	0.00026	0.025	0.000013	Not applicable	Not applicable
	3,400 TPBARs	0.53	0.00027	0.025	0.000013	Not applicable	Not applicable
Sequoyah	0 TPBARs (No Action)	0.84	0.00042	0.051	0.000026	Not applicable	Not applicable
	1,000 TPBARs	0.85	0.00042	0.052	0.000026	Not applicable	Not applicable
	3,400 TPBARs	0.87	0.00044	0.053	0.000027	Not applicable	Not applicable
Bellefonte	0 TPBARs [b]	0.37	0.00019	0.016	8.0×10^{-6}	Not applicable	Not applicable
	1,000 TPBARs	0.37	0.00019	0.016	8.0×10^{-6}	Not applicable	Not applicable
	3,400 TPBARs	0.38	0.00019	0.017	8.5×10^{-6}	Not applicable	Not applicable

[a] Increased likelihood of cancer fatality.

[b] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action Alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action Alternative radiological dose is 0.

Table D–31 Beyond Design-Basis Accident Annual Risks

Reactor Site	*Tritium Production*	*Maximally Exposed Offsite Individual* [a]	*Average Individual in Population to 80 kilometers (50 miles)* [a]	*Noninvolved Worker*
Release Category I - Vessel Breach with Early Containment Failure				
Watts Bar	0 TPBARs (No Action)	6.7×10^{-9}	8.8×10^{-11}	Not applicable
	1,000 TPBARs	6.7×10^{-9}	8.8×10^{-11}	Not applicable
	3,400 TPBARs	6.7×10^{-9}	8.8×10^{-11}	Not applicable
Sequoyah	0 TPBARs (No Action)	1.7×10^{-8}	1.6×10^{-10}	Not applicable
	1,000 TPBARs	1.7×10^{-8}	1.6×10^{-10}	Not applicable
	3,400 TPBARs	1.7×10^{-8}	1.6×10^{-10}	Not applicable
Bellefonte	0 TPBARs [b]	1.1×10^{-9}	1.1×10^{-11}	Not applicable
	1,000 TPBARs	1.1×10^{-9}	1.1×10^{-11}	Not applicable
	3,400 TPBARs	1.1×10^{-9}	1.1×10^{-11}	Not applicable
Release Category II - Vessel Breach with Containment Bypass				
Watts Bar	0 TPBARs (No Action)	2.2×10^{-8}	1.2×10^{-9}	Not applicable
	1,000 TPBARs	2.2×10^{-8}	1.2×10^{-9}	Not applicable
	3,400 TPBARs	2.2×10^{-8}	1.2×10^{-9}	Not applicable
Sequoyah	0 TPBARs (No Action)	2.1×10^{-8}	1.4×10^{-9}	Not applicable
	1,000 TPBARs	2.1×10^{-8}	1.4×10^{-9}	Not applicable
	3,400 TPBARs	2.1×10^{-8}	1.5×10^{-9}	Not applicable
Bellefonte	0 TPBARs [b]	3.1×10^{-8}	9.1×10^{-11}	Not applicable
	1,000 TPBARs	3.1×10^{-8}	9.1×10^{-11}	Not applicable
	3,400 TPBARs	3.1×10^{-8}	9.1×10^{-11}	Not applicable
Release Category III - Vessel Breach with Late Containment Failure				
Watts Bar	0 TPBARs (No Action)	2.4×10^{-9}	1.1×10^{-10}	Not applicable
	1,000 TPBARs	2.4×10^{-9}	1.2×10^{-10}	Not applicable
	3,400 TPBARs	2.5×10^{-9}	1.2×10^{-10}	Not applicable
Sequoyah	0 TPBARs (No Action)	3.9×10^{-9}	2.4×10^{-10}	Not applicable
	1,000 TPBARs	3.9×10^{-9}	2.4×10^{-10}	Not applicable
	3,400 TPBARs	4.0×10^{-9}	2.5×10^{-10}	Not applicable
Bellefonte	0 TPBARs [b]	9.7×10^{-10}	4.1×10^{-11}	Not applicable
	1,000 TPBARs	9.7×10^{-10}	4.1×10^{-11}	Not applicable
	3,400 TPBARs	9.7×10^{-10}	4.3×10^{-11}	Not applicable

[a] Increased likelihood of cancer fatality per year.

[b] The 0 TPBAR entry is included for consistency with the Watts Bar and Sequoyah Nuclear Plant analyses. The No Action Alternative at the Bellefonte Nuclear Plant implies that the reactors are not brought into commercial service. The No Action Alternative radiological dose is 0.

D.2 HAZARDOUS CHEMICAL ACCIDENT IMPACTS ON HUMAN HEALTH

D.2.1 Accident Scenario Selection and Description

D.2.1.1 Accident Scenario Selection

Tritium production at the Watts Bar and Sequoyah Nuclear Plants would not introduce any additional operations that require the use of hazardous chemicals. No hazardous chemical accidents attributable to tritium production are postulated for the Watts Bar and Sequoyah Nuclear Plants.

The chemical inventory for Bellefonte was reviewed to identify potential accident scenarios. The chemical inventory at Bellefonte is given in **Table D–32** (TVA 1998):

Table D–32 Chemical Inventory at the Bellefonte Nuclear Plant Site

Location	*Chemical*	*Storage*	*Quantity per Tank (gallons)*
Auxiliary Building	Boric Acid	1 Tank	2,340
		1 Tank	18,700
		2 Tanks	31,400
	Sodium Hydroxide	2 Tanks[a]	16,500
	Hydrazine (35 percent)	1 Tank	100
	Lithium Hydroxide	1 Tank	70
	Sodium Hydroxide	1 Tank	210
	Sulfuric Acid	batteries	5,000
Turbine Building	Ammonium Hydroxide	1 Tank	140
		1 Tank	175
		1 Tank	300
		1 Tank	500
		1 Tank	525
		1 Tank	4,000
	Hydrazine (35 percent)	2 Tanks	110
		1 Tank	250
		1 Tank	300
		1 Tank	525
	Sodium Hydroxide	1 Tank	250
	Sulfuric Acid	1 Tank	250
Chemical Storage Building	Sodium Hydroxide	1 Tank	13,000
	Sulfuric Acid	1 Tank	13,000

[a] One tank for each unit.

The largest quantity of material at risk that is likely to volatilize and be dispersed following accidental release from the tanks is in the turbine building. The hazardous chemicals stored in the turbine building were reviewed against the Emergency Planning and Community Right-to-Know Act, Section 302, Extremely Hazardous Substances List Threshold Planning Quantity values published by the EPA (EPA 1996) to determine if the quantities of chemicals stored in the turbine building exceed the Threshold Planning Quantity threshold values. In the event that the inventory of a chemical exceeds the Threshold Planning Quantity value, the EPA requires that emergency response planning actions be conducted, including evaluation of potential accident scenarios. Only the chemical inventory in the Turbine Building was used for the purpose of this analysis. The physical properties of the other chemicals suggest that they would be of less concern with respect to widespread exposure upon accidental release from storage tanks. The inventory of two chemicals exceeded the Threshold Planning Quantity values. These Threshold Planning Quantity values are:

Ammonium Hydroxide Threshold Planning Quantity = 500 pounds for anhydrous ammonia
Hydrazine Threshold Planning Quantity = 1,000 pounds

D.2.1.2 Accident Scenario Descriptions

Two hazardous chemical accident scenarios are postulated for this EIS: (1) the accidental uncontrolled release of ammonium hydroxide, and (2) the accidental uncontrolled release of hydrazine.

Ammonium Hydroxide Release

EPA requires that the chemical accident analysis consider the release of the maximum inventory from the largest tank. The ammonium hydroxide release scenario was developed based on the following information:

- The largest ammonium hydroxide storage tank volume is 4,000 gallons (TVA 1998).
- The ammonium hydroxide storage tanks are located inside a room in the Turbine Building and are surrounded by an 828-square foot dike (TVA 1998).
- The ammonium hydroxide concentration is 30 percent ammonia by weight (TVA 1998).

The scenario assumes that a break occurs in the largest ammonium hydroxide storage tank, releasing the entire contents of the tank (4,000 gallons) inside the confined area in the room formed by the dike. The released material forms a pool with an effective area of 828 square feet. Ammonia then evaporates from the ammonium hydroxide liquid pool and forms a vapor cloud that fills the immediate area, leaks from the building, and moves downwind away from the building.

The rate of ammonia evaporation from a 30 percent concentration ammonium hydroxide pool is given in the *Draft Risk Management Program Guidance–Wastewater Treatment Facilities Hazard Assessment*, June 1998 (EPA 1998) as follows:

$$QR = 0.036A_p$$

where A_p is the diked area in square feet, and QR is the rate of evaporation in pounds per minute

Based on a pool area of 828 square feet, the rate of ammonia evaporation from the pool is:

$$QR = 0.036 \times 828 = 29.8 \text{ pounds per minute}$$

Hydrazine Release

The hydrazine release scenarios were developed for conditions similar to those described for the ammonium hydroxide release scenarios. However, the accident analysis computer code has the capability of modeling pool evaporation for pure chemicals such as hydrazine.

The scenario assumes the release of 525 gallons of hydrazine (35 percent concentration) inside the room of the Turbine Building. Although hydrazine is very reactive, the scenario does not assume any loss of the material by reactivity. The release is assumed to form a pool on the floor, with hydrazine vapor generated from pool evaporation. The vapor fills the immediate area, leaks from the building, and is dispersed downwind. The effective pool area is the same as that of the ammonium hydroxide release case (i.e., 828 square feet) because the tank is located within the same dike. Since hydrazine has a relatively high boiling point, no ground effect is assumed in the release scenario.

D.2.2 Chemical Accident Analysis Methodology

The potential health impacts from accidental releases of hazardous chemicals were assessed by comparing estimated airborne concentrations of the chemicals to Emergency Response Planning Guidelines developed by the American Industrial Hygiene Association. The Emergency Response Planning Guidelines values are not regulatory exposure guidelines and do not incorporate the safety factors normally included in healthy worker exposure guidelines. Emergency Response Planning Guideline-1 values are maximum airborne concentrations below which nearly all individuals could be exposed for up to one hour, resulting in only mild, transient, and reversible adverse health impacts. Emergency Response Planning Guideline-2 values are protective of irreversible or serious health effects or impairment of an individual's ability to take protective action. Emergency Response Planning Guideline-3 values are indicative of potentially life-threatening health effects.

Emergency Response Planning Guideline values have not been developed for ammonium hydroxide. Upon release of ammonium hydroxide from the storage tanks, ammonia will volatilize and be dispersed downwind to expose potential receptors. Therefore, the Emergency Response Planning Guideline values for ammonia were used to evaluate the potential health impacts of an ammonium hydroxide release. The Emergency Response Planning Guideline values for ammonia and hydrazine are presented in **Table D–33**.

Table D–33 Emergency Response Planning Guide Values for Hydrazine and Ammonia

Chemicals	*ERPG-1 (parts per million)*	*ERPG-2 (parts per million)*	*ERPG-3 (parts per million)*
Hydrazine [a]	0.03	8	80
Ammonia [b]	25	200	1000

ERPG = Emergency Response Planning Guide.
[a] Gephart, et al. 1994.
[b] Craig, et al. 1995.
Note: Hydrazine ERPGs were removed by the American Industrial Hygiene Association for further study in 1996 and have not been reinserted as of July 1998.

D.2.2.1 Receptor Description

The potential health impacts of the accidental release of ammonium hydroxide and hydrazine were assessed for two types of receptors:

- noninvolved workers - workers assumed to be located 640 meters from the point of release

- maximally exposed offsite individual - a member of the public located off site at the site boundary, 914 meters from the point of release

Facility workers (i.e. those individuals in the building at the time of the accident) were assumed to be killed by the release. The analysis took no credit for mitigative actions (e.g., area atmosphere monitoring, area evacuation alarms, emergency operating procedures) or accident precursors (e.g., leak before break) to reduce the accident consequences to the facility worker.

D.2.2.2 Analysis Computer Code Selection

The computer code selected for estimation of airborne concentrations is the Computer Aided Management of Emergency Operations (CAMEO)/Areal Locations of Hazardous Atmospheres (ALOHA), developed by the National Safety Council, the EPA, and the National Oceanic and Atmospheric Administration (NSC 1990).

D.2.2.3 Description of the Model

The atmospheric dispersion modeling for the above scenarios was conducted using the ALOHA 5.05 computer code (NSC 1990).

The ALOHA code was designed for use by first responders. The model is most useful for estimating plume extent and concentration downwind from the release source for short-duration chemical accidents. It uses a Gaussian dispersion model to describe the movement and spreading of a gas that is neutrally buoyant. For heavier-than-air vapor releases, the model uses the same calculations as those used in the DEGADIS model, an EPA heavy gas dispersion model (EPA 1989).

There are a number of limitations to the model, and these are summarized below:

- ALOHA is not intended for use with accidents involving radioactive chemicals.

- It is not intended for use with the permitting of stack gas or chronic, low-level (fugitive) emissions.

- The ALOHA-DEGADIS heavy gas module is more conservative than the DEGADIS model, which may result in a larger footprint than actually would be expected.

- ALOHA does not consider the effects of thermal energy from fire scenarios or the byproducts resulting from chemical reactions.

- ALOHA does not include the process needed to model particulate dispersion.

- ALOHA does not consider the shape of the ground under the spill or in the area affected by the plume.

- ALOHA does not estimate concentrations under very low wind speeds (less than 1 meter per second), since the wind direction may become inconsistent at these conditions.

- Under very stable atmospheric conditions (usually late night or early morning), the model estimates will have large uncertainties due to shifting wind directions and virtually no mixing of the plume into the surrounding air. Thus, these processes may lead to high airborne concentrations for long periods of time or at large distances from the release source.

- ALOHA does not accurately represent variations associated with near-field (close to the release source) patchiness. In the case of a neutrally buoyant gas, the plume will move downwind; but very near the source, the plume can be oriented in a different direction (such as going backward) due to the effect of drifting eddies in the wind.

D.2.2.4 Weather Condition Assumptions

The model results are presented for atmospheric Stability Classes D and F, with wind speeds of 5.3 meters per second and 1.5 meters per second, respectively. Atmospheric Stability Class D is considered to be representative of "average" weather conditions; Stability Class F is considered to be representative of "worst-case" weather conditions. These weather conditions were selected because they are recommended by the EPA in its *Technical Guidance for Hazards Analysis* (EPA 1987).

The model parameter values for these weather conditions are as follows:

1. Average Condition — Stability Class D
   Ambient air temperature: 75°F
   Relative humidity: 50 percent
   Cloud cover: 50 percent
   Average wind speed: 5.3 meters per second

2. Worst-Case Condition — Stability Class F
   Ambient air temperature: 60°F
   Relative humidity: 25 percent
   Cloud cover: 20 percent
   Average wind speed: 1.5 meters per second

D.2.3 Human Health Impacts

The potential health impacts from the accidental releases were assessed by comparing the modeled ambient concentrations of ammonia and hydrazine at each of the receptor locations identified previously to the Emergency Response Planning Guidelines. The estimated airborne concentrations of ammonia and hydrazine are presented in **Table D–34** and **Table D–35** respectively. **Table D–36** presents a summary of the impacts data.

D.2.3.1 Impacts to Noninvolved Workers

Noninvolved workers are assumed to be located at 640 meters from the point of release. The concentrations of ammonia at 640 meters range from 14 to 318 parts per million, based on the assumed meteorological conditions. The maximum estimated airborne concentration at 640 meters in the F stability class exceeds the Emergency Response Planning Guideline-2 value of 200 parts per million for ammonia, which suggests that noninvolved workers may experience irreversible or serious, but not life-threatening, adverse health effects if the exposures are not mitigated.

For the hydrazine release scenarios, the concentrations at 640 meters range from 0.8 to 6.0 parts per million, based on the assumed meteorological conditions. As a result, the maximum estimated airborne concentration at 640 meters exceeds the Emergency Response Planning Guideline-1 value of 0.03 parts per million for hydrazine, which suggests the potential for only mild, transient, and reversible adverse health impacts to noninvolved workers.

Table D–34 Airborne Concentration Estimates for Ammonium Hydroxide (NH_3)Release Scenarios

Downwind Distance from Source (meters)	*NH_3 Concentration under Stability Class D*		*NH_3 Concentration under Stability Class F*	
	milligrams per cubic meters	*(parts per million)*	*milligrams per cubic meters*	*(parts per million)*
30	3,233	(4,590)	83,900	(119,138)
100	306	(435)	7,730	(10,976)
500	15.5	(22)	352	(500)
640	9.9	(14)	224	(318)
914	5.4	(7.7)	119	(169)
1000	4.7	(6.7)	102	(145)
1500	2.5	(3.5)	51.6	(73)
2000	1.5	(2.2)	32.7	(46)

Table D–35 Airborne Concentration Estimates for Hydrazine Release Scenarios

Downwind Distance from Source(meters)	*Concentration under Stability Class D*		*Concentration under Stability Class F*	
	milligrams per cubic meters	*(parts per million)*	*milligrams per cubic meters*	*(parts per million)*
30	168	(127)	730	(561)
100	30	(22.7)	194	(149)
500	1.6	(1.2)	12.2	(9.4)
640	1.1	(0.8)	7.81	(6.0)
914	0.5	(0.4)	4.17	(3.2)
1000	0.5	(0.4)	3.56	(2.7)
1500	0.3	(0.2)	1.7	(1.3)
2000	--	--	1.07	(0.8)

Table D–36 Summary of Impacts Data for Release Scenarios

	Guidelines	*Hydrazine (Stability Class D)*	*Hydrazine (Stability Class F)*	*Ammonia (Stability Class D)*	*Ammonia (Stability Class F)*
	ERPG-1 ERPG-2 ERPG-3	>2000 179 44	>2000 500 200	464 150 65	2250 825 425
Noninvolved worker (640 meters)	Parts per million Level of concern Potential health effects	0.8 ERPG-1 Mild, transient	6 ERPG-1 Mild, transient	16 ERPG-1 Mild, transient	318 ERPG-2 Serious
Maximally exposed offsite individual (914 meters)	Parts per million Level of concern Potential health effects	0.4 ERPG-1 Mild, transient	3.2 ERPG-1 Mild, transient	7.7 ERPG-1 None (<ERPG-1)	169 ERPG-1 Mild, transient

ERPG = Emergency Response Planning Guideline.

D.2.3.2 Offsite Impacts

The maximally exposed offsite individual is assumed to be located at a distance of 914 meters from the point of release. For the ammonium hydroxide release scenarios, the offsite receptor will be potentially exposed to an ammonia concentration of 7.7 parts per million under Stability Class D condition (see Table D–34), which is below the Emergency Response Planning Guideline-1 value for ammonia of 25 parts per million. Exposures to concentrations below the Emergency Response Planning Guideline-1 value are not expected to produce any adverse health effects for the offsite receptor. Under Stability Class F conditions, the offsite receptor may be exposed to an ammonia concentration of about 169 parts per million which is below the Emergency Response Planning Guideline-2 value for ammonia of 200 parts per million. Exposure of the offsite receptor at concentrations greater than the Emergency Response Planning Guideline-1 value but less than the Emergency Response Planning Guideline-2 value may produce only mild, transient and reversible adverse health effects.

For the hydrazine release scenarios, the offsite receptor exposure concentrations range from 0.4 parts per million to 3.2 parts per million (see Table D–35; both stability classes). These concentrations exceed the Emergency Response Planning Guideline-1 value for hydrazine of 0.03 parts per million, but are less than the Emergency Response Planning Guideline-2 value of 8 parts per million. This suggests that the offsite receptor may experience only mild, transient, and reversible adverse health effects as a result of the exposure.

D.2.3.3 Uncertainties in the Dispersion Analyses

The results of this screening level analysis contain a number of uncertainties in the atmospheric dispersion calculations, some of which are summarized below:

- The dispersion modeling does not take into account the reduction in the predicted rate of evaporation because the spillage is inside the building; the dilution is caused by the structures on the site; or the potential for other mitigating actions. There are no accurate methods for predicting the extent of this dilution, but predicted concentrations at any point could well be too high by factors of 2 to 5 or more.

- The dispersion modeling does not take account of the deposition of highly reactive vapors (such as hydrazine) onto surfaces including equipment, the ground, water, and vegetation. This means that the model overestimates airborne concentrations at longer distances.

- Overall, the uncertainties in predicted airborne concentrations may be as large as a factor of $\pm 2 \times$ the estimated concentration.

In view of these uncertainties, the results of this analyses should be considered only as screening level estimations. TVA will conduct analyses to comply with requirements specified in 40 CFR 68 prior to operation of the Bellefonte Nuclear Power Plant.

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APPENDIX E
EVALUATION OF HUMAN HEALTH EFFECTS OF OVERLAND TRANSPORTATION

E.1 INTRODUCTION

The overland transportation of any commodity involves a risk to both transportation crew members and members of the public. This risk results directly from transportation-related accidents and indirectly from the increased levels of pollution from vehicle emissions, regardless of the cargo. The transportation of certain materials, such as hazardous or radioactive waste, can pose an additional risk due to the unique nature of the material itself. To permit a complete appraisal of the environmental impacts of the proposed action and alternatives, the human health risks associated with the overland transportation of tritium-producing burnable absorber rods (TPBARs) and associated waste were assessed.

This appendix provides an overview of the approach used to assess the human health risks that may result from overland transportation. The appendix includes discussion of the scope of the assessment, analytical methods used for the risk assessment (i.e., computer models), important assessment assumptions, and determination of potential transportation routes. It also presents the results of the assessment. In addition, to aid in the understanding and interpretation of the results, specific areas of uncertainty are described with an emphasis on how the uncertainties may affect comparisons of the alternatives.

The risk assessment results are presented in this appendix in terms of "per-shipment" risk factors, as well as for the total risks for a given alternative. Per-shipment risk factors provide an estimate of the risk from a single TPBAR or waste shipment. The total risks for a given alternative are found by multiplying the expected number of shipments by the appropriate per-shipment risk factors.

E.2 SCOPE OF ASSESSMENT

The scope of the overland transportation human health risk assessment, including the alternatives and options, transportation activities, potential radiological and nonradiological impacts, and transportation modes considered, is described below. Additional details of the assessment are provided in the remaining sections of the appendix.

Proposed Action and Alternatives

The transportation risk assessment conducted for this environmental impact statement (EIS) estimates the human health risks associated with the transportation of TPBARs and waste for a number of alternatives.

Transportation-Related Activities

The transportation risk assessment is limited to estimating the human health risks incurred during overland transportation for each alternative. The risks to workers or to the public during loading, unloading, and handling prior to or after shipment are not included in the overland transportation assessment, but are addressed in Appendix D of this EIS. Similarly, the transportation risk assessment does not address possible impacts from increased transportation levels on local traffic flow, noise levels, or infrastructure.

Radiological Impacts

For each alternative, radiological risks (i.e., those risks that result from the radioactive nature of the irradiated TPBARs and waste) are assessed for both incident-free (i.e., normal) and accident transportation conditions. The radiological risk associated with incident-free transportation conditions would result from the potential exposure of people to external radiation in the vicinity of a loaded shipment. The radiological risk from transportation accidents would come from the potential release and dispersal of radioactive material into the environment during an accident and the subsequent exposure of people.

All radiological impacts are calculated in terms of committed dose and associated health effects in the exposed populations. The radiation dose calculated is the total effective dose equivalent (see 10 CFR 20), which is the sum of the effective dose equivalent from external radiation exposure and the 50-year committed effective dose equivalent from internal radiation exposure. Radiation doses are presented in units of roentgen equivalent man (rem) for individuals and person-rem for collective populations. The impacts are further expressed as health risks in terms of latent cancer fatalities and cancer incidence in exposed populations using the dose-to-risk conversion factors established by the National Council on Radiation Protection and Measurement (NCRP 1993).

Nonradiological Impacts

In addition to the radiological risks posed by overland transportation activities, vehicle-related risks are also assessed for nonradiological causes (i.e., causes related to the transport vehicles and not the radioactive cargo) for the same transportation routes. The nonradiological transportation risks, which would be incurred for similar shipments of any commodity, are assessed for both incident-free and accident conditions. The nonradiological risks during incident-free transportation conditions would be caused by potential exposure to increased vehicle exhaust emissions. The nonradiological accident risk refers to the potential occurrence of transportation accidents that directly result in fatalities unrelated to the shipment of cargo. State-specific transportation fatality rates are used in the assessment. Nonradiological risks are presented in terms of estimated fatalities.

Transportation Modes

All shipments to the reactors are assumed to take place by truck transportation modes. Additionally, dedicated rail shipments are considered from the commercial light water reactor (CLWR) sites to the U.S. Department of Energy (DOE) Savannah River Site.

Receptors

Transportation-related risks are calculated and presented separately for workers and members of the general public. The workers considered are truck or rail crew members involved in the actual overland transportation. The general public includes all persons who could be exposed to a shipment while it is moving or stopped en route. Potential risks are estimated for the collective populations of exposed people and for the hypothetical maximally exposed individual. For incident-free operation, the maximally exposed individual would be an individual stuck in traffic next to the shipment for 30 minutes. For accident conditions, the maximally exposed individual would be an individual located 33 meters (105 feet) directly downwind from the accident. The collective population risk is a measure of the radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risk is used as the primary means of comparing various alternatives.

E.3 PACKAGING AND REPRESENTATIVE SHIPMENT CONFIGURATIONS

Regulations that govern the transportation of radioactive materials are designed to protect the public from the potential loss or dispersal of radioactive materials, as well as from routine radiation doses during transit. The primary regulatory approach to promote safety is through the specification of standards for the packaging of radioactive materials. Because packaging represents the primary barrier between the radioactive material being transported and radiation exposure to the public and the environment, packaging requirements are an important consideration for transportation risk assessment. Regulatory packaging requirements are discussed briefly below and in Chapter 6. The representative packaging and shipment configurations assumed for this EIS also are described below.

E.3.1 Packaging Overview

Although several Federal and state organizations are involved in the regulation of radioactive waste transportation, primary regulatory responsibility resides with the U.S. Department of Transportation and the U.S. Nuclear Regulatory Commission (NRC). All transportation activities must take place in accordance with the applicable regulations of these agencies as specified in 49 CFR 173 and 10 CFR 71.

Transportation packaging for small quantities of radioactive materials must be designed, constructed, and maintained to contain and shield their contents during normal transport conditions. For large quantities and for more highly radioactive material, such as TPBARs or spent nuclear fuel, they must contain and shield their contents in the event of severe accident conditions. The type of packaging used is determined by the total radioactive hazard presented by the material within the packaging. Four basic types of packaging are used: Excepted, Industrial, Type A, and Type B. Another packaging option, “Strong, Tight,” is still available for some domestic shipments.

Excepted packages are limited to transporting materials with extremely low levels of radioactivity. Industrial packages are used to transport materials that, because of their low concentration of radioactive materials, present a limited hazard to the public and the environment. Type A packages are designed to protect and retain their contents under normal transport conditions and must maintain sufficient shielding to limit radiation exposure to handling personnel. These packages are used to transport radioactive materials with higher concentrations or amounts of radioactivity than Excepted or Industrial packages. Strong, Tight packages are used in the United States for shipment of certain materials with low levels of radioactivity, such as natural uranium and rubble from the decommissioning of nuclear reactors. Type B packages are used to transport material with the highest radioactivity levels and are described in more detail in the following sections.

E.3.2 Regulations Applicable to Type B Casks

Regulations for the transport of radioactive materials in the United States are issued by the U.S. Department of Transportation and are codified in 49 CFR 171–178. The regulation authority for radioactive materials transport is jointly shared by the U.S. Department of Transportation and the NRC. As outlined in a 1979 Memorandum of Understanding with the NRC, the U.S. Department of Transportation specifically regulates the carriers of spent nuclear fuel and the conditions of transport, such as routing, handling and storage, and vehicle and driver requirements. The U.S. Department of Transportation also regulates the labeling, classification, and marking of all spent nuclear fuel packages. The NRC regulates the packaging and transport of spent nuclear fuel for its licensees, which include commercial shippers of spent nuclear fuel. In addition, NRC sets the standards for packages containing fissile materials and spent nuclear fuel.

DOE policy requires compliance with applicable Federal regulations regarding domestic shipments of spent nuclear fuel. Accordingly, DOE has adopted the requirements of 10 CFR 71, “Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions,” and

49 CFR 171–178, "Hazardous Material Regulations." DOE Headquarters can issue a certificate of compliance for a package to be used only by DOE and its contractors.

E.3.2.1 Cask Design Regulations

Spent nuclear fuel is transported in robust Type B transportation casks that are certified for transporting radioactive materials. Casks designed and certified for spent nuclear fuel transportation within the United States must meet the applicable requirements of the NRC for design, fabrication, operation, and maintenance as contained in 10 CFR 71.

Cask design and fabrication can only be done by approved vendors with established quality assurance programs (10 CFR 71.101). Cask and component suppliers or vendors are required to obtain and maintain documents that prove the materials, processes, tests, instrumentation, measurements, final dimensions, and cask operating characteristics meet the design-basis established in the Safety Analysis Report for Packaging for the cask and that the cask will function as designed.

Regardless of where a transportation cask is designed, fabricated, or certified for use, it must meet certain minimum performance requirements (10 CFR 71.71–71.77). The primary function of a transportation cask is to provide containment and shielding. Casks similar to the designs being considered for TPBARs have been used to transport spent nuclear fuel for many years. Regulations require that casks must be operated, inspected, and maintained to high standards to ensure their ability to contain their contents in the event of a transportation accident (10 CFR 71.87). There are no documented cases of a release of radioactive materials from spent nuclear fuel shipments, even though thousands of shipments have been made by road, rail, and water transport. Further, a number of obsolete casks have been tested under severe accident conditions to demonstrate their adherence to design criteria, without failure. Such tests have demonstrated that transportation casks are fabricated not only to a very high factor of safety; they are even sturdier than required.

Transportation casks are built of heavy, durable structural materials, such as stainless steel. These materials must ensure cask performance under a wide range of temperatures (10 CFR 71.43). In addition to the structural materials, shielding is provided to limit radiation levels at the surface and at prescribed distances from the surface of transportation casks (10 CFR 71.47). Shielding typically consists of dense material, such as lead or depleted uranium. The design for a TPBAR cask is less challenging than the design for a spent nuclear fuel cask because the spent nuclear fuel cask must address additional requirements of criticality control and neutron shielding. Additionally, spent fuel rods are more radioactive, and the effect of the radioactivity is significantly greater for spent fuel rods than tritium rods. The cask cavity can be configured to hold various contents, including irradiated TPBARs or irradiated hardware. The assemblies are supported by internal structures, called baskets, that provide shock and vibration resistance and establish minimum spacing and heat transfer to maintain the temperature of the contents within the limits specified in the Safety Analysis Report for Packaging.

DOE is currently evaluating its approach to procuring transportation packages and/or services. DOE will specify the requirements for packages in great detail. As of publication of this document, it has not been determined whether an existing Type B package will be modified to handle TPBARs or a new package will be designed. The level of safety will be the same in either case. The choice will be based on the ability to economically meet the CLWR program requirements. Typical Type B packages are shown in **Figures E–1** and **E–2**.

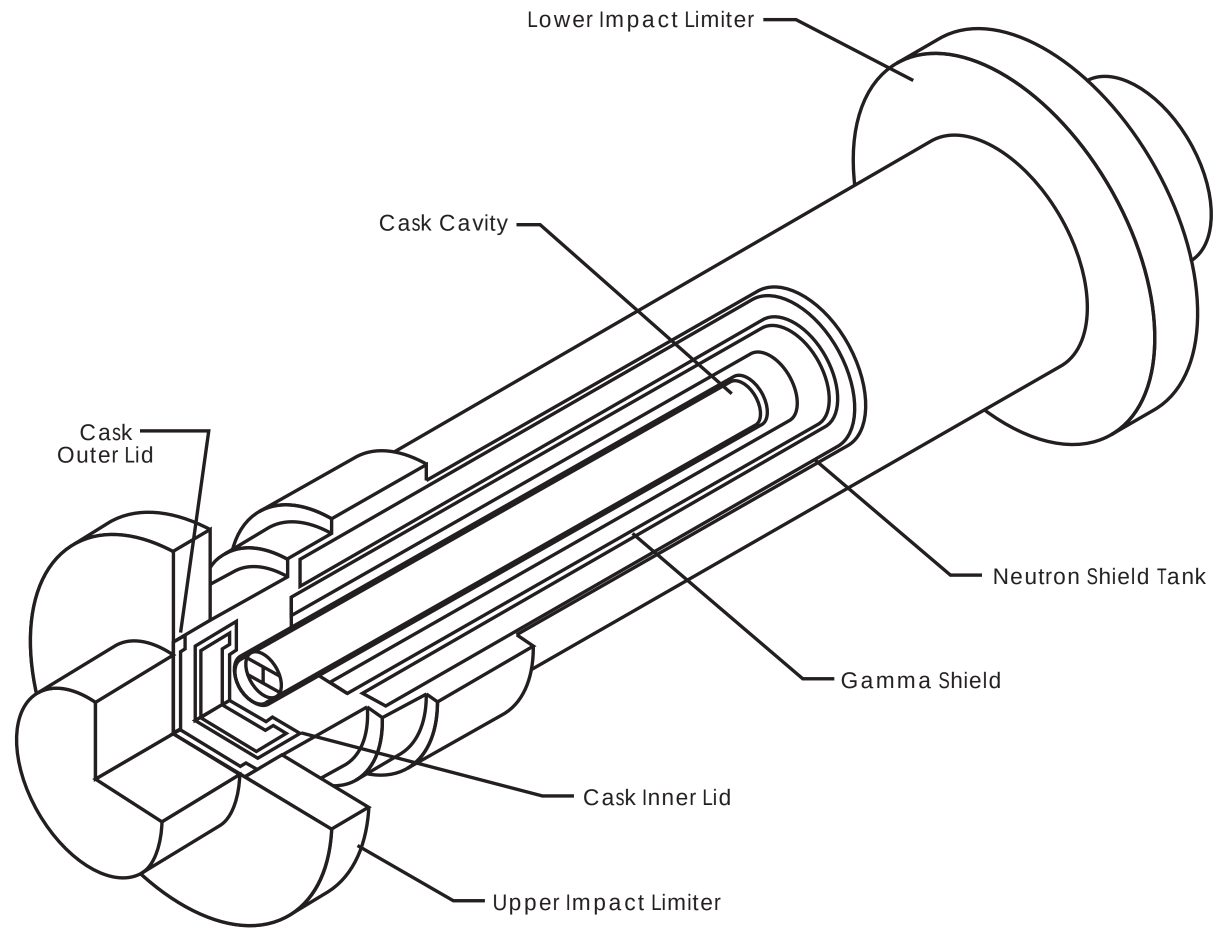


Figure E–1 Typical Type B Legal Weight Track Shipping Cask

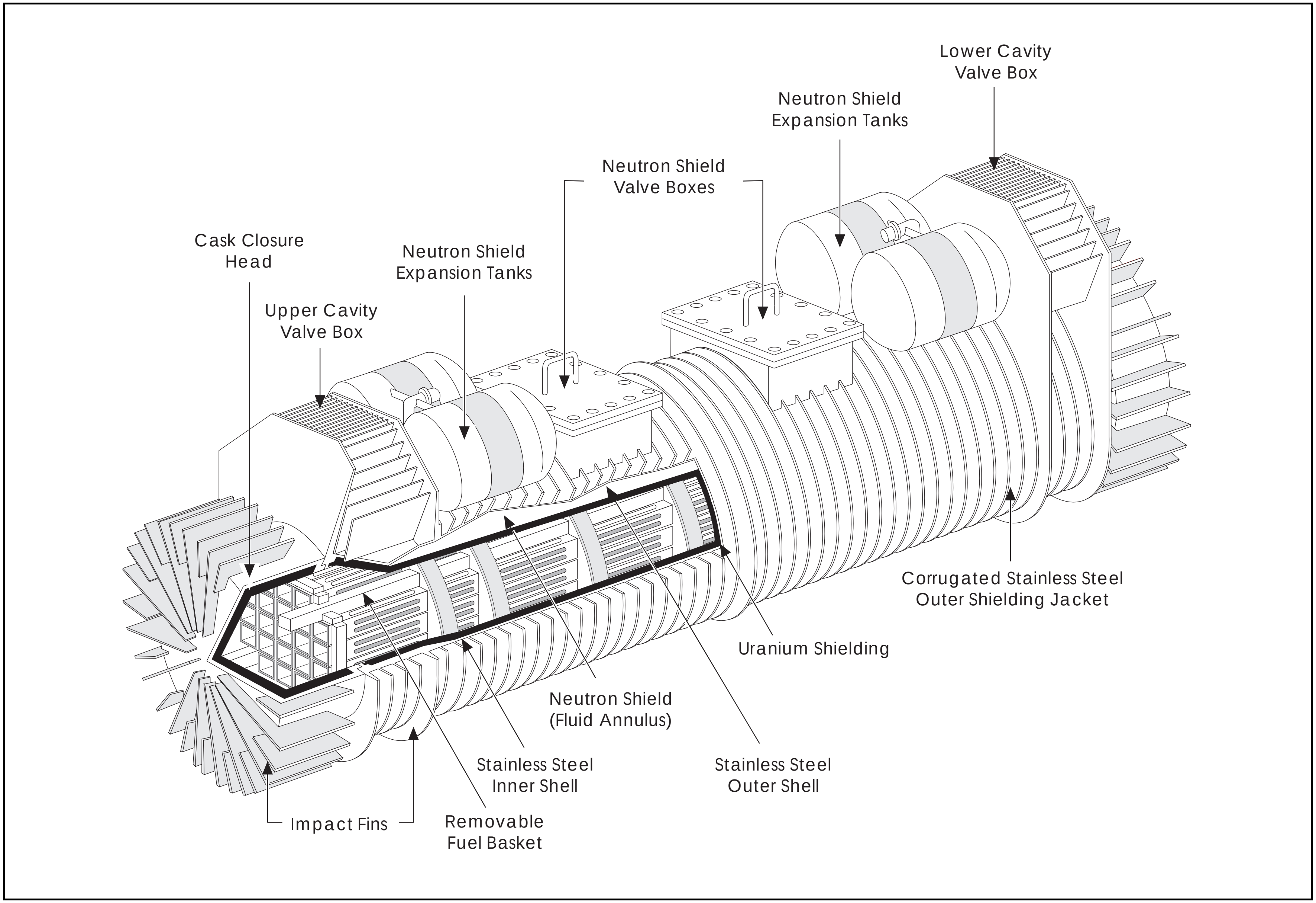


Figure E–2 Typical Type B Rail Shipping Cask

Finally, to limit impact forces and minimize damage to the structural components of a cask in the event of a transportation accident, impact-absorbing structures may be attached to the exterior of the cask. These are usually composed of balsa wood, foam, or aluminum honeycomb designed to readily deform to absorb impact energy. All of these components are designed to work together in order to satisfy the regulatory requirements for a cask to operate under normal conditions of transportation and maintain its integrity in an accident.

E.3.2.2 Design Certification

For certification, transportation casks must be shown by analysis and/or testing to withstand a series of hypothetical accident conditions. These conditions have been internationally accepted as simulating damage to transportation casks that could occur in most reasonably foreseeable accidents. The impact, fire, and water-immersion tests are considered in sequence to determine their cumulative effects on one package. These accident conditions are described in **Figure E–3**. The NRC issues regulations, 10 CFR 71, governing the transportation of radioactive materials. In addition to the tests shown in Figure E–3, the regulations affecting Type B casks require that a transportation cask with activity greater than 10^6 Curies (which is applicable to irradiated TPBARs) be designed and constructed so that its undamaged containment system would withstand an external water pressure of 290 pounds per square inch, or immersion in 200 meters (656 feet) of water, for a period of not less than one hour without collapse, buckling, or allowing water to leak into the cask.

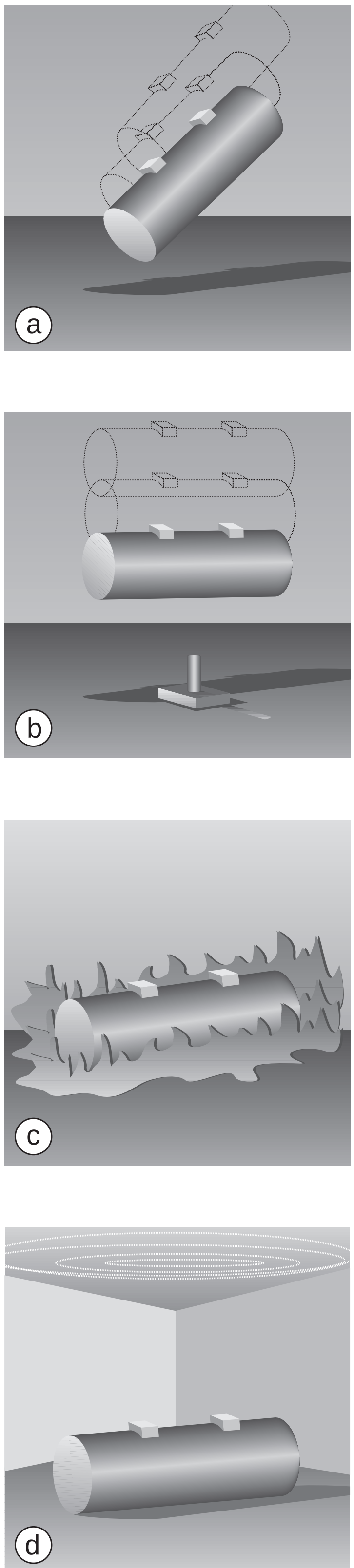
Under the Federal certification program, a Type B packaging design must be supported by a Safety Analysis Report for Packaging, which demonstrates that the design meets Federal packaging standards. The Safety Analysis Report for Packaging must include a description of the proposed packaging in sufficient detail to identify the packaging accurately and provide the basis for evaluating its design. The Safety Analysis Report for Packaging must provide the evaluation of the structural design, materials properties, containment boundary, shielding capabilities, and criticality control, and present the operating procedures, acceptance testing, maintenance program, and the quality assurance program to be used for design and fabrication. Upon completion of a satisfactory review of the Safety Analysis Report for Packaging to verify compliance to the regulations, a Certificate of Compliance is issued.

E.3.2.3 Transportation Regulations

To ensure that the transportation cask is properly prepared for transportation, trained technicians perform numerous inspections and tests (10 CFR 71.87). These tests are designed to ensure that the cask components are properly assembled and meet leak-tightness, thermal, radiation, and contamination limits before shipping radioactive material. The tests and inspections are clearly identified in the Safety Analysis Report for Packaging and/or the Certificate of Compliance for each cask. Casks can be operated only by registered users who conduct operations in accordance with documented and approved quality assurance programs meeting the requirements of the regulatory authorities. Records must be maintained that document proper cask operations in accordance with the quality requirements of 10 CFR 71.91. Reports of defects or accidental mishandling must be submitted to the NRC. DOE will be the Shipper-of-Record for the TPBAR and waste shipments.

External radiation from a package must be below specified limits that minimize the exposure of handling personnel and the general public. For these types of shipments, the external radiation dose rate during normal transportation conditions must be maintained below the following limits of 49 CFR 173:

- 10 millirem per hour at any point 2 meters (6.6 feet) from the vertical planes projected by the outer lateral surfaces of the transport vehicle (referred to as the regulatory limit throughout this document)



Standards for Type B Casks

For certification by the NRC, a cask must be shown by test or analysis to withstand a series of accident conditions without releasing its contents. These conditions have been internationally accepted as simulating damage to spent fuel casks that could occur in most severe credible accidents. The impact, fire, and water-immersion tests are considered in sequence to determine their cumulative effects on one package. A separate cask is subjected to a deep water-immersion test. The details of the tests are as follows:

Impact

Free Drop (a) – The cask drops 30 feet onto a flat, horizontal, unyielding surface so that it strikes at its weakest point.

Puncture (b) – The cask drops 40 inches onto a 6-inch-diameter steel bar at least 8 inches long; the bar strikes the cask at its most vulnerable spot.

Fire (c)

After the impact tests, the cask is totally engulfed in a 1,475°F thermal environment for 30 minutes.

Water Immersion (d)

The cask is completely submerged under at least 3 feet of water for 8 hours. A separate cask is completely immersed under 50 feet of water for 8 hours.

Figure E–3 Standards for Transportation Casks

- 2 millirem per hour in any normally occupied position in the transport vehicle

Additional restrictions apply to package surface contamination levels, but these restrictions are not important for the transportation radiological risk assessment. For risk assessment purposes, it is important to note that all packaging of a given type is designed to meet the same performance criteria. Therefore, two different Type B designs would be expected to perform similarly during incident-free and accident transportation conditions. The specific containers selected or designed, however, will determine the total number of shipments necessary to transport a given quantity of irradiated TPBARs.

E.3.2.4 Communications

Proper communication assists in ensuring safe preparation and handling of transportation casks. Communication is provided by labels, markings, placarding, shipping papers, or other documents. Labels (49 CFR 172.403) applied to the cask document the contents and the amount of radiation emanating from the cask exterior (transport index). The transport index lists the ionizing radiation level (in millirem per year) at a distance of 1 meter (3.3 feet) from the cask surface.

In addition to the label requirements, markings (49 CFR 173.471) should be placed on the exterior of the cask to show the proper shipping name and the consignor and consignee, in case the cask is separated from its original shipping documents (49 CFR 172.203). Transportation casks are required to be permanently marked with the designation “Type B,” the owner's (or fabricator's) name and address, the Certificate of Compliance number, and the gross weight (10 CFR 71.83).

Placards (49 CFR 172.500) are applied to the transport vehicle or freight container holding the transportation cask. The placards indicate the radioactive nature of the contents. Irradiated TPBARs, which constitute a highway route-controlled quantity or “HRCQ,” must be placarded according to 49 CFR 172.507. Placards provide the first responders to a traffic or transportation accident with initial information about the nature of the contents.

Shipping papers for the irradiated TPBARs should contain the notation “HRCQ” and have entries identifying the following: the name of the shipper, emergency response telephone number, description of contents, and the shipper's certificate, as described in 49 CFR 172, Subpart C.

In addition, drivers of motor vehicles transporting radioactive material must have training in accordance with the requirements of 49 CFR 172.700. The training requirements include familiarization with the regulations, emergency response information, and the communication programs required by the Occupational Safety and Health Administration. Drivers are also required to have training on the procedures necessary for safe operation of the vehicle used to transport the irradiated TPBARs or hardware.

E.3.3 Ground Transportation Route Selection Process

According to DOE guidelines, TPBAR and waste shipments must comply with both NRC and U.S. Department of Transportation regulatory requirements. NRC regulations cover the packaging and transport of irradiated TPBARs and waste, whereas the U.S. Department of Transportation specifically regulates the carriers and the conditions of transport, such as routing, handling and storage, and vehicle and driver requirements. The highway routing of nuclear material is systematically determined according to U.S. Department of Transportation regulations 49 CFR 171–179 and 49 CFR 397 for commercial shipments. Specific routes cannot be identified publicly in advance for DOE’s Transportation Safeguards Division’s shipments because they are classified to protect national security interests.

The U.S. Department of Transportation routing regulations require that shipment of a highway route-controlled quantity of radioactive material be transported over a preferred highway network, including interstate highways, with preference toward interstate system bypasses and beltways around cities and state-designated preferred routes. A state or Tribe may designate a preferred route to replace or supplement the interstate highway system in accordance with U.S. Department of Transportation guidelines (DOT 1992).

Carriers of highway route-controlled quantities are required to use the preferred network unless they are moving from their origin to the nearest interstate highway or from the interstate highway to their destination, are making necessary repair or rest stops, or emergency conditions render the interstate highway unsafe or impassable. The primary criterion for selecting the preferred route for a shipment is travel time. Preferred routing takes into consideration accident rate, transit time population density, activities, time of day, and day of the week.

The HIGHWAY computer code (ORNL 1993a) is used for selecting highway routes in the United States. The HIGHWAY database is a computerized road atlas that currently describes about 386,400 kilometers (240,000 miles) of roads. The Interstate System and all U.S. (U.S.-designated) highways are completely described in the database. In addition, most of the principal state highways and many local and community roads are also identified. The code is updated periodically to reflect current road conditions and has been benchmarked against reported mileages and observations of commercial truck firms. Features in the HIGHWAY code allow the user to select routes that conform to U.S. Department of Transportation regulations. Additionally, the HIGHWAY code contains data on the population densities along the routes. The distances and populations from the HIGHWAY code are part of the information used for the transportation impact analysis in this EIS.

The INTERLINE (ORNL 1993b) computer program, designed to simulate routing of the U.S. rail system, is used for selecting railway routes for the purpose of analysis. The INTERLINE database consists of 94 separate subnetworks and represents various competing rail companies in the United States. The database used by INTERLINE was originally based on Federal Railroad Administration data and reflected the U.S. railroad system in 1974. The database has since been expanded and modified over the past two decades. The code is updated periodically to reflect current track conditions and has been benchmarked against reported mileages and observations of commercial rail firms. The INTERLINE model uses a shortest-route algorithm that finds the minimum impedance path within an individual subnetwork. A separate routine is used to find paths along the subnetworks. The routes selected for this study used the standard assumptions in the INTERLINE model that simulate the selection process that railroads use to direct shipments.

E.4 Methods for Calculating Transportation Risks

The overland transportation risk assessment method is summarized in **Figure E–4**. After the EIS alternatives were identified and the goals of the shipping campaign were understood, data was collected on material characteristics and accident parameters. Accident parameters were largely based on the DOE-funded study of transportation accidents (ANL 1994).

Representative routes that may be used for the shipment of TPBARs and waste were selected for risk assessment purposes using the HIGHWAY code. They do not necessarily represent the actual routes that would be used to transport nuclear materials. Specific routes cannot be identified in advance because the routes cannot be finalized until they have been reviewed and approved by the NRC. The selection of the actual route would be responsive to environmental and other conditions that would be in effect or could be predicted at the time of shipment. Such conditions could include adverse weather conditions, road conditions, bridge closures, and local traffic problems. For security reasons, details about a route would not be publicized before the shipment.

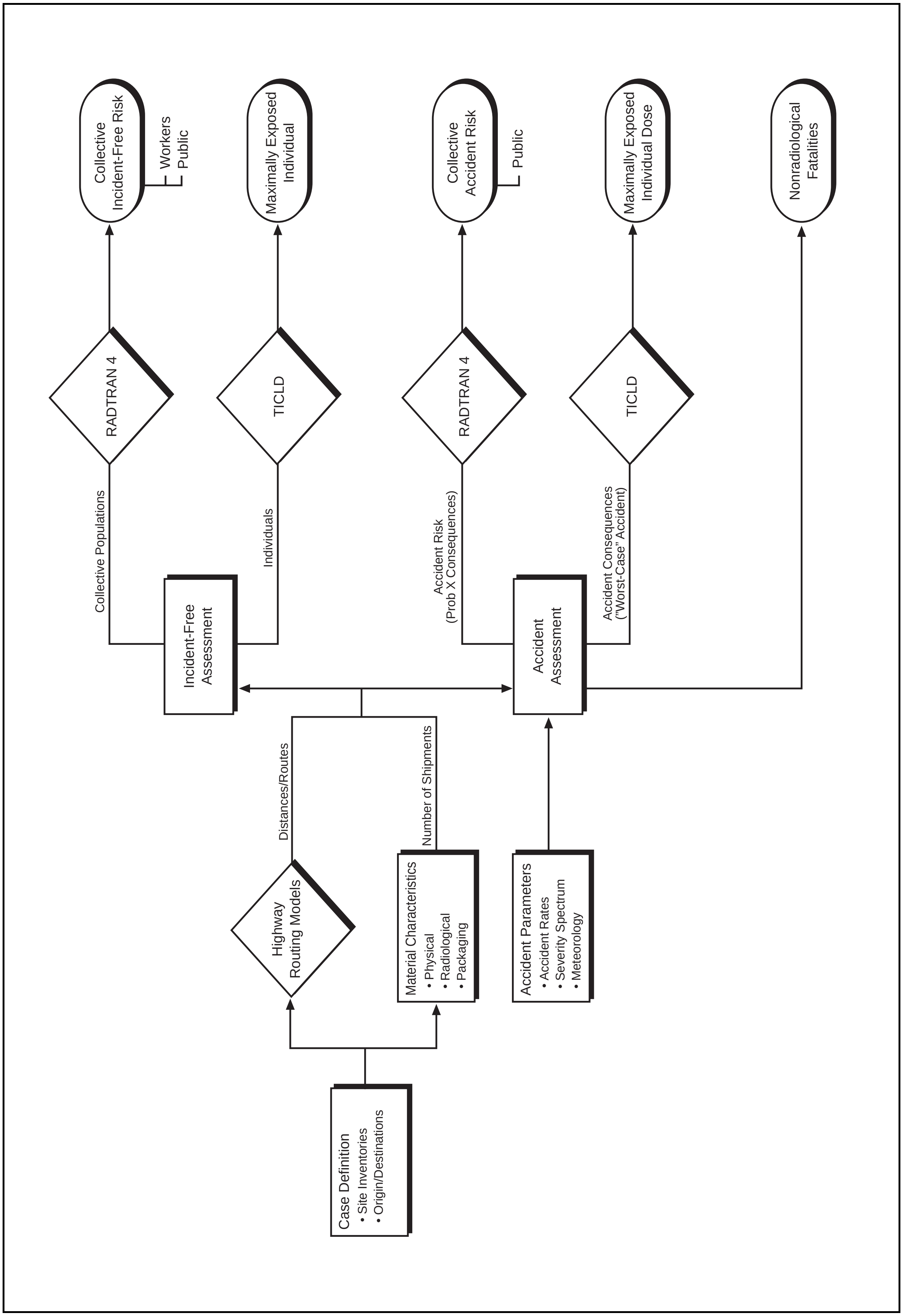


Figure E–4 Overland Transportation Risk Assessment

The first analytic step in the ground transportation analysis was to determine the incident-free and accident risk factors on a per-shipment basis. Risk factors, as with any risk estimate, are the product of the probability of exposure and the magnitude of the exposure. Accident risk factors were calculated for radiological and nonradiological traffic accidents. The probabilities, which are much lower than one, and the magnitudes of exposure were multiplied, yielding very low risk numbers. Incident-free risk factors were calculated for crew and public exposure to radiation emanating from the shipping container (cask) and public exposure to the chemical toxicity of the transportation vehicle exhaust. The probability of incident-free exposure is unity (one).

For each alternative, risks were assessed for both incident-free transportation and accident conditions. For the incident-free assessment, risks are calculated for both collective populations of potentially exposed individuals and for maximally exposed individuals. The accident assessment consists of two components: (1) a probabilistic accident risk assessment that considers the probabilities and consequences of a range of possible transportation accident environments, including low-probability accidents that have high consequences and high-probability accidents that have low consequences, and (2) an accident consequence assessment that considers only the consequences of the most severe postulated transportation accidents.

The RADTRAN 4 computer code (SNL 1993b) is used for incident-free and accident risk assessments to estimate the impacts on populations. RADTRAN 4 was developed by Sandia National Laboratories to calculate population risks associated with the transportation of radioactive materials by a variety of modes, including truck, rail, air, ship, and barge. The Transportation Incident Center Line Dose (TICLD) code, run in conjunction with RADTRAN 4, was used to calculate the doses to the maximally exposed individuals.

The RADTRAN 4 population risk calculations take into account both the consequences and probabilities of potential exposure events. The RADTRAN 4 and TICLD codes consequence analyses include the cloud shine, ground shine, inhalation, and resuspension exposures. The collective population risk is a measure of the total radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risk is used as the primary means of comparing the various alternatives.

E.5 Alternatives, Parameters, and Assumptions

E.5.1 Description of Alternatives

Four transportation segments were evaluated in this EIS: (1) shipment of fabricated TPBARs to assembly facilities, (2) shipment of TPBAR assemblies to each of the CLWRs, (3) shipment of irradiated TPBARs to the Savannah River Site, and (4) shipment of irradiated hardware to a waste disposal site.

Transportation segment 1 involves shipment of nonhazardous, nonradioactive TPBAR material in secure commercial containers from TPBAR fabricators to fuel assembly facilities. Candidate sites for fabrication of the TPBARs include Wilmington, North Carolina (General Electric); Hematite, Missouri (Asea Brown-Boveri/Combustion Engineering); and Columbia, South Carolina (Westinghouse Electric Corporation).

Transportation segment 2 involves shipment of nonhazardous, nonradioactive TPBAR material in secure commercial containers, along with new (fresh, unirradiated) reactor fuel. The impacts of shipping fresh reactor fuel are outside the scope of this EIS and are covered in NUREG-0170 (NRC 1977). Candidate sites for assembly of the TPBARs include Richland, Washington (Siemens Power Corporation); Lynchburg, Virginia (Framatome-Cogema Fuels or BWX Technologies, Inc.); Hermatite, Missouri (Asea Brown-Boveri/Combustion Engineering); and Columbia, South Carolina (Westinghouse Electric Corporation). The transportation impacts of all possible combinations of these facilities have been evaluated. The choice of facilities will be made by DOE using normal commercial practices.

Transportation segment 3 involves shipment of irradiated TPBARs from the CLWRs to the Tritium Extraction Facility at the Savannah River Site. The metallic components of the TPBARs will have been activated by the reactor flux, and they will contain the radioactive tritium. Therefore, these TPBARs will be shipped in a Type B cask. This EIS has evaluated the shipment of TPBARs by three distinct methods. First, truck-sized casks, which hold a single consolidated assembly, could be transported using legal-weight trucks (one cask per truck) on public roads. Second, two truck-sized casks could be shipped by dedicated train on rail lines. Third, rail-sized casks, which hold between 2 and 24 consolidated TPBAR containers, could be shipped by dedicated train on rail lines. For the purpose of conservative analysis, this EIS assumes that only two consolidated containers will be loaded in a rail-size cask. This assumption is conservative because putting more than two consolidated assemblies into a cask would decrease the number of shipments, which decreases the incident-free and traffic accident risks. These risks are dominant contributors of the transportation risk.

The transportation analysis looked at likely implementation approaches for each of the three reactor options. The approaches quantitatively addressed minimum production at a single unit (1,000 TPBARs per 18-month fuel cycle) and maximum production at a single unit (3,400 TPBARs per 18-month fuel cycle).

Transportation segment 4 involves shipment of irradiated hardware from the CLWRs to either the Savannah River Site or the Barnwell disposal facility in South Carolina for disposal as low-level radioactive waste. Irradiated hardware includes base plates and thimble plugs removed from the TPBARs at the CLWR site.

E.5.2 Representative Routes

Representative overland truck routes were selected for the shipments to the CLWRs, the Savannah River Site, and the Barnwell waste disposal facility. The routes were selected consistent with current routing practices and all applicable routing regulations and guidelines (DOT 1992). However, the routes were determined for risk assessment purposes. They do not necessarily represent the actual routes that would be used to transport TPBARs and waste in the future. Specific routes cannot be identified in advance. The representative truck routes are shown in **Figure E–5**. Rail routes, determined by commercial as well as safety considerations, are not shown on Figure E–5 for brevity.

Route characteristics that are important to the radiological risk assessment include the total shipment distance and the population distribution along the route. The specific route selected determines both the total potentially exposed population and the expected frequency of transportation-related accidents. Route characteristics are summarized in **Table E–1**. The population densities along each route are derived from 1990 U.S. Bureau of Census data. Rural, suburban, and urban areas are characterized according to the following breakdown: rural population densities range from 0 to 54 persons per square kilometer (0 to 139 person per square mile); the suburban range is from 55 to 1,284 persons per square kilometer (140 to 3,326 persons per square mile); and the urban range includes all population densities greater than 1,284 persons per square kilometer (3,326 persons per square mile). The exposed population includes all persons living within 800 meters (0.5 mile) of each side of the road. The exposed population, for the purpose of route characterization and incident-free dose calculation, includes all persons living within 800 meters (0.5 mile) of each side of the road.

The preferred route for truck shipments entering the Savannah River Site is to enter the site from Jackson, South Carolina, on Route 125 at barricade 7; take Road 3 over to Road 5; go south on Road 5 until reaching Road 6; go east on Road 6 until reaching F Road; go north on F Road until reaching E Road; go north on E Road until reaching Road 4; go north on Road 4 into the H-area; and then approach the Tritium Extraction Facility via the local H-area roads. DOE has identified two alternate routes (WSRC 1996):

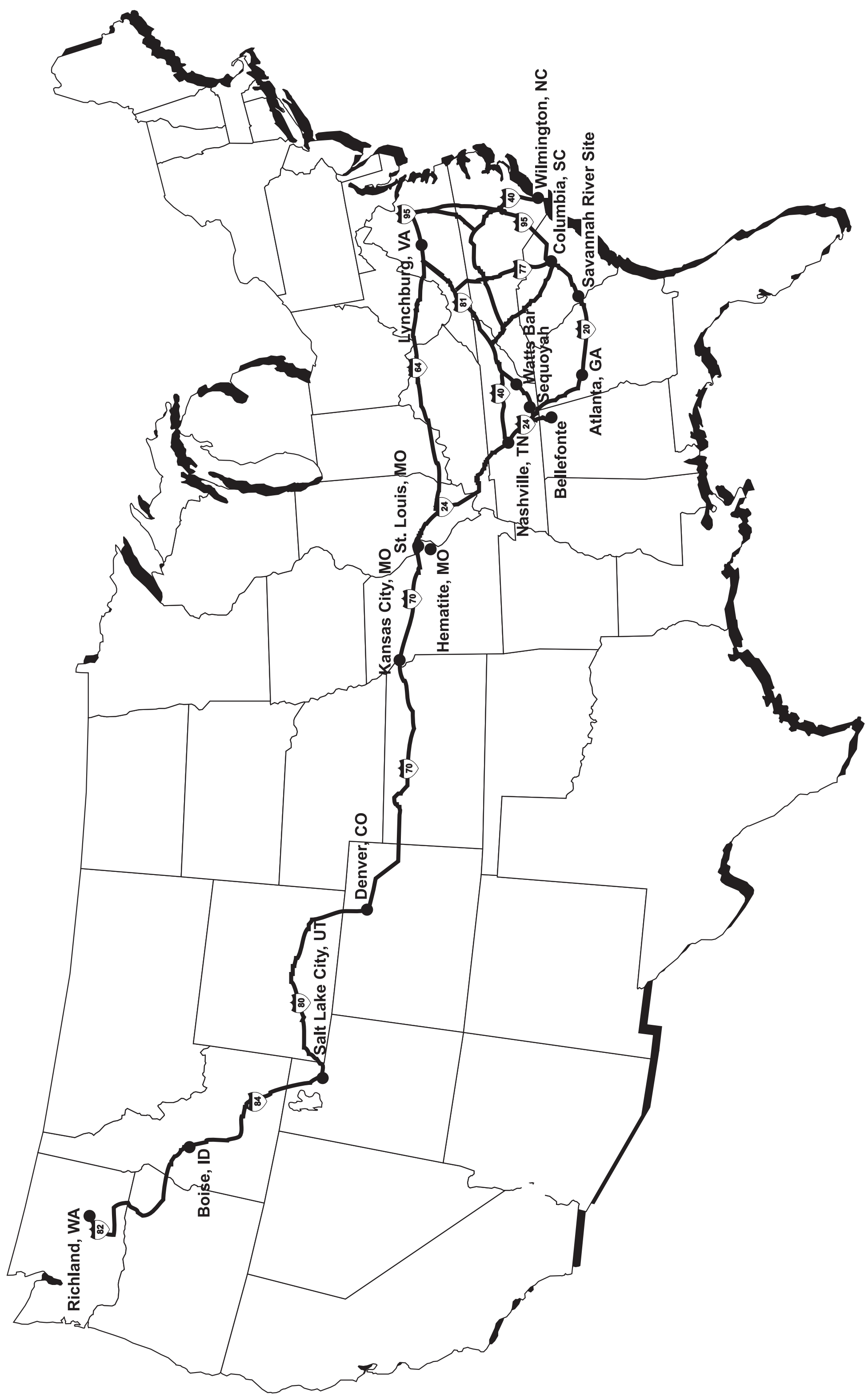


Figure E–5 Representative Overland Truck Routes

Table E–1 Potential Shipping Routes Evaluated for the CLWR EIS

From	To	Distance (kilometers)	Percentages in Zones			Population Density in Zone (persons per square kilometer)			Number of Affected Persons
			Rural	Suburban	Urban	Rural	Suburban	Urban	
Truck Routes									
Watts Bar Nuclear Plant	Savannah River Site	574.5	61.7	34.9	3.4	18.1	349.7	2,195.3	191,000
Sequoyah Nuclear Plant	Savannah River Site	498.9	55.0	40.6	4.4	16.8	373.0	2,157.4	204,000
Bellefonte Nuclear Plant	Savannah River Site	560.0	61.7	34.5	3.8	16.7	358.4	2,158.0	193,000
Wilmington, NC	Columbia, SC	513.4	72.3	27.2	0.4	19.9	229.3	1,764.7	69,000
Wilmington, NC	Hematite, MO	1,673.7	70.8	28.3	0.8	14.1	294.9	2,229.9	298,000
Wilmington, NC	Lynchburg, VA	577.7	83.0	16.1	0.7	14.4	188.7	2,276.9	54,000
Wilmington, NC	Richland, WA	4,787.7	82.7	16.1	1.2	7.4	329.5	2,169.9	653,000
Columbia, SC	Lynchburg, VA	595.4	70.0	28.7	1.3	16.9	296.5	2,037.7	118,000
Columbia, SC	Richland, WA	4,451.3	85.7	13.1	1.2	6.7	336.5	2,146.8	538,000
Hematite, MO	Columbia, SC	1,337.3	77.8	21.3	0.9	12.7	286.4	2,134.2	193,000
Hematite, MO	Watts Bar Nuclear Plant	917.3	83.0	16.2	0.8	12.2	253.1	2,321.9	102,000
Lynchburg, VA	Watts Bar Nuclear Plant	614.8	69.6	29.6	0.8	18.7	276.3	2,028.9	109,000
Columbia, SC	Watts Bar Nuclear Plant	552.0	70.0	29.1	0.9	14.2	297.0	1,856.0	100,000
Richland, WA	Watts Bar Nuclear Plant	4,031.3	87.7	11.0	1.2	6.2	340.7	2,174.7	445,000
Hematite, MO	Sequoyah Nuclear Plant	836.8	79.2	19.9	1.0	13.0	280.2	2,297.9	119,000
Lynchburg, VA	Sequoyah Nuclear Plant	729.0	64.7	34.2	1.1	19.3	302.4	1,967.3	160,000
Columbia, SC	Sequoyah Nuclear Plant	597.1	57.1	39.5	3.4	16.0	348.2	2,110.6	209,000
Richland, WA	Sequoyah Nuclear Plant	3,950.8	87.0	11.7	1.3	6.2	347.2	2,173.3	469,000
Hematite, MO	Bellefonte Nuclear Plant	811.1	82.0	17.1	0.9	13.0	266.4	2,313.2	100,000
Lynchburg, VA	Bellefonte Nuclear Plant	790.2	68.8	30.3	0.9	18.9	287.8	1,950.5	149,000
Columbia, SC	Bellefonte Nuclear Plant	658.2	62.6	34.4	3.0	16.0	334.7	2,109.6	198,000
Richland, WA	Bellefonte Nuclear Plant	3,925.1	87.6	11.1	1.3	6.2	347.0	2,173.8	453,000
Watts Bar Nuclear Plant	Barnwell, SC	632.5	62.9	34.3	2.8	16.5	342.3	2,145.2	190,000
Sequoyah Nuclear Plan	Barnwell, SC	556.8	57.0	39.3	3.7	14.9	364.0	2,110.7	205,000
Bellefonte Nuclear Plant	Barnwell, SC	618.0	62.9	33.9	3.2	15.2	350.1	2,109.8	194,000

From	To	Distance (kilometers)	Percentages in Zones			Population Density in Zone (persons per square kilometer)			Number of Affected Persons
			Rural	Suburban	Urban	Rural	Suburban	Urban	
Rail Routes									
Watts Bar Nuclear Plant	Savannah River Site	668.2	62.4	36.2	1.3	14.1	269.0	2,091.1	143,000
Sequoyah Nuclear Plant	Savannah River Site	611.9	60.5	38.0	1.4	14.3	271.4	2,091.1	138,000
Bellefonte Nuclear Plant	Savannah River Site	675.9	63.3	35.4	1.2	14.0	268.8	2,091.1	140,000

- Assuming that the newly completed bridge modification on Road F is adequate to handle trucks, enter the site from Jackson, South Carolina, on Route 125 at barricade 7. Take Road 3 over to Road 5. Go northeast on Road 5 until reaching C Road. Go north on C Road until reaching Road 4. Go northeast on Road 4 into the H-area, and approach the Tritium Extraction Facility via the local H-area roads.

- Assuming that the newly completed bridge on Road F is adequate to handle trucks, enter the site from the North on Route 19 through barricade 2. Take road 2 to F Road. Go south on F Road until reaching Road 4. Go southeast on Road 4 into the H-area, and approach the Tritium Extraction Facility via the local H-area roads.

The differences in the risk of the three possible routes were evaluated to be much less than the significant figures shown on the risk estimates. Final determination of route details is an operational decision to be made at the time of shipment.

If rail transportation is the chosen mode, the preferred rail system is to use existing Savannah River Site rails and railspurs. The Savannah River Site would use an existing 300-ton Manitowoc portable crane at the end of the rail spur to transfer the casks from the rail car to trucks. The trucks would travel the quarter mile to the Tritium Extraction Facility. A railspur terminal support facility may be required to support this crane. Construction impact estimates (if construction is required) are not available at this time (WSRC 1996).

The Bellefonte, Watts Bar, and Sequoyah Nuclear Plants currently have cranes that could handle 125-ton casks, although Sequoyah is currently downgraded to 80 tons and load testing would be required to restore the rating to the design capacity of 125 tons. Large cask handling has not been addressed in detail at any of the sites, so regulatory, structural, and spacial issues must be evaluated before rail transportation could be implemented.

E.5.3 Material Inventory

The amount of hazardous material in a package is called the inventory. It refers to the material available for release in an accident scenario. Inventory estimates for the materials shipped are given below.

Low-Level Radioactive Waste

DOE assumes 24 TPBARs per production assembly. Irradiation of 3,400 TPBARs per 18-month fuel cycle would generate 141 hold-down assemblies (see Appendix A, **Figure A–12**). These hold-down assemblies would be discarded as low-level radioactive waste. The low-level radioactive waste volume is estimated to be about 0.43 cubic meters (15 cubic feet) per year (WEC 1998).

Use of a "generic legal weight truck waste cask" with a usable cavity measuring 18 inches in diameter by 144 inches long would result in about two shipments per year. However, achieving perfect packing efficiency of these wastes is not realistic, and this estimate must be expanded. DOE estimates that the annual waste shipments will be a minimum of two and a maximum of eight.

Pacific Northwest National Laboratory provided source terms for 16 thimble plugs, which are equal to about 1,500 grams of irradiated hardware (PNNL 1998). Using the above information, which was chosen to conservatively estimate the amount of irradiated hardware, each shipment will carry about 56 kilograms of irradiated hardware. The thimble plugs are more highly irradiated than other hardware, so use of the data from thimble plugs is conservative. **Table E–2** lists the derived source term used for the purpose of analyzing low-level radioactive waste transportation risks. Further analysis, using final design information and actual irradiation schedules, will be used to verify that the concentration of radionuclides does not exceed the Class C limits of 10 CFR 61. The regulatory limit dose rates were assumed for low-level radioactive waste shipments.

TPBARs

Pacific Northwest National Laboratory determined the radionuclide inventory and decay heat for the Lead Test Assembly TPBARs at reactor discharge and for decay times ranging from 7 days to 10 years following reactor discharge (PNNL 1998). Table E–2 shows the TPBAR radionuclide inventory, with a decay time of 30 days used for the analysis. The inventory includes tritium and other irradiated components associated with the cladding, liner, getter, and other structures within a TPBAR. The latter is collectively called nontarget-bearing components.

Crud

The crud inventory assumed to be available for release from TPBARs is shown in Table E–2 with a 30-day decay time following reactor discharge in units of Curies/TPBAR. The crud inventory has been very conservatively bounded using worst-case measurements of crud from pressurized water reactor spent nuclear fuel (SNL 1991a).

Table E–2 Irradiated Hardware and TPBAR Inventory

Nuclide	*Low-Level Radioactive Waste (Curies per shipment)*	*TPBAR (Curies per TPBAR)*	*TPBAR Crud (Curies per TPBAR)*
Tritium		9,600[a]	
Carbon-14	0.0000042	0.0095	NA
Chromium-51	30,000	300	0.21
Manganese-54	2,700	23	0.4
Iron-55	14,000	120	NA
Iron-59	890	7.5	0.21
Cobalt-58	3,400	66	1.2
Cobalt-60	3,500	33	0.15
Zinc-65	0.000038	0.0015	NA
Zirconium-89	0.000029	0.0000022	NA
Zirconium-95	0.04	31	0.029
Niobium-95	8.1	.39	NA
Molybdenum-99	2.6	0.19	NA
Ruthenium-103	0.014	0.0010	NA

[a] For a failed TPBAR, a value of 1.15×10^4 Curies of tritium (1.2 grams of tritium) per TPBAR is used for analytic consistency.
NA = Not available

E.5.4 External Dose Rates

Cask design for irradiated TPBARs and cask selection for low-level radioactive waste are not complete. However, even though the hardware is highly irradiated, the container external dose rate is not as high as the regulatory limits. For the purposes of analysis, it is conservative to assume that TPBAR and low-level radioactive waste container external dose rates are equal to regulatory limits.

E.5.5 Health Risk Conversion Factors

The health risk conversion factors used to estimate expected cancer fatalities were: 0.0005 and 0.0004 fatal cancer cases per person-rem for members of the public and workers, respectively (NCRP 1993).

E.5.6 Accident Involvement Rates

For the calculation of accident risks, vehicle accident and fatality rates are taken from data provided in other reports (ANL 1994). Accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel in that same year. Therefore, the rate is a fractional value, with accident-involvement count as the numerator of the fraction and vehicular activity (total travel distance in truck-kilometers or railcar-kilometers) as its denominator. Accident rates are generally determined for a multi-year period. For assessment purposes, the total number of expected accidents or fatalities is calculated by multiplying the total shipment distance for a specific case by the appropriate accident or fatality rate.

For truck transportation, the rates presented are specifically for heavy combination trucks involved in interstate commerce (ANL 1994). Heavy combination trucks are rigs composed of a separable tractor unit containing the engine and one to three freight trailers connected to each other. Heavy combination trucks are typically used for radioactive waste shipments. The truck accident rates are computed for each state based on statistics compiled by the U.S. Department of Transportation Office of Motor Carriers from 1986 to 1988. Saricks and Kvitek present accident involvement and fatality counts; estimated kilometers of travel by state; and the corresponding average accident involvement, fatality, and injury rates for the three years investigated. A fatality caused by an accident is the death of a member of the public who is killed instantly or dies within 30 days due to the injuries sustained in the accident.

Rail accident rates are computed and presented similarly to truck accident rates (ANL 1994). The state-specific rail accident involvement and fatality rates are based on statistics compiled by the Federal Railroad Administration from 1985 to 1988. Rail accident rates include both main line accidents and those occurring in railyards. It is important to note that the accident rates used in this assessment were computed using the universe of all interstate heavy combination truck shipments, independent of shipment cargo. The cited report points out that shippers and carriers of radioactive material generally have a higher than average awareness of transport risk and prepare cargoes and drivers for such shipments accordingly (ANL 1994). This preparation should have a twofold effect of reducing component/equipment failure and mitigating the human error contribution to accidents. These effects were not given credit in the accident assessment.

E.5.7 Container Accident Response Characteristics and Release Fractions

E.5.7.1 Development of Conditional Probabilities

The Modal Study was the result of an initiative taken by the NRC (NRC 1987) to refine more precisely the analysis presented in NUREG-0170 (NRC 1977) for spent nuclear fuel shipping casks. Whereas the NUREG-0170 analysis was primarily performed using best engineering judgments and presumptions concerning cask response, the Modal Study relies on sophisticated structural and thermal engineering analysis and a probabilistic assessment of the conditions that could be experienced in severe transportation accidents. The Modal Study results are based on representative spent nuclear fuel casks that were assumed to have been designed, manufactured, operated, and maintained in accordance with national codes and standards. Design parameters of the representative casks were chosen to meet the minimum test criteria specified in 10 CFR 71. The study is believed to provide realistic, yet conservative, results for radiological releases under transport accident conditions.

In the Modal Study, potential accident damage to a cask is categorized according to the magnitude of the mechanical forces (impact) and thermal forces (fire) to which a cask may be subjected during an accident. Because all accidents can be described in these terms, severity is independent of the specific accident sequence. In other words, any sequence of events that results in an accident in which a cask is subjected to forces within a certain range of values is assigned to the accident severity region associated with that range. The accident severity scheme is designed to take into account all potential foreseeable transportation accidents, including accidents with low probability but high consequences and those with high probability but low consequences.

Each severity region actually represents a set of accidents defined by a combination of mechanical and thermal forces. A conditional probability of occurrence—that is, the probability that if an accident occurs, it is of a particular severity—is assigned to each region. The Modal Study conditional probability matrices for truck and train accidents (see **Figures E–6** and **E–7**) each contain 20 accident regions. In the Modal Study, these regions are collapsed to form six severity categories, where a severity category represents a set of accidents defined by a combination of mechanical and thermal forces that are expected to produce accident source terms that have similar magnitudes. The fraction of all accidents that fall into each severity category is developed by summing the values for the fractions of all accidents presented in the Modal Study for the set of regions combined to form one severity category. Figure E–6 indicates the regions that were combined to generate each of the six accident categories specified in DOE/EIS-0203-F (DOE 1995) and DOE/EA-1210 (DOE 1997). The y-axis breakpoints on the accident matrix (S_1 = 0.2 percent, S_2 = 2 percent, S_3 = 30 percent) specify the maximum strain in percent on the inner shell of the Type B truck cask. The x-axis breakpoints (T_1 = 260°C, T_2 = 316°C, T_3 = 343°C, T_4 = 565°C) specify the lead mid-wall temperature. Thus, each of the 20 regions in the matrix specifies both an impact load and a thermal load. Figure E–7 presents the Modal Study matrix for rail accidents and gives the conditional probability for each of the 20 accident regions. The y-axis and x-axis breakpoints are the same as those developed for the Modal Study truck accident matrix. The regions have not been grouped into categories for TPBAR performance in train accidents, so none are presented.

Accidents in Region (1,1) are the least severe but most frequent, whereas accidents in Region (4,5) are very severe but very infrequent. To determine the expected frequency of an accident of a given severity, the conditional probability in the category is multiplied by the baseline accident rate. The entire spectrum of accident severities is considered in the accident risk assessment.

As discussed above, the accident consequence assessment only considers the potential impacts from the most severe transportation accidents. In terms of risk, the severity of an accident must be viewed in terms of potential radiological consequences, which are directly proportional to the fraction of the radioactive material within a cask that is released to the environment during the accident. Although regions span the entire range of mechanical and thermal accident loads, they are grouped into accident categories that can be characterized by a single set of release fractions and are, therefore, considered together in the accident consequence assessment. The accident category severity fraction is the sum of all conditional probabilities in that accident category.

To use the conditional probabilities developed in the Modal Study for Rail Casks Transported by Rail for the case of truck casks transported by rail, a comparison of the effect of rail accidents on truck casks was made. The response of truck and rail casks to rail accident impacts is essentially identical; therefore, no adjustment was required. However, these casks would respond differently to a rail accident involving fire. For the same design-basis fire environment, the truck cask will reach a given temperature in a shorter duration than the rail cask. The Modal Study provides graphs that relate the fire duration with lead mid-wall temperature for both truck and rail casks. Using the graph for rail casks, the durations of engulfing fires required to reach each of the x-axis breakpoints were determined. From these durations, the graph for truck casks was used to develop new x-axis breakpoints. An exponential function was fitted to the resulting cumulative probability versus mid-wall temperature data, and it was then applied to determine the cumulative probability for the original Modal Study x-axis breakpoints. The resulting conditional probabilities for truck casks transported by rail are given in **Figure E–8**.

Strain					
	R(4,1) 1.532E-7	R(4,2) 3.926E-14	R(4,3) 1.495E-14	R(4,4) 7.681E-16	R(4,5) <1.0E-16 **Category 6**
S_3 30%	R(3,1) 1.7984E-3	R(3,2) 1.574E-7 **Category 5**	R(3,3) 2.034E-7	R(3,4) 1.076E-7	R(3,5) 4.873E-8
S_2 2%	R(2,1) 3.8192E-3	R(2,2) 2.330E-7 **Category 3**	R(2,3) 3.008E-7	R(2,4) 1.592E-7 **Category 4**	R(2,5) 7.201E-8
S_1 0.2%	R(1,1) 0.99431 **Category 1**	R(1,2) 1.687E-5	R(1,3) 2.362E-5 **Category 2**	R(1,4) 1.525E-5	R(1,5) 9.570E-6

T_1 260°C, T_2 316°C, T_3 343°C, T_4 565°C

Temperature

1.532E-7 = 1.532 x 10^{-7}

Figure E–6 Conditional Probability Matrix for Modal Study Truck Cask

Strain					
	R(4,1) 1.786E-9	R(4,2) 3.290E-13	R(4,3) 2.137E-13	R(4,4) 1.644E-13	R(4,5) 3.459E-14
S_3 30%	R(3,1) 5.545E-4	R(3,2) 1.021E-7	R(3,3) 6.634E-8	R(3,4) 5.162E-8	R(3,5) 5.296E-8
S_2 2%	R(2,1) 2.7204E-3	R(2,2) 5.011E-7	R(2,3) 3.255E-7	R(2,4) 2.531E-7	R(2,5) 1.075E-8
S_1 0.2%	R(1,1) 0.993962	R(1,2) 1.2275E-3	R(1,3) 7.9511E-4	R(1,4) 6.140E-4	R(1,5) 1.249E-4

T_1 260°C, T_2 316°C, T_3 343°C, T_4 565°C

Temperature

1.786E-9 = 1.786 x 10^{-9}

Figure E–7 Conditional Probability Matrix for Modal Study Rail Cask

Strain					
	R(4,1) 1.786E-7	R(4,2) 1.659E-13	R(4,3) 2.777E-13	R(4,4) 2.091E-13	R(4,5) 1.361E-13
S_3 30%					
	R(3,1) 5.544E-4	R(3,2) 5.148E-8	R(3,3) 8.621E-8	R(3,4) 6.565E-8	R(3,5) 2.084E-7
S_2 2%					
	R(2,1) 2.7204E-3	R(2,2) 2.523E-7	R(2,3) 4.230E-7	R(2,4) 3.219E-7	R(2,5) 4.230E-8
S_1 0.2%					
	R(1,1) 0.99380	R(1,2) 6.190E-4	R(1,3) 1.033E-3	R(1,4) 7.808E-4	R(1,5) 4.914E-4

Temperature: T_1 260°C, T_2 316°C, T_3 343°C, T_4 565°C

1.786E-7 = 1.786×10^{-7}

Figure E–8 Conditional Probability Matrix for Truck Cask Transported by Rail

E.5.7.2 Transportation Risk Analyses Assumptions

E.5.7.2.1 Cask Response to Impact and Thermal Loads

This section provides separate analyses for casks with elastomeric seals and metallic seals, since they perform differently in accidents. In general, elastomeric seals will perform better (i.e., fail at a higher strain) than metallic seals in accidents involving impacts without fires. Metallic seals will perform better (i.e., fail at a higher temperature) than elastomeric seals in accidents involving fires.

The regulatory design-basis accident defined by 10 CFR 71 and 49 CFR 173 is encompassed within a region bounded by a maximum impact load of S_1 (0.2 percent maximum strain on the inner shell) and a maximum thermal load of T_1 (260°C [500°F] lead shield mid-wall temperature).

The cask containment boundary for a truck or rail cask using elastomeric seals was assumed not to fail for impact loads less than S_2 (2 percent strain) and temperatures less than T_1. Radioactive material packages are designed to a very rigorous set of standards. This design philosophy results in a large margin of safety against accidents more severe than the design-basis accident. For the EIS analyses, the conditional probabilities were taken directly from the Modal Study, and those conditional probabilities were based on the response of the representative truck and rail casks described in the Modal Study. These generic casks were chosen such that the regulatory design-basis accident would result in a 0.2 percent strain in the inner shell of the cask. Recent tests and analyses performed at Sandia National Laboratory using packages with elastomeric seals have shown that this level of strain is reasonable for the design-basis accident and that the cask containment boundary does not fail for accidents resulting in inner shell strains of up to 20 percent (Ammerman 1995). Based on these results, the EIS transportation risk analyses assumed that the cask containment boundary will not fail for packages using elastomeric seals for inner shell strains less than S_2.

Packages using metallic seals cannot tolerate the slight amounts of closure movements that may occur during extra-regulatory impacts. Therefore, the EIS analyses assume that any impact load above S_1 for a cask using metallic seals results in failure of the cask containment boundary. The probability of failure of the cask containment boundary as a result of failure of the metallic seal below T_4 (565°C) is similar to the negligible probability of seal failure for normal operating conditions. The American Society for Testing and Materials Type 304 stainless steel structural materials and metallic seal materials typically used in radioactive material packages are also used in high-temperature industrial applications. To avoid creep, the American Society of Mechanical Engineers Code, Section III, rates the American Society for Testing and Materials Type 304 material commonly used for radioactive material packages at 122 mega-Pascal (17.7 thousand pounds per square inch) for a 10-hour exposure to temperatures of 565°C. With only internal pressure as a source of primary stresses and secondary thermal stresses, stress levels in the seal area are anticipated to be well below this material rating. However, bolt materials for package closures must be carefully selected. The American Society of Mechanical Engineers Codes, Sections VIII and III, rate common high-strength carbon steel bolt materials only to temperatures near 370°C for most applications. Inconel bolts, however, are rated to temperatures as high as 620°C, and these analyses have assumed that high-temperature bolts will be utilized (SNL 1999).

E.5.7.2.2 TPBARs Response to Impact and Thermal Loads

The EIS transportation risk analyses assumed a TPBAR failure rate, consistent with the assumptions used for reactor operations, of 2 TPBARs per core (maximum of 3,400 TPBARs per core). Since the possibility exists that the 2 assumed failed TPBARs could be transported in the same cask shipment following consolidation at the reactor, the EIS transportation risk analyses assumed that there could be a maximum of 2 prefailed (failed prior to transportation) TPBARs in a truck cask (at least 289 TPBARs per shipment) or a given rail cask (at least 578 TPBARs per shipment).

Following design-basis accident impacts, spent fuel rods with precracking due to pellet-clad interactions at the pellet boundaries experience very few failures (SNL 1992). Therefore, the analysis assumes that the regulatory impact (S_1 = 0.2 percent) will not cause any TPBAR cladding failures. Moreover, the design conservatism in the impact limiters for spent fuel casks results in only relatively small increases in acceleration loads to the contents for extra-regulatory impacts up to a point where the strain in the wall is equal to 2 percent. Therefore, it is assumed that there are no failures of the TPBAR cladding for impact loads resulting in strains below S_2 (2 percent). To achieve strains higher than 2 percent, the impact limiter must be completely locked up (can no longer absorb energy) and the acceleration levels increase significantly. At this point there is a possibility that some of the TPBARs could experience cladding failure due to the mechanical loads placed upon them. Considering the high ductility of the TPBAR cladding, it was assumed that the only TPBARs that can fail during impact loads are those with pre-existing part-wall cracks (SNL 1999). These analyses conservatively assumed that this is equal to 1 percent of the TPBARs, based on the frequency of spent fuel rods with pre-existing part-wall cracks (SNL 1992). The failed TPBARs would release all of their tritium inventories (PNNL 1999).

As noted earlier, the temperatures that define the regions for the conditional probabilities in the Modal Study truck and rail cask accident matrices are the temperatures at the mid-wall of the lead shield that result from thermal loads during the fire accident. The temperature of the TPBAR cladding is conservatively assumed to be equal to lead shield mid-wall temperature. For temperatures below T_3 (343°C), the EIS analyses assume that 0.12 millicurie per TPBAR per hour of tritium in the form of molecular tritium gas (T_2 and HT) are released from all intact TPBARs into the cask cavity (PNNL 1999). For the purposes of determining the quantity of molecular tritium gas that is released from intact TPBARs into the cask cavity, the EIS analyses conservatively assume that the TPBARs are in the transport cask for a period of two weeks. For the purpose of analysis, each TPBAR is designed to contain an average of 1 gram of tritium, or approximately 9,640 Curies (PNNL 1997). For temperatures between T_3 and T_4 (343° and 565°C), the EIS analyses assume that

0.015 grams of tritium/TPBAR in the form of molecular tritium gas are released from all intact TPBARs into the cask cavity (PNNL 1999).

For temperatures below T_4, the EIS analyses assume that 0.015 grams of tritium/TPBAR in the form of tritiated water (T_2O and HTO) are instantaneously released into the cask cavity from all TPBARs that have failed due to impact and thermal loads (PNNL 1999). The potential for TPBAR rupture was assessed at T_4, and it was determined that TPBARs are unlikely to rupture at temperatures less than T_4. However, TPBARs may rupture at temperatures higher than T_4. Therefore, the analyses conservatively assume that all TPBARs fail during a transportation cask fire accident when TPBAR temperatures are above T_4. For TPBARs with temperatures above T_4, the analyses assume that 100 percent of the tritium inventory of the TPBARs is instantaneously released in the form of tritiated water into the cask cavity (PNNL 1999).

Finally, the EIS analyses assume that 100 percent of the tritium inventory of prefailed (failed prior to transportation) TPBARs will be released into the cask cavity in the form of tritiated water (PNNL 1999) and that tritiated water does not permeate through the elastomeric seals comprising the cask containment boundary for temperatures less than T_1 (260°C) or through the metallic seals comprising the cask containment boundary for temperatures less than T_4.

E.5.7.3 Accident Matrix Category Descriptions

The six accident categories specified in DOE/EA-1210 (DOE 1997) and shown in Figure E–6 were based on the performance of spent nuclear fuel. The analysis described in Section E.5.7.2 has been used to refine the category descriptions to better fit the characteristic behavior of TPBARs. Retaining the basic structure of the Modal Study matrices allows the use of the conditional probabilities given in the Modal Study for accident matrix regions.

The 20 regions described by the 4 × 5 conditional probability matrix were combined to give seven accident severity categories for the truck and rail casks used to transport the irradiated TPBARs from the production reactor to the Tritium Extraction Facility. The regions of the conditional probability matrix that are encompassed by a specific accident category will differ between a cask using elastomeric seals and one using metallic seals, due to the varying response of each cask to the impact and thermal loads.

E.5.7.3.1 Elastomeric Seals

Figure E–9 gives the accident matrix for both truck and rail casks using an elastomeric seal. The regions that were combined to generate the seven accident categories are also shown in Figure E–9.

E.5.7.3.2 Metallic Seals

Figure E–10 gives the accident matrix for both truck and rail casks using a metallic seal. The regions that were combined to generate each of the seven accident categories are also shown in Figure E–10.

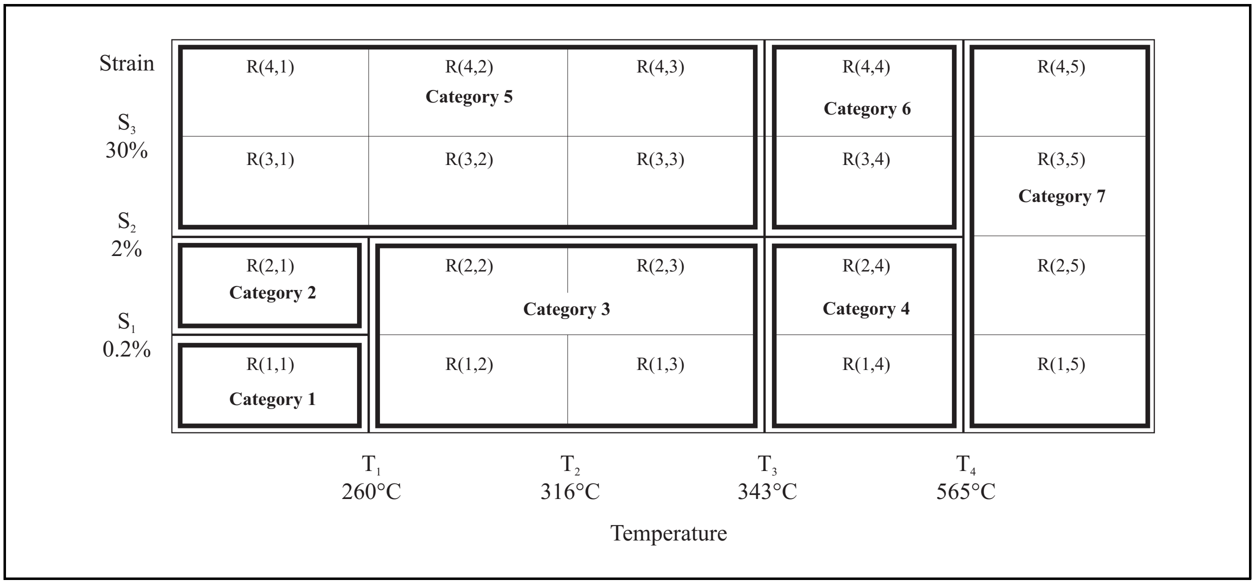


Figure E–9 Accident Matrix for Truck and Rail Casks Using Elastomeric Seals

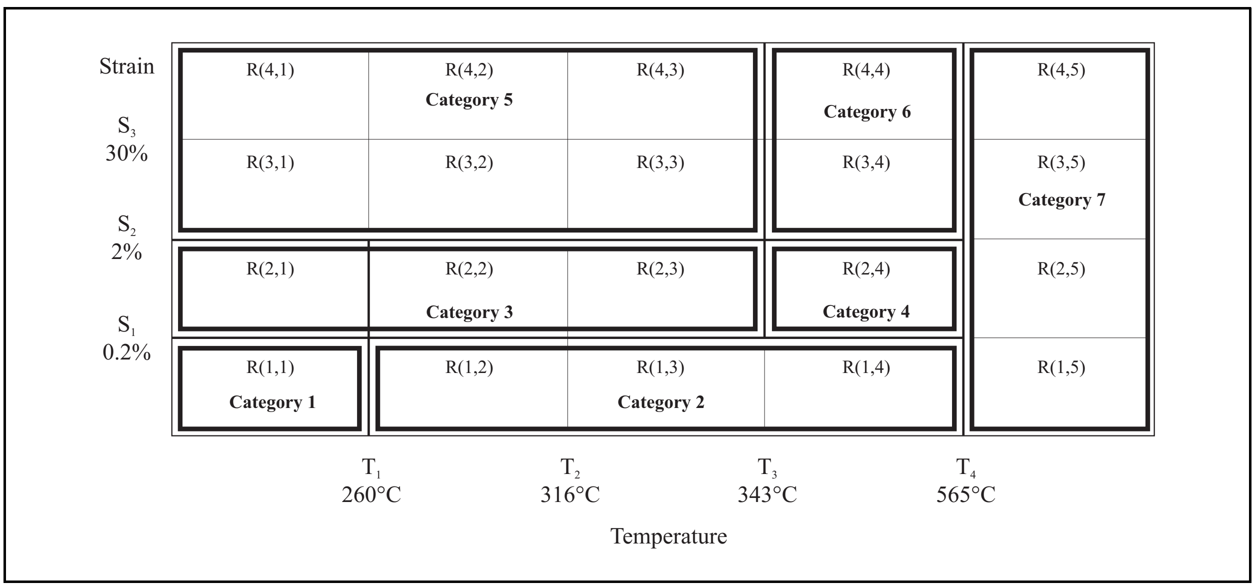


Figure E–10 Accident Matrix for Truck and Rail Casks Using Metallic Seals

E.5.7.3.3 Accident Category Release Fractions for Tritium, Nontarget-Bearing Components, and Crud

Release fractions for tritium, both as molecular tritium gas (T_2 or HT) and as tritiated water (T_2O or HTO); nontarget-bearing components; and crud for truck casks transported by road, truck casks transported by rail, and rail casks transported by rail, with no prefailed TPBARs, are given in **Table E–3** for each of the seven accident categories. For both regulatory and extra-regulatory transport conditions, 100 percent of the crud is assumed to spall. The average crud concentration in a cask cavity can be expressed as the concentration immediately after spallation and initial mixing, multiplied by a release reduction factor that incorporates all geometrical information on the cask volume, settling, and collection areas, and the aerosols time-varying size distribution (SNL 1993a). A bounding maximum release fraction for crud based on 100-percent spallation and typical release reduction factors is 2×10^{-3} (SNL 1991b). Release fractions for nontarget-bearing components are equivalent to those used in DOE/EA-1210 (DOE 1997) for the Lead Test Assembly, with adjustments made for the accident categories that are defined by different regions of the matrix. The crud and nontarget-bearing components release fractions are independent of whether the cask uses an elastomeric seal or a metallic seal.

Table E–3 Release Fractions for Truck and Rail Casks with No Prefailed TPBARs

Category	***1***	***2***	***3***	***4***	***5***	***6***	***7***
T_2 / HT	0	0	4.18×10^{-6}	4.18×10^{-6}	4.18×10^{-6}	4.18×10^{-6}	4.18×10^{-6}
T_2O / HTO	0	0	0	1.5×10^{-2}	1.0×10^{-2}	2.5×10^{-2}	1.0
NTBC	0	0	3.1×10^{-10}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-7}
Crud	0	0	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}

T_2 / HT = molecular tritium gas.
T_2O / HTO = tritiated water.
NTBC = Nontarget-bearing components.

Release fractions for tritium, non-target-bearing components, and crud for truck casks transported by road and truck casks transported by rail with two prefailed TPBARs out of 289 TPBARs are given in **Table E–4** for each of the seven accident categories. The release fractions are independent of whether the cask uses an elastomeric seal or a metallic seal.

Table E–4 Release Fractions for Truck Casks with Two Prefailed TPBARs

Category	***1***	***2***	***3***	***4***	***5***	***6***	***7***
T_2 / HT	0	0	4.15×10^{-6}	4.15×10^{-6}	4.15×10^{-6}	4.15×10^{-6}	4.15×10^{-6}
T_2O / HTO	0	0	8.29×10^{-3}	2.32×10^{-2}	1.83×10^{-2}	3.32×10^{-2}	1.0
NTBC	0	0	3.1×10^{-10}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-7}
Crud	0	0	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}

T_2 / HT = molecular tritium gas.
T_2O / HTO = tritiated water.
NTBC = Nontarget-bearing components.

Release fractions for tritium, nontarget-bearing components, and crud for rail casks transported by rail with two prefailed TPBARs out of 578 TPBARs in two consolidated containers in the rail cask are given in **Table E–5** for each of the seven accident categories. The release fractions are independent of whether the cask uses an elastomeric seal or a metallic seal.

Table E–5 Release Fractions for Rail Casks with Two Prefailed TPBARs

Category	***1***	***2***	***3***	***4***	***5***	***6***	***7***
T_2 / HT	0	0	4.17×10^{-6}	4.17×10^{-6}	4.17×10^{-6}	4.17×10^{-6}	4.17×10^{-6}
T_2O / HTO	0	0	4.15×10^{-3}	1.91×10^{-2}	1.42×10^{-2}	2.91×10^{-2}	1.0
NTBC	0	0	3.1×10^{-10}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-7}
Crud	0	0	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}

T_2 / HT = molecular tritium gas.
T_2O / HTO = tritiated water.
NTBC = Nontarget-bearing components.

E.5.7.3.4 Accident Category Severity Fractions

The conditional probabilities given in Figure E–6, Figure E–7, and Figure E–8 were combined using the accident categories depicted in Figures E–9 and E–10 to develop the accident category severity fractions given in **Table E–6**. The severity fractions are independent of whether there are any prefailed TPBARs, since the conditional probability accident matrix category descriptions are the same whether there are no prefailed TPBARs or there are two prefailed TPBARs in the transport cask.

Table E–6 Accident Category Severity Fractions

	Category						
	1	***2***	***3***	***4***	***5***	***6***	***7***
Truck cask transported by road using elastomeric seals	0.99432	3.819×10^{-3}	4.102×10^{-5}	1.541×10^{-5}	1.799×10^{-3}	1.076×10^{-7}	9.641×10^{-6}
Truck cask transported by rail using elastomeric seals	0.99380	2.720×10^{-3}	1.653×10^{-3}	9.812×10^{-4}	5.546×10^{-4}	6.565×10^{-8}	4.917×10^{-4}
Rail cask transported by rail using elastomeric seals	0.99396	2.720×10^{-3}	2.023×10^{-3}	6.143×10^{-4}	5.547×10^{-4}	5.162×10^{-8}	1.250×10^{-4}
Truck cask transported by road using metallic seals	0.99432	5.574×10^{-5}	3.828×10^{-3}	1.542×10^{-7}	1.799×10^{-3}	1.076×10^{-7}	9.641×10^{-6}
Truck cask transported by rail using metallic seals	0.99380	2.433×10^{-3}	2.721×10^{-3}	3.219×10^{-7}	5.546×10^{-4}	6.565×10^{-8}	4.917×10^{-4}
Rail cask transported by rail using metallic seals	0.99396	2.637×10^{-3}	2.721×10^{-3}	2.531×10^{-7}	5.547×10^{-4}	5.162×10^{-8}	1.250×10^{-4}

E.5.8 Nonradiological Risk (Vehicle-Related)

Vehicle-related health risks resulting from incident-free transport may be associated with the generation of air pollutants by transport vehicles during shipment and are independent of the radioactive nature of the shipment. The health endpoint assessed under incident-free transport conditions is the excess latent mortality due to inhalation of vehicle exhaust emissions. Risk factors for pollutant inhalation in terms of latent mortality have been generated (SNL 1982). These risks are 1×10^{-7} mortality per kilometer (1.6×10^{-7} per mile) and 1.3×10^{-7} mortality per kilometer (2.1×10^{-7} per mile) of truck and rail travel in urban areas, respectively. The risk factors are based on regression analyses of the effects of sulfur dioxide and particulate releases from diesel exhaust on mortality rates. Excess latent mortalities are assumed to be equivalent to latent cancer fatalities. Vehicle-related risks from incident-free transportation are calculated for each case by multiplying the total distance traveled in urban areas by the appropriate risk factor. Similar data are not available for rural and suburban areas.

Risks are summed over the entire route and over all shipments for each case. This method has been used in several EISs to calculate risks from incident-free transport. Lack of information for rural and suburban areas is an obvious data gap, although the risk factor would presumably be lower than for urban areas because of lower total emissions from all sources and lower population densities in rural and suburban areas.

E.6 Risk Analysis Results

Per-shipment risk factors have been calculated for the collective populations of exposed persons and for the crew for all anticipated routes and shipment configurations. The radiological risks are presented in doses per shipment for each unique route, material, and container combination. The radiological dose per shipment factors for incident-free transportation are presented in **Table E–7**. Doses are calculated for the crew, off-link public (i.e., people living along the route), on-link public (i.e., pedestrians and drivers along the route), and the public at rest and fueling stops (i.e., stopped cars, buses and trucks, workers, and other bystanders).

Accident impacts were calculated under the conservative assumption that all tritium gas released is quickly oxidized to form tritiated water.

The radiological dose risk factors for accident transportation conditions are also presented in Table E–7. The accident risk factors are called "dose risk," because the values incorporate the spectrum of accident severity probabilities and associated consequences. They are presented for normal transportation (i.e., no failed TPBARs) and the abnormal event of two failed TPBARs in a shipment. The risks are only slightly higher if the failed TPBARs were to be shipped in a single cask.

The nonradiological risk factors are presented in fatalities per shipment in **Table E–8**. Separate risk factors are provided for fatalities resulting from exhaust emissions (caused by hydrocarbon emissions known to be carcinogens) and transportation accidents (fatalities resulting from impact).

The performance of both elastomeric and metallic cask seals was evaluated. Elastomeric seals perform better in accidents that involve impact because they are more flexible. Metallic seals perform better in accidents that involve fire because they are less susceptible to heat damage. Overall, metallic seals exhibit a slightly higher risk and, therefore, are used to evaluate EIS alternatives.

Table E–9 shows the risks of transporting each of the hazardous materials. The risks are calculated by multiplying the previously given per-shipment factors by the number of shipments over 40 years' duration of the program and, in the case of the radiological doses, by the health risk conversion factors. The accident risk from TPBAR shipments includes the irradiated metal and the crud deposited onto the TPBARs. Over 90 percent of the accident risk comes from the tritium. Based on the results of the transportation risk analysis, it is unlikely that shipping TPBARs and waste will result in a fatality. The risk estimates include the highest conceivable impacts of shipping unirradiated TPBARs and assemblies.

The risks to various exposed individuals under incident-free transportation conditions have been estimated for hypothetical exposure scenarios. The estimated doses to inspectors and the public are presented in **Table E–10** on a per-event basis (person-rem per event). Note that the potential exists for larger individual exposures if multiple exposure events occur. For example, the dose to a person stuck in traffic next to a shipment for 30 minutes is calculated to be 11 millirem. If the exposure duration were longer, the dose would rise proportionally. In addition, a person working at a truck service station could receive a significant dose if trucks were to use the same stops repeatedly. The dose to a person fueling a truck could be as much as 1 millirem. Administrative controls could be instituted to control the location and duration of truck stops if multiple exposures were to happen routinely.

The cumulative dose to a resident was calculated assuming all shipments passed his or her home. The cumulative doses assume that the resident is present for every shipment and is unshielded at a distance of 30 meters (about 100 feet) from the route. Therefore, the cumulative dose is only a function of the number of shipments passing a particular point and is independent of the actual route being considered. The maximum dose to this resident, if all the material were to be shipped via this route, would be less than 0.1 millirem.

The estimated dose to transportation crew members is presented for a commercial crew. No credit is taken for the shielding associated with the tractor or trailer.

Table E–7 Radiological Risk Factors for Single Shipments

From	To	Material & Package	Incident-Free Dose (Person-rem)					Accident Dose (Person-rem)
			Crew	Public				
				Off-link	On-link	Stops	Total	
No Failed TPBARs								
Truck Routes								
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.4×10^{-2}	2.4×10^{-3}	1.3×10^{-2}	6.8×10^{-2}	8.4×10^{-2}	3.2×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.3×10^{-2}	2.9×10^{-3}	1.7×10^{-2}	5.9×10^{-2}	7.9×10^{-2}	3.7×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.4×10^{-2}	2.3×10^{-3}	1.4×10^{-2}	6.6×10^{-2}	8.2×10^{-2}	4.0×10^{-5}
Rail Routes								
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Cask	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.8×10^{-3}	5.7×10^{-3}	2.0×10^{-5}
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.9×10^{-3}	5.8×10^{-3}	7.0×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Cask	1.1×10^{-3}	6.9×10^{-4}	1.5×10^{-4}	4.7×10^{-3}	5.6×10^{-3}	1.8×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.1×10^{-3}	6.9×10^{-4}	1.5×10^{-4}	4.8×10^{-3}	5.6×10^{-3}	6.5×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Cask	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.8×10^{-3}	5.7×10^{-3}	2.0×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.2×10^{-3}	7.6×10^{-4}	1.6×10^{-4}	4.9×10^{-3}	5.8×10^{-3}	7.1×10^{-5}
2 Failed TPBARs								
Truck Routes								
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.4×10^{-2}	2.4×10^{-3}	1.3×10^{-2}	6.8×10^{-2}	8.4×10^{-2}	4.0×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.3×10^{-2}	2.9×10^{-3}	1.7×10^{-2}	5.9×10^{-2}	7.9×10^{-2}	6.1×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs	1.4×10^{-2}	2.3×10^{-3}	1.4×10^{-2}	6.6×10^{-2}	8.2×10^{-2}	5.4×10^{-5}

			Incident-Free Dose (Person-rem)					
				Public				
From	***To***	***Material & Package***	***Crew***	***Off-link***	***On-link***	***Stops***	***Total***	***Accident Dose (Person-rem)***
All Metallic Seals								
Rail Routes								
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Cask	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.8×10^{-3}	5.7×10^{-3}	2.0×10^{-5}
Watts Bar Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.9×10^{-3}	5.8×10^{-3}	7.1×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Cask	1.1×10^{-3}	6.9×10^{-4}	1.5×10^{-4}	4.7×10^{-3}	5.6×10^{-3}	1.8×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.1×10^{-3}	6.9×10^{-4}	1.5×10^{-4}	4.8×10^{-3}	5.6×10^{-3}	6.6×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs - Rail Casks	1.2×10^{-3}	7.5×10^{-4}	1.6×10^{-4}	4.8×10^{-3}	5.7×10^{-3}	2.0×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	Irradiated TPBARs - 2 Truck Casks	1.2×10^{-3}	7.6×10^{-4}	1.6×10^{-4}	4.9×10^{-3}	5.8×10^{-3}	7.2×10^{-5}
Waste Transport								
Truck Routes								
Watts Bar Nuclear Plant	Savannah River Site	Low-Level Radioactive Waste	1.9×10^{-2}	1.7×10^{-3}	6.2×10^{-3}	6.8×10^{-2}	7.6×10^{-2}	$<1.0 \times 10^{-8}$
Sequoyah Nuclear Plant	Savannah River Site	Low-Level Radioactive Waste	1.7×10^{-2}	1.7×10^{-3}	5.9×10^{-3}	5.9×10^{-2}	6.7×10^{-2}	$<1.0 \times 10^{-8}$
Bellefonte Nuclear Plant	Savannah River Site	Low-Level Radioactive Waste	1.2×10^{-2}	1.0×10^{-3}	3.9×10^{-3}	4.3×10^{-2}	4.7×10^{-2}	$<1.0 \times 10^{-8}$
Watts Bar Nuclear Plant	Barnwell	Low-Level Radioactive Waste	2.0×10^{-2}	1.7×10^{-3}	6.6×10^{-3}	7.5×10^{-2}	8.3×10^{-2}	$<1.0 \times 10^{-8}$
Sequoyah Nuclear Plant	Barnwell	Low-Level Radioactive Waste	1.9×10^{-2}	1.8×10^{-3}	6.3×10^{-3}	6.6×10^{-2}	7.4×10^{-2}	$<1.0 \times 10^{-8}$
Bellefonte Nuclear Plant	Barnwell	Low-Level Radioactive Waste	2.0×10^{-2}	1.7×10^{-3}	6.5×10^{-3}	7.3×10^{-2}	8.1×10^{-2}	$<1.0 \times 10^{-8}$

The accident consequence assessment is intended to provide an estimate of the maximum potential impacts posed by the most severe potential transportation accidents involving a shipment. The maximum foreseeable (frequency greater than 1×10^{-7} per year) offsite transportation accident involves a shipment of irradiated TPBARs under neutral (average) weather conditions. The accident has a probability of occurring about once every 10 million years and could result in a 5.9 rem to a person 30 meters (about 100 feet) from the vehicle. The probability of an accident occurring is smaller with failed TPBARs or under stable atmospheric conditions. This accident would fall into Category 5 of the previously described accident matrix shown in Figure E–9. In this hypothetical accident, the impact would cause the cask to fail, and the deformation of the cask would be assumed to fail 1 percent of the TPBARs. In the event of a fire, it would not be hot enough or would be too short in duration to damage the TPBARs. To incur this level of damage, the cask would have to collide with an immovable object at a speed much greater than 88.5 kilometers per hour (55 miles per hour). The probability of an accident with a more energetic collision or fire and higher consequences is lower.

Table E–8 Nonradiological Risk Factors per Shipment

Nonradiological Risk Estimates (Fatalities/Shipment)			
From	***To***	***Exhaust Emission***	***Accident***
Truck Routes			
Watts Bar Nuclear Plant	Savannah River Site	1.95×10^{-6}	1.13×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	2.20×10^{-6}	9.87×10^{-6}
Bellefonte Nuclear Plant	Savannah River Site	2.13×10^{-6}	1.10×10^{-5}
Wilmington, NC	Columbia, SC	2.05×10^{-7}	9.97×10^{-6}
Wilmington, NC	Lynchburg, VA	4.04×10^{-7}	1.11×10^{-5}
Wilmington, NC	Richland, WA	5.75×10^{-6}	9.26×10^{-5}
Wilmington, NC	Hematite, MO	1.34×10^{-6}	3.26×10^{-5}
Columbia, SC	Lynchburg, VA	7.74×10^{-7}	1.16×10^{-5}
Columbia, SC	Richland, WA	5.34×10^{-6}	8.60×10^{-5}
Hematite, MO	Columbia, SC	1.20×10^{-6}	2.59×10^{-5}
Hematite, MO	Watts Bar Nuclear Plant	7.34×10^{-7}	1.77×10^{-5}
Lynchburg, VA	Watts Bar Nuclear Plant	4.92×10^{-7}	1.20×10^{-5}
Columbia, SC	Watts Bar Nuclear Plant	4.97×10^{-7}	1.08×10^{-5}
Richland, WA	Watts Bar Nuclear Plant	4.84×10^{-6}	7.77×10^{-5}
Lynchburg, VA	Sequoyah Nuclear Plant	8.02×10^{-7}	1.43×10^{-5}
Columbia, SC	Sequoyah Nuclear Plant	2.03×10^{-6}	1.18×10^{-5}
Hematite, MO	Sequoyah Nuclear Plant	8.37×10^{-7}	1.62×10^{-5}
Richland, WA	Sequoyah Nuclear Plant	5.14×10^{-6}	7.63×10^{-5}
Lynchburg, VA	Bellefonte Nuclear Plant	7.11×10^{-7}	1.54×10^{-5}
Columbia, SC	Bellefonte Nuclear Plant	1.97×10^{-6}	1.29×10^{-5}
Hematite, MO	Bellefonte Nuclear Plant	7.30×10^{-7}	1.57×10^{-5}
Richland, WA	Bellefonte Nuclear Plant	5.10×10^{-6}	7.57×10^{-5}
Watts Bar Nuclear Plant	Barnwell, SC	1.77×10^{-6}	1.24×10^{-5}
Sequoyah Nuclear Plant	Barnwell, SC	2.06×10^{-6}	1.10×10^{-5}
Bellefonte Nuclear Plant	Barnwell, SC	1.98×10^{-6}	1.21×10^{-5}
Rail Routes			
Watts Bar Nuclear Plant	Savannah River Site	1.13×10^{-6}	1.57×10^{-5}
Sequoyah Nuclear Plant	Savannah River Site	1.11×10^{-6}	1.44×10^{-5}
Bellefonte Nuclear Plant	Savannah River Site	1.05×10^{-6}	1.59×10^{-5}

Table E–9 Risks of Transporting the Hazardous Materials

Reactor Site (No. of TPBARs)	TPBAR Transportation Mode	Incident-Free				Accident
		Radiological		Nonradiological		
		Crew	Public	Emission	Traffic	Radiological
Watts Bar (3,400 TPBARs/cycle)	Truck Cask via Truck	0.0033	0.021	0.0032	0.031	5.1×10^{-6}
	Truck Cask via Rail	0.0016	0.008	0.0023	0.029	5.7×10^{-6}
	Rail Cask via Rail	0.0016	0.008	0.0023	0.029	1.6×10^{-6}
Sequoyah (3,400 TPBARs/cycle)	Truck Cask via Truck	0.0030	0.019	0.0035	0.029	6.1×10^{-6}
	Truck Cask via Rail	0.0014	0.007	0.0024	0.028	5.2×10^{-6}
	Rail Cask via Rail	0.0014	0.007	0.0024	0.028	1.5×10^{-6}
Bellefonte (3,400 TPBARs/cycle)	Truck Cask via Truck	0.0026	0.018	0.0034	0.030	6.4×10^{-6}
	Truck Cask via Rail	0.0010	0.005	0.0024	0.028	5.8×10^{-6}
	Rail Cask via Rail	0.0010	0.005	0.0024	0.028	1.6×10^{-6}
Watts Bar (1,000 TPBARs/cycle)	Truck Cask via Truck	0.0010	0.007	0.0010	0.009	1.7×10^{-6}
	Truck Cask via Rail	0.0005	0.002	0.0007	0.009	1.9×10^{-6}
	Rail Cask via Rail	0.0005	0.002	0.0007	0.009	5.3×10^{-7}
Sequoyah (1,000 TPBARs/cycle)	Truck Cask via Truck	0.0009	0.006	0.0011	0.009	2.0×10^{-6}
	Truck Cask via Rail	0.0004	0.002	0.0007	0.008	1.7×10^{-6}
	Rail Cask via Rail	0.0004	0.002	0.0007	0.008	4.9×10^{-7}
Bellefonte (1,000 TPBARs/cycle)	Truck Cask via Truck	0.0008	0.006	0.0010	0.009	2.1×10^{-6}
	Truck Cask via Rail	0.0003	0.001	0.0007	0.009	1.9×10^{-6}
	Rail Cask via Rail	0.0003	0.001	0.0007	0.009	5.4×10^{-7}

Maximum impacts are assumed for fabrication, assembly, and waste transportation, and are included in these totals.
All risks are expressed as number of latent cancer fatalities, except for the Accident-Traffic column, which lists number of accident fatalities.

Table E–10 Estimated Dose to Exposed Individuals During Incident-Free Transportation Conditions

Receptor		*Dose to Maximally Exposed Individual*[a]
Workers	Crew member (truck driver)	0.1 rem per year [b]
	Inspector	0.0029 rem per event
Public	Resident	4.0×10^{-7} rem per event
	Person in traffic congestion	0.011 rem per event
	Person at service station	0.001 rem per event

rem = roentgen equivalent man.

[a] Doses are calculated assuming that the shipment external dose rate is equal to the maximum expected dose of 10 millirem per hour at 2 meters (6.6 feet) from the package.

[b] This is a dose limit for a nonradiation worker (10 CFR 20). The truck driver dose could exceed this limit in the absence of administrative controls.

E.7 Conclusions and Long-Term Impacts of Transportation

E.7.1 Conclusions

It is unlikely that the transportation of radioactive materials will cause an additional fatality.

E.7.2 Long-Term Impacts of Transportation

The *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995) analyzed the cumulative impacts of all transportation of radioactive materials, including impacts from reasonably foreseeable actions that include transportation of radioactive material for a specific purpose and general radioactive materials transportation that is not related to a particular action. The total worker and general population collective doses are summarized in **Table E–11**. The table shows that the impacts of this program are quite small compared with overall transportation impacts. Total collective worker doses from all types of shipments (historical, the alternatives, reasonably foreseeable actions, and general transportation) were estimated to be 320,000 person-rem (130 latent cancer fatalities) for the period 1943 through 2035 (93 years). Total general population collective doses were also estimated to be 320,000 person-rem (160 latent cancer fatalities). The majority of the collective dose for workers and the general population was due to the general transportation of radioactive material. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The total number of latent cancer fatalities estimated to result from radioactive materials transportation over the period between 1943 and 2035 was 290. Over this same period (93 years), approximately 28 million people would die from cancer, based on 300,000 cancer fatalities per year (10 CFR 71). It should be noted that the estimated number of transportation-related latent cancer fatalities would be indistinguishable from other latent cancer fatalities, and the transportation-related latent cancer fatalities are 0.0010 percent of the total number of latent cancer fatalities.

Table E–11 Cumulative Transportation-Related Radiological Collective Doses and Latent Cancer Fatalities (1943 to 2035)

Category	*Collective Worker Dose (person-rem)*	*Collective General Population Dose (person-rem)*
CLWR Impacts		
Shipment of TPBARs and LLW	< 100	< 100
Latent cancer fatalities from TPBARs and LLW	<1	<1
Other Nuclear Material Shipments		
Reasonably foreseeable actions[a]		
Truck	11,000	50,000
Rail	820	1,700
General transportation (1943–2035)	310,000	270,000
Total collective dose	320,000	320,000
Total Latent Cancer Fatalities	**130**	**160**

[a] LLW = Low-Level Radioactive Waste.
Source: DOE 1995.

E.8 UNCERTAINTY AND CONSERVATISM IN ESTIMATED IMPACTS

The sequence of analyses performed to generate the estimates of radiological risk for transportation includes: (1) determination of the inventory and characteristics, (2) estimation of shipment requirements, (3) determination of route characteristics, (4) calculation of radiation doses to exposed individuals (including estimation of environmental transport and uptake of radionuclides), and (5) estimation of health effects. Uncertainties are associated with each of these steps. Uncertainties exist in the way that the physical systems being analyzed are represented by the computational models; in the data required to exercise the models (due to measurement errors, sampling errors, natural variability, or unknowns simply caused by the future nature of the actions being analyzed); and in the calculations themselves (e.g., approximate algorithms used by the computers).

In principle, one can estimate the uncertainty associated with each input or computational source and predict the resultant uncertainty in each set of calculations. Thus, one can propagate the uncertainties from one set of calculations to the next and estimate the uncertainty in the final, or absolute, result; however, conducting such a full-scale quantitative uncertainty analysis is often impractical and sometimes impossible, especially for actions to be initiated at an unspecified time in the future. Instead, the risk analysis is designed to ensure, through uniform and judicious selection of scenarios, models, and input parameters, that relative comparisons of risk among the various alternatives are meaningful. In the transportation risk assessment, this design is accomplished by uniformly applying common input parameters and assumptions to each alternative. Therefore, although considerable uncertainty is inherent in the absolute magnitude of the transportation risk for each alternative, much less uncertainty is associated with the relative differences among the alternatives in a given measure of risk.

In the following sections, areas of uncertainty are discussed for the assessment steps enumerated above. Special emphasis is placed on identifying whether the uncertainties affect relative or absolute measures of risk. The degree of reality conservatism of the assumption is addressed. Where practical, the parameters that most significantly affect the risk assessment results are identified.

E.8.1 Uncertainties in TPBAR and Radioactive Waste Inventory and Characterization

The inventories and the physical and radiological characteristics are important input parameters of the transportation risk assessment. The potential amount of transportation for any alternative is determined primarily by the projected dimensions of package contents and, in the case of irradiated TPBARs, the strength of the radiation field and assumptions concerning shipment capacities. The physical and radiological characteristics are important in determining the amount of material released during accidents and the subsequent doses to exposed individuals through multiple environmental exposure pathways.

Uncertainties in the inventory and characterization will be reflected to some degree in the transportation risk results. If the inventory is overestimated (or underestimated), the resulting transportation risk estimates also will be overestimated (or underestimated) by roughly the same factor. However, the same inventory estimates are used to analyze the transportation impacts of each of the EIS alternatives. Therefore, for comparative purposes, the observed differences in transportation risks among the proposed reactor sites as given in Table E-9 are believed to represent unbiased, reasonably accurate estimates from current information in terms of relative risk comparisons.

If DOE should enter into the final design and implementation phase of the project, the amount of tritium in the TPBARs could change. The incident-free risk estimate would not change unless the number of shipments changes, because the maximum regulatory limit dose rate was used. However, since over 90 percent of the accident impact comes from the tritium in the TPBARs, the accident impact would increase or decrease in proportion to the amount of tritium in the TPBARs.

E.8.2 Uncertainties in Containers, Shipment Capacities, and Number of Shipments

The amount of transportation required for each alternative is based in part on assumptions concerning the packaging characteristics and shipment capacities for commercial trucks and safe secure transports. Representative shipment capacities have been defined for assessment purposes based on probable future shipment capacities. In reality, the actual shipment capacities may differ from the predicted capacities such that the projected number of shipments and, consequently, the total transportation risk would change. However, although the predicted transportation risks would increase or decrease accordingly, the relative differences in risks among alternatives would remain about the same. The maximum amount of material allowed in Type B containers is set by conservative safety analyses.

E.8.3 Uncertainties in Route Determination

Representative routes have been determined between all origin and destination sites considered in the EIS. The routes have been determined consistent with current guidelines, regulations, and practices, but may not be the actual routes that would be used in the future. In reality, the actual routes could differ from the representative ones in terms of distances and total population along the routes. Moreover, since TPBARs and waste could be transported over an extended period of time starting at some time in the future, the highway infrastructures and the demographics along routes could change. These effects have not been accounted for in the transportation assessment; however, it is not anticipated that these changes would significantly affect relative comparisons of risk among the alternatives considered in the EIS. Specific routes cannot be identified in advance because the routes are classified to protect national security interests.

E.8.4 Uncertainties in the Calculation of Radiation Doses

The models used to calculate radiation doses from transportation activities introduce a further uncertainty in the risk assessment process. It is generally difficult to estimate the accuracy or absolute uncertainty of the risk assessment results. The accuracy of the calculated results is closely related to the limitations of the computational models and to the uncertainties in each of the input parameters that the model requires. The single greatest limitation facing users of RADTRAN, or any computer code of this type, is the scarcity of data for certain input parameters.

Uncertainties associated with the computational models are minimized by using state-of-the-art computer codes that have undergone extensive review. Because there are numerous uncertainties that are recognized but difficult to quantify, assumptions are made at each step of the risk assessment process that are intended to produce conservative results (i.e., overestimate the calculated dose and radiological risk). Because parameters and assumptions are applied to all alternatives, this model bias is not expected to affect the meaningfulness of relative comparisons of risk; however, the results may not represent risks in an absolute sense.

To understand the most important uncertainties and conservatism in the transportation risk assessment, the results for all cases were examined to identify the largest contributors to the collective population risk. The results of this examination are discussed briefly in the following paragraph.

For truck shipments, the largest contributors to the collective population dose, in decreasing order of importance, were found to be: (1) incident-free dose to members of the public at stops, (2) incident-free dose to transportation crew members, (3) incident-free dose to members of the public sharing the route (on-link dose), (4) incident-free dose to members of the public residing along the route (off-link dose), and (5) accident dose risk to members of the public. Approximately 80 percent of the estimated public dose was incurred at stops; 15 percent was received by the on-link population and 5 percent by the off-link population. In general, the accident contribution to the total risk was negligible compared with the incident-free risks.

As shown above, incident-free transportation risks are the dominant component of the total transportation risk. The most important parameter in calculating incident-free doses is the shipment external dose rate (incident-free doses are directly proportional to the shipment external dose rate). For this assessment, it was assumed that all shipments would have an external dose rate at the regulatory limit of 10 millirem per hour at 2 meters. In practice, the external dose rates would vary from shipment to shipment, but would not exceed the regulatory limit.

Finally, the single largest contributor to the collective population doses calculated with RADTRAN was found to be the dose to members of the public at truck stops. Currently, RADTRAN uses a simple point-source approximation for truck-stop exposures and assumes that the total stop time for a shipment is proportional to the shipment distance. The parameters used in the stop model were based on a survey of a very limited number of radioactive material shipments that examined a variety of shipment types in different areas of the country. It was assumed that stops occur as a function of distance, with a stop rate of 0.011 hour per kilometer (0.018 hour per mile). It was further assumed that an average of 50 people at each stop are exposed at a distance of 20 meters (66 feet). In RADTRAN, the population dose is directly proportional to the external shipment dose rate and the number of people exposed and inversely proportional to the square of the distance. The stop rate assumed results in an hour of stop time per 100 kilometers (62 miles) of travel.

Based upon the qualitative discussion with shippers, the parameter values used in the assessment appear to be conservative. However, data do not exist to quantitatively assess the degree of control and the location, frequency, and duration of truck stops. However, based on the regulatory requirements for continuous escort of the material (10 CFR 73) and the requirement for two drivers, it is clear that the trucks would be on the move much of the time until arrival at the destination. Therefore, the calculated impacts are extremely conservative. By using these conservative parameters, the calculations in this EIS are consistent with the RADTRAN default values.

Shielding of exposed populations was not considered. For all incident-free exposure scenarios, no credit was taken for shielding of exposed individuals. In reality, shielding would be afforded by trucks and cars sharing the transport routes, rural topography, and the houses and buildings in which people reside. Incident-free exposure to external radiation could be reduced significantly, depending on the type of shielding present. For residential houses, shielding factors (i.e., the ratio of shielded to unshielded exposure rates) have been estimated to range from 0.02 to 0.7, with a recommended value of 0.33. If shielding were to be considered for the maximally exposed resident living near a transport route, the calculated doses and risks would be reduced by approximately 70 percent. Similar levels of shielding may be provided to individuals exposed in vehicles. However, consideration of shielding does not significantly affect the overall incident-free risks to the general public.

Post-accident mitigative actions are not considered for dispersal accidents. For severe accidents involving the release and dispersal of radioactive materials in the environment, no post-accident mitigative actions, such as interdiction of crops or evacuation of the accident vicinity, have been considered in this risk assessment. In reality, mitigative actions would take place following an accident in accordance with U.S. Environmental Protection Agency radiation protection guides for nuclear incidents (EPA 1991). The effects of mitigative actions on population accident doses are highly dependent upon the severity, location, and timing of the accident. For this risk assessment, ingestion doses are only calculated for accidents occurring in rural areas (the calculated ingestion doses, however, assume all food grown on contaminated ground is consumed and is not limited to the rural population). Examination of the severe accident consequence assessment results has shown that ingestion of contaminated foodstuffs contributes on the order of 50 percent of the total population dose for rural accidents. Interdiction of foodstuffs would act to reduce, but not eliminate, this contribution.

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APPENDIX F
THE PUBLIC SCOPING PROCESS

F.1 Scoping Process Description

As a preliminary step in the development of an environmental impact statement (EIS), regulations established by the Council on Environmental Quality (40 CFR 1501.7) and the U.S. Department of Energy (DOE) require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." The purpose of this scoping process is: (1) to inform the public about a proposed action and the alternatives being considered and (2) to identify and/or clarify issues that are relevant to the EIS by soliciting public comments.

On January 16, 1998, DOE published a Notice of Intent in the *Federal Register* concerning its proposal to produce tritium in one or more nuclear power plants owned and operated by the Tennessee Valley Authority (TVA). During the National Environmental Policy Act (NEPA) process, there are opportunities for public involvement (**Figure F–1**). The Notice of Intent listed the issues initially identified by DOE for evaluation in the EIS. Public citizens, civic leaders, and other interested parties were invited to comment on these issues and to suggest additional issues that should be considered in the EIS. The Notice of Intent informed the public that comments on the proposed action could be communicated via U.S. mail, a special DOE web site on the Internet, a toll-free phone line, a toll-free fax line, or in person at public meetings to be held near the TVA plant sites.

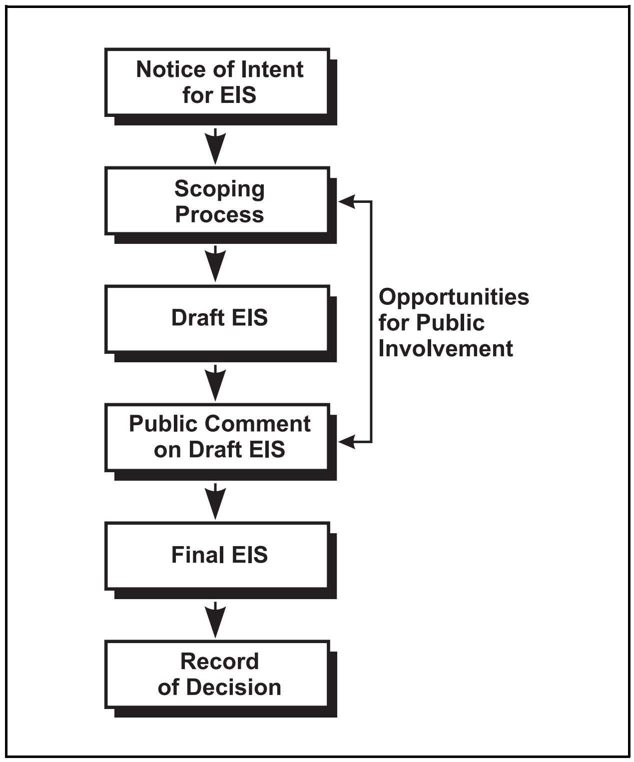

Figure F–1 NEPA Process

Two public meetings were held near the TVA nuclear power plants proposed for tritium production (**Figure F–2**). The first was held on February 24, 1998, in Rainsville, Alabama, near the partially completed Bellefonte Nuclear Plant site. More than 800 persons, mostly from regional communities, attended the Rainsville meeting. The second meeting was held in Evensville, Tennessee, near the Watts Bar and Sequoyah Nuclear Power Plants, on February 26, 1998. An estimated 400 persons attended this meeting. A majority of the attendees were residents of communities located near the two TVA plants and several attendees were from cities such as Nashville and Knoxville, Tennessee.

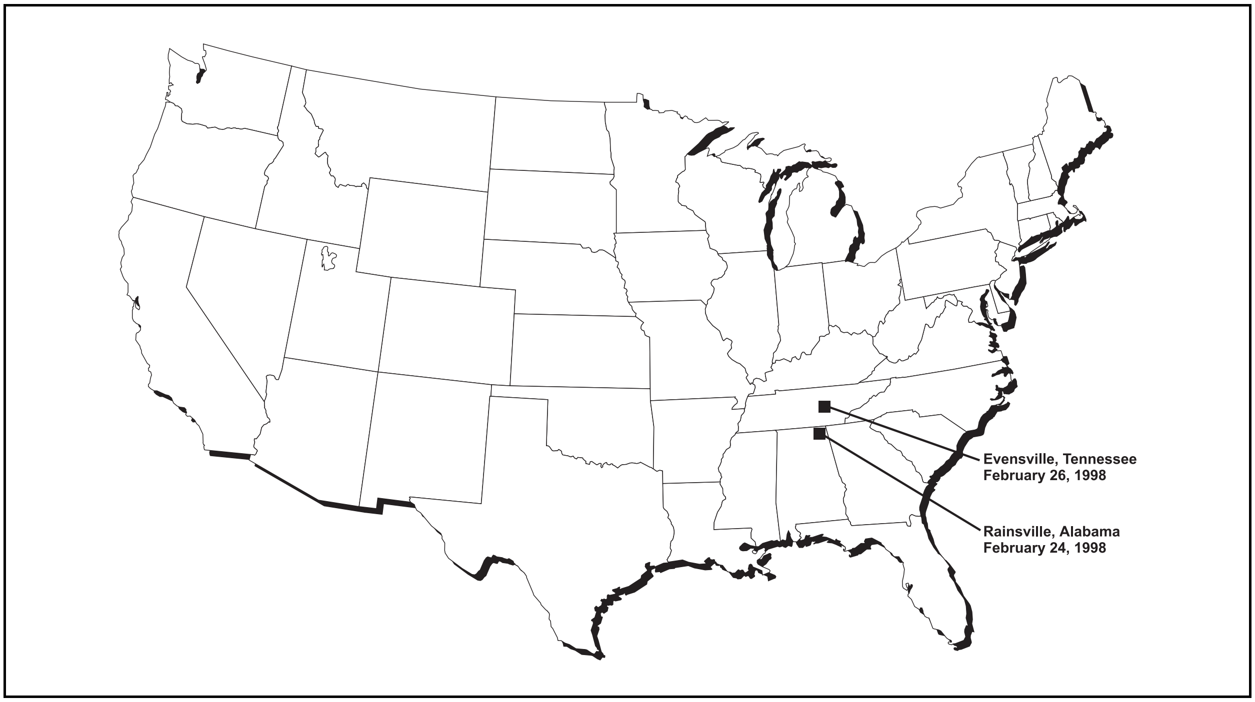

Figure F–2 Public Scoping Meeting Locations and Dates (1998)

As a result of previous experience and positive responses from attendees of other DOE/NEPA public meetings and hearings, DOE chose an interactive format for the scoping meetings. Each meeting began with a presentation by a DOE representative who explained the proposed tritium production plan. Afterwards, an impartial facilitator opened the floor to questions, comments, and concerns from the audience. DOE and TVA personnel were available to respond to the questions and comments as needed. While verbatim recordings or transcripts of the meetings were not produced, trained note-takers recorded the substance of each public comment. In addition, the public was encouraged to submit written or verbal comments either during the meetings or via letters, the DOE Internet web site, the toll-free phone line, or the toll-free fax line until the end of the scoping period on March 20, 1998.

It should be noted that, for EIS public scoping purposes, a comment is defined as a single statement or opinion concerning a specific issue. Any statement may contain many separate comments. Most of the verbal and written public statements submitted during the EIS scoping period contained multiple comments on various individual issues.

F.2 SCOPING PROCESS RESULTS

Approximately 700 comments were received from citizens, interested groups, and Federal, state, and local officials during the public scoping period, including 156 verbal comments made during the public meetings. The remainder of the comments (513) were submitted at the public meetings in written form, or via mail, Internet, fax, or phone over the entire scoping period. Commentors who spoke at the public meetings often read from written statements that were later submitted during or after the meetings. Where this occurred, each comment provided by an individual commentor in both verbal and written form was counted as a single comment. In addition to the comments, four petitions totaling 1,586 signatures were submitted in support of completing the Bellefonte plant for tritium production purposes.

The majority of the verbal and written comments received during the public scoping period favored producing tritium at one or more of TVA's nuclear power plants. Comments from residents of northern Alabama were particularly supportive of completing the Bellefonte plant for tritium production. Reasons given for this support mostly involved potential socioeconomic benefits such as job creation, a greater abundance of inexpensive electricity, attraction of new businesses to the area, and increased local revenues.

Many of the comments received from residents of the local areas near the TVA plants also communicated an understanding that the United States will begin producing tritium in the near future–either at the Savannah River Site (the accelerator option) or at one of TVA's nuclear power plants. These commentors expressed confidence in the safety of the TVA plants and the capabilities of area workers to provide the skills needed for tritium production. They also said they believe nuclear power plants are a more sensible choice for tritium production because reactors are a proven technology and the total project cost would be less than the cost of building an accelerator.

A significant number of other comments received during the scoping period opposed tritium production in general and the use of a nuclear power plant for this purpose in particular. This group disagreed with the Presidential and Congressional decision to produce tritium and denied there is any real defense-related need for new tritium production because they believe other options are available. Among the options cited were unilateral disarmament, commercial purchases, recycling the material from deactivated nuclear weapons, and/or extending the half-life of tritium.

Several commentors voiced concerns about the environmental, health, and safety risks they believe are inherent to tritium production. DOE representatives were urged to thoroughly evaluate the potential consequences of the proposed action on local water resources and the health and safety of area residents and wildlife. Concerns also were raised about the safety of TVA's nuclear power plants and how the security of the plants would be managed if tritium production were to begin.

Waste production and disposal was another issue. Some commentors correctly stated that tritium production in a nuclear reactor would increase the amount of spent fuel wastes generated. Questions were posed as to how this additional waste would be dealt with, both on site and in the long term.

Many commentors also viewed the U.S. Government's decision to produce tritium as a violation of its own policies and commitments under the international Nonproliferation and Strategic Arms Limitation Treaties. They accused the government of hypocrisy and asserted that tritium production in a commercial light water reactor (CLWR) would blur the historical line between U.S. civilian and military nuclear programs. This action, they warned, would encourage other countries to use their own commercial plants to produce weapons materials and to increase their weapons stockpiles.

The public comments and materials submitted during the scoping period were carefully logged as they were received and placed in the Administrative Record of this EIS. Their disposition is described in the next section.

F.3 COMMENT DISPOSITION AND ISSUE IDENTIFICATION

Comments received during the scoping period were systematically reviewed by the EIS preparers. Where possible, comments on similar or related topics were grouped under comment categories as a means of summarizing the comments. An attempt was made to avoid duplication in counting the number of comments received; however, comments submitted in both written and verbal form may have been counted twice in some cases. The comment categories were used to identify specific issues of public concern. After the issues were identified, they were evaluated to determine whether they fell within or outside the scope of the EIS. Some issues were found to be already "in scope," i.e., they were among the EIS issues already identified by DOE for inclusion in the EIS. **Table F–1** lists these issues along with their EIS references.

Table F–1 Issues Already Included in the EIS (In Scope)

Issues	*No. of Comments*	*EIS References*
Use of commercial nuclear power reactors to produce tritium will blur the line between civilian and military programs and will impact U.S. nuclear nonproliferation efforts	93	Section 1.5.4
Socioeconomic benefits such as job creation, new business growth, and increased TVA payments in-lieu-of-taxes to Jackson County as a result of using any of the TVA plants for tritium production	142	Section 5.2.3.8
Tritium's importance to national security	24	Chapter 1 Chapter 2
Environmental, safety, and health impacts of tritium production, including potential for increased rates of breast cancer, childhood leukemia, and birth defects	52	Sections 5.2.1.9 5.2.2.9 5.2.3.9 Appendix C
Section 7 Consultation with the National Wildlife Service	1	Sections 5.2.1.6 5.2.2.6 5.2.3.6
Frequency and public notification of water/soil testing near the Bellefonte plant	1	Chapter 6
Handling and shipping (transportation) of TPBARs and radioactive waste and associated escort requirements	8	Section 5.2.8 Appendix E
Safety record of TVA's nuclear power plants	22	Chapter 6
Reactor accident analyses	18	Sections 5.2.1.9 5.2.2.9 5.2.3.9 Appendix D
Impacts of spent fuel production and interim storage	13	Section 5.2.6
Final, long-term disposition of spent fuel rods if no deep geologic repository is available and the fuel pools are filled	2	Section 3.2.1
Additional plant security requirements	15	Section 5.2.10
Potential safety impacts of shortening the refueling schedule	2	Section 5.2.9
Processing tritium-producing burnable absorber rods	1	Appendix A
Impacts of tritium production on reactor decommissioning plans	1	Section 5.2.5
Need for separate EISs for the Bellefonte plant, one for tritium production and one for completion	4	Section 1.5.1.3
Support for conversion of the Bellefonte plant to a natural gas facility	2	Section 1.5.2.3
Use of excess electricity produced by tritium production at the Bellefonte plant	2	Section 5.4.2
Rationale for making the accelerator option the "no action" alternative	4	Section 3.2.4

One additional issue, the avoidance of greenhouse gases as a result of tritium production in a reactor instead of an accelerator, was added to the scope of the EIS as a result of the public scoping process. (**See Table F–2.**)

Table F–2 Issues Added to the Scope of the EIS

Issues	*No. of Comments*	*EIS References*
Avoidance of greenhouse gases as a result of tritium production in a reactor instead of an accelerator	8	Section 5.2.11

Many of the public issues were not analyzed for a specific reason or were determined to be outside the scope of the EIS. These issues are listed in **Table F–3**. Corresponding responses from DOE also are provided in Table F–3 to explain why each issue was not analyzed.

Table F–3 Issues Considered to be Out of Scope or Raised But Not Analyzed

Issues	*No. of Comments*	*DOE Responses*
Tritium Production		
Tritium production is not needed because: (1) there are reserve stockpiles, (2) it can be recycled from deactivated nuclear weapons and/or purchased, or (3) the half-life can be extended.	33	As stated in Section 1.3.3 of the CLWR EIS, reductions in the size of the nuclear weapons stockpile, brought on by international arms control agreements, have enabled DOE to fulfill its tritium requirements by recycling tritium removed from dismantled weapons. This source of tritium is presently being utilized and has already been factored into the tritium requirement projections, which indicate a need for a new supply of tritium by approximately 2005. DOE has considered the purchase of tritium from other sources, including foreign nations, and has determined that the uncertainties associated with obtaining tritium from foreign sources render this alternative unreasonable for an assured long-term supply. Accordingly, as discussed in Section 3.1.3 of the Tritium Supply and Recycling Programmatic EIS (DOE 1995), DOE considered this alternative but eliminated it from detailed study. DOE is aware of and has reviewed laboratory research on extending the half-life of isotopes similar to tritium. To date, such a process does not exist and the likelihood of developing such a process in sufficient time to reduce the need for tritium is too low to render this a credible alternative. DOE will, however, continue to monitor results from such research. As discussed in Chapter 2 of the CLWR EIS, DOE presently maintains a strategic reserve of tritium. This reserve contains a quantity of tritium maintained for emergencies and contingencies, and similar to tritium available from dismantled weapons, has been factored into the tritium requirement projections which indicate a need for a new supply of tritium by approximately 2005.
Tritium production is not needed because nuclear arms reduction treaties will allow the United States to deactivate and dismantle its nuclear weapons as their tritium load decays.	4	The need for tritium is explained in Chapter 2 of the CLWR EIS. As explained in Chapter 2, the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive mandate that new tritium must be available by approximately 2005 if a CLWR is the selected option for tritium production. While it is true that recent international arms control agreements have caused the nuclear weapons stockpile to be reduced in size, these reductions are accounted for in the Presidential requirements. While future arms control reductions may change the requirements, DOE is responsible for meeting the current requirements set forth by the President.

Issues	***No. of Comments***	***DOE Responses***
Reactor tritium production relies on a proven technology and is more sensible and economical than the accelerator option.	21	The purpose of the CLWR EIS is to assess the environmental impacts associated with tritium production in one or more CLWRs. Relative comparisons between the CLWR option and the accelerator option have previously been documented in the Record of Decision for the Tritium Supply and Recycling Programmatic EIS (DOE 1995). As a tiered document from that Programmatic EIS, the CLWR EIS does not purport to compare the CLWR and the accelerator for tritium production.
An international agreement is needed to halt tritium production as a means of using tritium's decay rate to pace a reciprocal build-down of nuclear weapons.	1	There are currently no international agreements that prohibit tritium production. In accordance with national security requirements set forth by the President, DOE is responsible for producing the tritium required to support the nation's nuclear deterrent. Future international agreements related to tritium production are speculative and beyond the scope of the CLWR EIS.
DOE should: (1) develop a list of no more than three commercial reactors that could be used for tritium production only as a contingency source in case of Congressionally declared war or another national emergency [ref. Section 108 of the Atomic Energy Act], (2) obtain tritium only by purchasing irradiation services at one of these reactors under such emergency circumstances, and (3) use the reactor only under defined conditions that preserve the principle of separating civilian and military nuclear activities (i.e., the reactor should not generate electricity for sale while being used for tritium production).	1	The need for tritium is explained in Chapter 2 of the CLWR EIS. As explained in Chapter 2, the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive mandate that new tritium must be available by approximately 2005 if a CLWR is the selected option for tritium production. The CLWR EIS is being prepared in accordance with the national security requirements set forth by the President.
DOE should more clearly articulate the policy options for tritium production to the public; e.g., use of reactors as either a primary or contingency source, purchasing a commercial reactor or merely purchasing irradiation services from a commercial reactor, etc. [the comment refers to information found in the Programmatic EIS].	1	The policy options for tritium production are explained in the Tritium Supply and Recycling Programmatic EIS (DOE 1995). The purpose of the CLWR EIS is to assess the environmental impacts associated with tritium production in one or more CLWRs, not debate policy options.
Couldn't nuclear weapons be maintained without tritium?	2	All weapons in the existing stockpile require tritium to function as designed. Section 1.3.2 of the CLWR EIS describes how tritium is used in the modern nuclear weapon. Section 3.1.3 of the Tritium Supply and Recycling Programmatic EIS (DOE 1995) provides a thorough discussion of why redesigning weapons with less or no tritium is not a reasonable alternative.
How many weapons does the United States really need?	2	The number of United States nuclear weapons needed is set forth by the Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive.

Issues	***No. of Comments***	***DOE Responses***
The United States has called for a negotiated ban on production of fissile materials for weapons. While not covered under this ban, operation of tritium production facilities would complicate treaty verification because the facilities could be used for clandestine production of plutonium, but will not be subject to intrusive verification measures because of their military significance. How would appropriate safeguards be employed at a commercial tritium production reactor?	1	Safeguard and security provisions of TVA and of DOE have been reviewed and found to be sufficiently protective of both Federal property and employees and the general public. Section 5.2.10 of the CLWR EIS provides additional information related to safeguards and security issues.
Could the K-Reactor at DOE's Savannah River Site in South Carolina be refurbished and used for tritium production if the serious safety issues were corrected?	2	The option of utilizing the K-Reactor, located at the Savannah River Site in South Carolina, along with other existing DOE reactors or accelerators, was evaluated but dismissed from further consideration in the Tritium Supply and Recycling Programmatic EIS (Section 3.1.3) (DOE 1995). In the early 1990s, when tritium supply needs were much greater, DOE not only considered putting the K-Reactor back on line, but had an extensive and costly effort underway to restart the K-Reactor. Unfortunately, the age of this facility and the magnitude of the environmental and safety upgrades required for this task proved too great, and in 1994, the K-Reactor was placed in a "cold stand-by" status with no provisions for restart. The reduced tritium needs of today make the K-Reactor alternative even less attractive.
Why is new reactor-produced tritium needed in 2005, but accelerator-produced tritium is not needed until 2007?	5	The Presidential Decision Directive that accompanies the 1996 Nuclear Weapons Stockpile Plan mandates that new tritium must be available by approximately 2005 if a CLWR is the selected option for tritium production, and approximately 2007 if the accelerator is the selected option. The reason the year 2007 is mandated for the accelerator is because that is the earliest date by which the accelerator could be built and begin operation. In such a case, tritium requirements from 2005 until 2007 would have to be met by dipping into the tritium reserve shown on Figure 2–1 of this CLWR EIS. The tritium reserve would then be replenished by producing tritium quantities greater than the decay requirements.
Why doesn't the government just purchase a commercial reactor for tritium production?	5	Concurrent with the preparation of the CLWR EIS, DOE is evaluating the feasibility of various CLWR alternatives through a procurement process. Through that process, DOE expects to enter into a contract/interagency agreement with the owner/operator of one or more commercial reactors for the purpose of producing tritium. Such a contract/interagency agreement could result in DOE purchasing CLWR irradiation services and/or purchasing a CLWR. In response to the procurement request, none of the CLWR owners/operators proposed selling a CLWR to DOE. Instead, only irradiation services have been proposed. Thus, it now appears likely that DOE will purchase irradiation services only.
Would hydrogen ignitors be used in a tritium production plant?	1	Hydrogen ignitors are currently used in Watts Bar and Sequoyah. The use of hydrogen ignitors at a reactor facility is independent of tritium production.

Issues	*No. of Comments*	*DOE Responses*
If a second major use for tritium is identified, now or in the future, the safest course would be construction of a new tritium production facility at DOE's Savannah River Site in South Carolina.	1	DOE is addressing only that amount of tritium necessary to support the U.S. nuclear weapons stockpile. Based on the analysis of the Tritium Supply and Recycling Programmatic EIS DOE, in the December 1995 Record of Decision, decided to pursue a dual-track approach on the two most promising tritium-supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) to design, build, and test critical components of an accelerator for tritium production. DOE will select one of these alternatives as the primary source for tritium. The other alternative, if feasible, would continue to be developed as a backup tritium source.
The EIS should address the additional complications of loading and unloading the boron isotope or lithium aluminate cores, their subsequent unloading, and the final tritium separation processes.	2	The environmental impacts associated with the fabrication of the TPBARS are addressed in Section 5.2.7 of the CLWR EIS. DOE has already analyzed the environmental impacts associated with the unloading and the final tritium extraction process in the Tritium Extraction Facility EIS (DOE 1998, DOE 1999). A summary of the environmental impacts associated with the Preferred Alternative in the Tritium Extraction Facility EIS may be found in Section 5.3 of the CLWR EIS.
DOE should not be doing this EIS because they are overcommitted to other activities, their management is inadequate, their staffing and technical expertise are insufficient, and they have contaminated every site they have managed.	11	DOE is fully committed to carrying out all of its responsibilities in full compliance with all Federal, state, and local laws and requirements.
Tritium should not be produced by anyone who thinks about the future of humanity. Everyone involved in creating these weapons of mass destruction should quit their jobs.	1	The issue of an individual's employment choice is beyond the scope of the EIS.
Environment, Safety, and Health		
The EIS should evaluate global environmental impacts resulting from U.S. tritium production.	8	The CLWR EIS evaluates the direct, indirect, and cumulative environmental impacts associated with producing tritium at one or more CLWRs. The only reasonable foreseeable global environmental impacts that are assessed concern impacts to global warming. DOE is unaware of any other global environmental impacts associated with tritium production.
The EIS should evaluate the environmental impacts of tritium production in other countries with similar programs.	3	The CLWR EIS evaluates the direct, indirect, and cumulative environmental impacts associated with producing tritium at one or more CLWRs. Environmental impacts associated with tritium production in other countries is beyond the scope of the CLWR EIS.
The EIS should address the environmental impacts of the full life cycle of the tritium-producing fuel rods, from mining through final disposal.	3	DOE has focused the analysis in the CLWR EIS on the proposed action in accordance with the requirements of NEPA, Council on Environmental Quality requirements, and the DOE NEPA regulations. From a life cycle cost perspective, the analyses of costs are not part of the EIS process. Accordingly, analyses of costs are not included in the CLWR EIS. DOE does, however, consider costs in its final decision, and in this instance, has determined that sufficient quantities of the materials required for the fabrication of the TPBARs are openly available and that the cost of mining and finishing of such products is already reflected in their cost. Since sufficient source material is available already, the provision of source materials (e.g., mining) is not analyzed. The disposition of TPBARs is addressed in the EIS for the construction and operation of a Tritium Extraction Facility at the Savannah River Site. (See Section 1.5.2.2.)

Issues	*No. of Comments*	*DOE Responses*
		Waste
The wastes generated by tritium production should be placed in the backyards of those who make the decisions and Congress.	1	Any wastes generated as a result of activities addressed by the CLWR EIS will be managed in accordance with all applicable Federal and state regulations and DOE Orders.
Plutonium should not be brought for disposal to northern Alabama.	1	DOE has no plans to utilize plutonium in the CLWR Tritium Program. The CLWR Tritium Program would utilize nonradioactive lithium targets to be placed into the normal reactor cycle, with no change in normal operations. No plutonium would be generated in these targets. Although the normal operation of a commercial reactor does generate small quantities of plutonium as an integral part of the spent nuclear fuel, such spent nuclear fuel is presently being stored at commercial reactor sites for ultimate disposal at a national repository. DOE is presently considering only one site for the location of such a repository, Yucca Mountain, Nevada. DOE has no plans to site such a repository in the State of Alabama.
		Socioeconomics
The EIS should evaluate the socioeconomic benefits of completing the Bellefonte plant, such as abundant electricity and reduced power rates.	8	The CLWR EIS evaluates the environmental impacts associated with completing construction of one or both of the Bellefonte plants and operating them for tritium production. Socioeconomic impacts are assessed, including impacts associated with population and employment, housing, schools, and tax revenues. The environmental impacts associated with electricity production are also assessed.
The EIS should evaluate the potential economic consequences to ratepayers from extended outages.	2	There are no extended outages expected from tritium production at any of the reactor plant alternatives. Consequently, no economic consequences are expected. As a matter of contract law, the contract/interagency agreement between DOE and TVA would be expected to provide a mechanism for addressing any cost issues associated with unexpected extended outages. The CLWR EIS does provide a sensitivity analysis of shortening a reactor's fuel cycle from 18 to 12 months, but no socioeconomic consequences are envisioned.
It is unfair for the government to subsidize TVA; this proposal is just an attempt to help TVA resolve its debts.	6	Concurrent with the preparation of the CLWR EIS, DOE is evaluating the feasibility of various CLWR alternatives through a procurement process. That process, which was based on the policy of full and open competition, has been conducted in accordance with all applicable laws, and was open to all owners/operators of pressurized CLWRs. The proposals from TVA for producing tritium using existing and partially completed reactors were the only bids determined to be responsive to the requirements contained in the request for proposals.
Area utilities will oppose using government funding to help TVA complete a competitive nuclear power plant at Bellefonte.	1	The opposition or support of area utilities to the alternatives in the CLWR EIS is beyond the scope of the EIS.
Ratepayers who are against nuclear weapons should not be forced to pay for tritium production.	6	DOE does not anticipate costs being passed on to rate payers, since DOE will be paying for services.
Will tritium production at a TVA power plant require any hydro-pumped storage?	1	No.
		Costs
How cost-effective is tritium production in a commercial nuclear power plant for U.S. taxpayers? How do the costs compare with the accelerator option?	38	Costs are beyond the scope of the EIS. Relative cost comparisons between a CLWR and an accelerator have previously been documented in the Record of Decision for the Tritium Supply and Recycling Programmatic EIS (DOE 1995).

Issues	*No. of Comments*	*DOE Responses*
Who will cover the costs of power outages or identification of safety problems resulting from the shorter refueling cycle?	5	Costs are beyond the scope of the EIS. Additionally, there is no proposal to shorten the fuel cycle of any reactor that would produce tritium. For completeness, the CLWR EIS does provide a sensitivity analysis of shortening a reactor's fuel cycle from 18 to 12 months. That sensitivity analysis is provided as a contingency to address the situation of maximizing tritium production in a reactor. Such a situation is not currently expected or proposed. As a matter of contract law, the contract/interagency agreement between DOE and TVA would be expected to provide a mechanism for addressing any cost issues associated with shortening a reactor's fuel cycle from 18 to 12 months.
If Bellefonte is completed for tritium production, who will pay for hazardous materials training and equipment?	3	Costs are beyond the scope of the EIS. However, DOE does not expect tritium production to change the requirements for hazardous material training or equipment.
The EIS should include cost analyses for tritium production at each TVA reactor plant.	3	Costs are beyond the scope of the EIS. However, concurrent with the preparation of the CLWR EIS, DOE is evaluating the feasibility of the various CLWR alternatives through a procurement process. Through that process, DOE expects to enter into a contract/interagency agreement with TVA for the purpose of producing tritium. Once a contract/interagency agreement is reached, the terms would be made public, as appropriate.
DOE should release the report from the accounting firm of Putnam, Hayes, & Bartlett, which assessed the costs of various options for tritium production.	1	The Putnam, Hayes, and Bartlett report is available to anyone who wishes to request that report from DOE, DP-62.
The EIS should explain the total cost of completing Bellefonte and the difficulty of obtaining Congressional appropriations for this purpose.	3	The cost to complete the Bellefonte plant is beyond the scope of the CLWR EIS. Through the procurement process, DOE expects to enter into a contract/interagency agreement with TVA for the purpose of producing tritium. Once a contract/interagency agreement is reached, the terms would be made public, as appropriate. The issue of obtaining Congressional appropriations is beyond the scope of the EIS. While it is true that Congressional appropriations will have to be made for any of the CLWR EIS alternatives, DOE will pursue such appropriations independent of the EIS process.
Nuclear Weapons		
The EIS should explain whether new [nuclear weapons] designs or prototypes are being considered and whether international nonproliferation treaties prohibit the manufacture of new nuclear weapons.	2	As stated in Section 1.3.1 of the CLWR EIS, the United States is no longer producing new-design nuclear weapons. Since the end of the Cold War, the United States has significantly reduced the size of its nuclear weapons stockpile and DOE has dismantled more than 8,000 nuclear weapons. At the present time, the United States is further downsizing the nuclear weapons stockpile consistent with the terms of the START I Treaty, and DOE is continuing dismantlement. The United States has ratified the START II Treaty and is hopeful that Russia will do likewise. DOE acknowledges that further multilateral reductions in the United States' nuclear weapons stockpile could occur. However, the negotiations required for such reductions are likely to stretch well into the next century. Therefore, a new supply source of tritium is required to assure the reliability of the stockpile. Such a program is consistent with, and fully supportive of, the commitments of the United States under the terms of the START I Treaty, the START II Treaty, and Article VI of the Nonproliferation Treaty.

Issues	***No. of Comments***	***DOE Responses***
		EIS Process
The EIS process is inadequate; it does not address all the risks.	16	The EIS process is performed in accordance with all applicable laws and regulations. The purpose of the CLWR EIS is to assess the direct, indirect, and cumulative environmental impacts associated with tritium production in one or more CLWRs.
Why were additional scoping meetings not held in other areas?	11	Scoping meetings were held at all locations where DOE determined that there was significant interest to warrant public input related to the potential for environmental impacts from CLWR tritium production. This resulted in scoping meetings near each of the reactor sites that were determined to be a reasonable alternative in the CLWR EIS. The scoping process allows for comments from anyone at any location.
Other Federal agencies, such as the U.S Environmental Protection Agency and the U.S. Department of Defense, should be involved in preparing this EIS.	2	In accordance with the Council on Environmental Quality Guidelines and DOE's NEPA regulations for the preparation of a NEPA document, the U.S. Department of Defense, as well as other major Federal agencies, were notified of the opportunity to participate as a cooperating agency in the preparation of the CLWR EIS. TVA was the only Federal agency that requested, and was granted, designation as a cooperating agency. The U.S. Department of Defense has a vested interest in DOE activities in assuring the long-term supply of tritium and is briefed as to the status of the Tritium Project Office, including the analysis being conducted for the CLWR EIS, on a regular basis. Although EPA did not choose to participate as a cooperating agency in the preparation of the CLWR EIS, EPA will review the adequacy of the EIS and provide DOE with its comments as to the adequacy of the EIS in accordance with the Council on Environmental Quality guidelines.
The NRC should be fully involved in this EIS process from the beginning.	3	In accordance with the Council on Environmental Quality Guidelines and the DOE NEPA regulations for the preparation of a NEPA document, the NRC was notified of its opportunity to participate as a cooperating agency in the preparation of the CLWR EIS, and did not elect to participate. The CLWR EIS addresses DOE activities for the production of tritium in a commercial reactor. Any commercial reactors participating in the CLWR Tritium Program would be required to obtain a license amendment from the NRC. Prior to the production of any tritium in a commercial reactor, the NRC would be the responsible agency for conducting any NEPA analysis required on the part of specific commercial reactors participating in the CLWR Tritium Program.
The EIS process should be delayed until completion of the tests of the tritium-producing rods at Watts Bar in 1999.	9	DOE has sufficient experience and confidence in the production of tritium using TPBARs to initiate the CLWR Tritium Program prior to the completion of the Watts Bar Demonstration Project. That project, referred to by DOE as the Lead Test Assembly demonstration, has a stated purpose to provide confidence to regulators and the public that tritium production in a commercial light water reactor is straightforward and safe. Preliminary data from the Lead Test Assembly demonstration supports DOE's preliminary conclusion that tritium production in a CLWR is straightforward and safe.
		Miscellaneous
Tritium should be redesignated as a special nuclear material to ensure that it is treated the same as all other materials that are critical for nuclear weapons production.	1	The issue of reclassifying tritium as a special nuclear material is beyond the scope of the EIS. However, Section 51 of the Atomic Energy Act authorizes the NRC to determine whether a material should be classified as “special nuclear material.” To date, neither the NRC, nor any of its predecessor agencies, have ever determined that tritium should be classified as a special nuclear material in accordance with the criteria spelled out in Section 51 of the Atomic Energy Act.
What is the possibility of burning mixed oxide fuel at Bellefonte?	8	TVA officials stated at the public scoping meeting in Evensville, Tennessee, on February 26, 1998, that TVA has no intention of burning mixed oxide fuel at any TVA reactor that would be utilized for tritium production. Consequently, the potential impacts associated with producing tritium while also burning mixed oxide fuel are not reasonably foreseeable.

Issues	*No. of Comments*	*DOE Responses*
The fairness and adequacy of the procurement process for tritium production appears questionable.	6	The CLWR procurement process was based on the policy of full and open competition and has been conducted in accordance with all applicable laws. The procurement process was open to all owners/operators of pressurized CLWRs. The proposals from TVA for producing tritium using existing and partially completed reactors were the only bids determined to be responsive to the requirements contained in the request for proposals.
The contractors hired to work on this project should be U.S. citizens, and the public should have oversight responsibilities for their qualifications and experience.	1	The nationality and qualifications of contractors, as well as their oversight, are issues beyond the scope of the EIS. However, all work associated with the CLWR Program will comply with all applicable laws and regulations.
The information materials used to prepare this EIS are inadequate and are not conveniently available to the public.	4	The analysis, dissemination of information, and the inclusion of public participation for the CLWR EIS is conducted in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508), and DOE's NEPA regulations (10 CFR 1021) and procedures. DOE has acted in accordance with these requirements, making a good faith effort to disseminate factsheets explaining the issues associated with tritium production, holding meetings with community groups and the media, holding more than the required number of public scoping meetings, and in addressing all questions put to DOE on such issues.
The following information should be declassified because it is relevant to this EIS and the public should have access to it: (1) the amount of tritium currently in the U.S. arsenal, (2) the size of current reserve stockpiles of tritium, (3) the total number of nuclear weapons assumed to be in the U.S. arsenal between 2011 and 2015, and (4) projected amounts that must be produced annually to maintain the nuclear arsenal after 2015.	1	The CLWR EIS has been prepared based on unclassified information. To the extent possible, the EIS provides unclassified information as a substitute for classified information that cannot be disseminated. The classification of information and the potential for the declassification of information within the control of DOE is outside of the scope of the CLWR EIS. Information such as the existing amount of tritium in the national stockpile of nuclear weapons, the exact number and make-up of nuclear weapons in the stockpile, and the exact number of nuclear weapons which are expected to be in the U.S. arsenal in future years is critical to U.S. national security and cannot be disclosed.
The EIS should evaluate the dangers and impacts of maintaining a nuclear weapons stockpile and the possible explosion of a nuclear warhead.	5	The environmental impacts associated with maintaining a nuclear weapons stockpile are assessed in DOE's Stockpile Stewardship and Management Programmatic EIS (DOE 1996). The environmental impacts associated with the possible explosion of a nuclear warhead are speculative and beyond the scope of the CLWR EIS.
In addition to evaluating the physical and social environments, the EIS should look at the moral and ethical issues related to continuing the production of nuclear weapons.	6	Moral and ethical issues are beyond the scope of the EIS.

START = Strategic Arms Reduction Treaty

F.4 REFERENCES

DOE (U.S. Department of Energy), 1995, *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling*, DOE/EIS-0161, Office of Reconfiguration, Washington, DC, October 19.

DOE (U.S. Department of Energy), 1996, *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*, DOE/EIS-0236, September.

DOE (U.S. Department of Energy), 1998, *Draft Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271D, Savannah River Operations Office, Aiken, South Carolina, May.

DOE (U.S. Department of Energy), 1999, *Final Environmental Impact Statement, Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS–0271F, Savannah River Operations Office, Aiken, South Carolina, to be published March 1999.

APPENDIX G
ENVIRONMENTAL JUSTICE ANALYSIS

G.1 INTRODUCTION

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to identify and address, as appropriate, the disproportionately high and adverse health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

The Council on Environmental Quality has oversight responsibility for documentation prepared in compliance with the National Environmental Policy Act (NEPA). In December 1997, the Council released its guidance on environmental justice under the National Environmental Policy Act (CEQ 1997). The Council's guidance was adopted as the basis for the analysis of environmental justice contained in this environmental impact statement (EIS).

This section provides an assessment of the potential for disproportionately high and adverse human health or environmental effects due to production of tritium in a commercial light water reactor (CLWR) on minority and low-income populations that live within areas surrounding the candidate facilities. The potential for adverse impacts from onsite activities during tritium production and transportation is determined in this EIS.

G.2 DEFINITIONS AND APPROACH

The following definitions of minority individuals and population were used in this analysis of environmental justice:

- **Minority Individuals**—Members of any of the following population groups: Hispanic, Native American, Asian or Pacific Islander, or Black.

- **Minority Population**—The total number of minority individuals residing within a potentially affected area.

In the discussions of environmental justice in this document, persons self-designated as Hispanic are included in the Hispanic population, regardless of race. For example, the Asian or Pacific Islander population is composed of persons self-designated as Asian or Pacific Islander and not of Hispanic origin. Asian or Pacific Islanders who designate themselves as having Hispanic origins are included in the Hispanic population. Data for the analysis of minorities and racial population were extracted for year 2025 from the U.S. Census Bureau's worldwide web site (http://www.census.gov/ population/www/projections/stproj.html).

Executive Order 12898 specifically addresses "disproportionately high and adverse effects" on "low-income" populations. The Council on Environmental Quality recommends that poverty thresholds be used to identify "low-income" individuals.

The following definitions of low-income individuals and population were used in this analysis:

- **Low-Income Individuals**—All persons whose self-reported incomes are less than the poverty threshold.

- **Low-Income Population**—The total number of poverty-level individuals residing within potentially affected area.

Data for the analysis of low-income populations were extracted from Table P121 of Standard Tape File 3 (DOC 1992).

Disproportionately High and Adverse Human Health Effects

Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts to human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority population or low-income population is significant and exceeds the risk of exposure rate for the general population or, where available, for another appropriate comparison group (CEQ 1997).

Disproportionately High and Adverse Environmental Impacts

A disproportionately high environmental impact refers to an impact (or risk of an impact) in a low-income or minority community that is significant and exceeds the environmental impact on the larger community. An adverse environmental impact is a deleterious environmental impact that is determined to be significant. In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed low-income or minority populations were considered (CEQ 1997).

Potentially affected areas examined in this EIS include areas defined by an 80-kilometer (50-mile) radius centered on candidate facilities for CLWR production of tritium located at the Watts Bar, Sequoyah, and Bellefonte Nuclear Plants. Minority and low-income populations residing within a 1.6-kilometer (1-mile) corridor centered on representative transportation routes were also included in the evaluation of environmental justice.

G.3 METHODOLOGY

G.3.1 Spatial Resolution

For the purposes of enumeration and analysis, the U.S. Census Bureau has defined a variety of areal units (DOC 1992). Areal units of concern in this document include (in order of increasing spatial resolution) states, counties, census tracts, block groups, and blocks. The block is generally the smallest of these entities and offers the finest spatial resolution. This term refers to a relatively small geographical area bounded on all sides by visible features such as streets and streams or by invisible boundaries such as city limits and property lines. During the 1990 census, the U.S. Census Bureau subdivided the United States and its territories into 7,017,425 A blocks. For comparison, the number of counties, census tracts, and block groups used in the 1990 census were 3,248; 62,276; and 229,192; respectively. While blocks offer the finest spatial resolution, economic data required for identification of low-income populations are not available at the block-level of spatial resolution. In the analysis below, block groups are used throughout as the areal unit. Block groups generally contain between 250 and 500 housing units (DOC 1992).

During the decennial census, the U.S. Census Bureau collects data from individuals and aggregates the data according to residence in a geographical area, such as a county or block group. Boundaries of the areal units are selected to coincide with features such as streams and roads or political boundaries such as county and city borders. Boundaries used for aggregation of the census data usually do not coincide with boundaries used in the calculation of health effects. As discussed in Chapter 5 of this EIS, radiological health effects due to an accident at one of the sites for commercial production of tritium are evaluated for persons residing within a distance of 80 kilometers (50 miles) of the accident site. In general, the boundary of the circle with an

80-kilometer (50-mile) radius centered at the accident site will not coincide with boundaries used by the U.S. Census Bureau for enumeration of the population in the potentially affected area. Some block groups lie completely inside or outside of the radius for health effects calculation. However, other block groups are only partially included. As a result of these partial inclusions, uncertainties are introduced into the estimate of the population at risk from the accident.

To estimate the populations at risk in partially included block groups, it was assumed that populations are uniformly distributed throughout the area of each block group. For example, if 30 percent of the area of a block group lies within 80 kilometers (50 miles) of the accident site, it was assumed that 30 percent of the population residing in that block group would be at risk. An upper bound for the population at risk was obtained by including the total population of partially included block groups in the population at risk. Similarly, a lower bound for the population at risk was obtained by excluding the population of partially included blocks from the population at risk. As a general rule, if the areas of geographic units defined by the U.S. Census Bureau are small in comparison with the potentially affected area, then the uncertainties due to partial inclusions will be relatively small.

G.3.2 Population Projections

Health effects were calculated for populations projected to reside in potentially affected areas during the year 2025. Extrapolations of the total population for individual states are available from both the U.S. Census Bureau and various state agencies (DOC 1996). The U.S. Census Bureau also projects populations by ethnic and racial classification in 1-year intervals for the years from 1995 to 2025 at the state level. State agencies project total populations for individual counties. No Federal or state agency projects block groups or low-income populations. Data used to project minority populations were extracted from the U.S. Census Bureau's Internet web site (http://www.census.gov/ population/www/projections/stproj.html). To project minority populations in potentially affected areas, minority populations determined from the 1990 census data were taken as a baseline for each block group. Then it was assumed that percentage changes in the minority population of each block group for a given year (compared to the 1990 baseline data) will be the same as percentage changes in the state minority population projected for the same year. An advantage to this assumption is that the projected populations are obtained using a consistent method, regardless of the state and associated block group involved in the calculation. A disadvantage is that the method is insensitive to localized demographic changes that could alter the projection in a specific area.

The U.S. Census Bureau uses the cohort-component method to estimate future populations for each state (DOC 1996). The set of cohorts is comprised of: (1) age groups from 1 year or less to 85 years or more, (2) male and female populations in each age group, and (3) the following racial and ethnic groups in each age group: Hispanic, non-Hispanic Asian, non-Hispanic African American, non-Hispanic Native American, and non-Hispanic White. Components of the population change used in the demographic accounting system are births, deaths, net state-to-state migration, and net international migration. If P(t) denotes the number of individuals in a given cohort at time "t," then:

$$P(t) = P(t_0) + B - D + DIM - DOM + IIM - IOM \qquad (1)$$

where:

$P(t_0)$	=	Cohort population at time $t_0 \leq t$. For this analysis, t_0 denotes the year 1990.
B	=	Births expected during the period from t_0 to t.
D	=	Deaths expected during the period from t_0 to t.
DIM	=	Domestic migration expected into the state during the period from t_0 to t.
DOM	=	Domestic migration expected out of the state during the period from t_0 to t.
IIM	=	International migration expected into the state during the period from t_0 to t.
IOM	=	International migration expected out of the state during the period from t_0 to t.

Estimated values for the components shown on the right side of equation 1 are based on past data and various assumptions regarding changes in the rates for birth, mortality, and migration (DOC 1996). Persons of Hispanic origin are included in the Hispanic population regardless of race. It should be noted that the U.S. Census Bureau does not project populations of individuals who identified themselves as "other race" during the 1990 Census. This population group is less than 2 percent of the total population in each of the states. However, to project total populations in the environmental justice analysis, population projections for the "other race" group were made under the assumption that the growth rate for the "other race" population will be identical to the growth rate for the combined minority and White populations.

G.4 ENVIRONMENTAL JUSTICE ASSESSMENT

The analysis of environmental justice concerns was based on an assessment of the impacts reported in Chapter 5 of this EIS. This analysis was performed to identify any disproportionately high and adverse human health or environmental impacts on minority or low-income populations surrounding the three potential sites. Demographic information obtained from the U.S. Census Bureau was used to identify the minority populations and low-income communities in the zone of potential impact surrounding the sites. The outer zone is within the region of influence, a circle that has an 80-kilometer (50-mile) radius around the potential sites. This radius is consistent with that used to evaluate the collective dose for human health effects, air impact modeling, and socioeconomic impacts, and is judged to encompass all of the impacts that may occur.

G.5 RESULTS FOR THE SITES

As discussed in Chapter 3 of this EIS, three CLWR sites were selected as candidates for the production of tritium: Watts Bar, Sequoyah, and Bellefonte. This section will describe the analysis of potentially affected minority and low-income populations residing near the candidate sites. It should be noted that projections of the total population provided in this appendix differ from the projected total populations used in the health effects calculations described in Chapter 5. This is because the projections used in the analysis of environmental justice are based on projections for the states provided by the U.S. Bureau of the Census (DOC 1996). Projections used in the analysis of health effects are based on county-wide projections provided by state agencies. As discussed in Section G.3.2, the county projections are more sensitive to localized demographic changes. However, the states do not provide projections for minority populations. Therefore, the U.S. Bureau of the Census projections were used in the analysis of environmental justice. Population projections obtained with the two approaches differ by 8 percent or less and will have essentially no effect on the results of the analyses.

G.5.1 Watts Bar Site

Figure G–1 shows the racial and ethnic composition of the minority population residing within 80 kilometers (50 miles) of the Watts Bar site in 1990 (DOC 1992) and those projected to reside in the potentially affected area in the year 2025. In the interval between 1990 and 2025, the percentage of the total population composed of minorities is projected to increase from 8.9 percent to 11.7 percent. For comparison, during the 1990 census, minorities were found to comprise approximately one-quarter of the total national population. By the year 2025, minorities are projected to comprise approximately one-third of the total national population. The percentage minority population residing in the potentially affected area surrounding the Watts Bar site was less than the corresponding national percentage in 1990, and is expected to remain so through the year 2025. Blacks are the largest minority group residing in the potentially affected area, while the Asian and Hispanic populations are projected to show the largest growth rates.

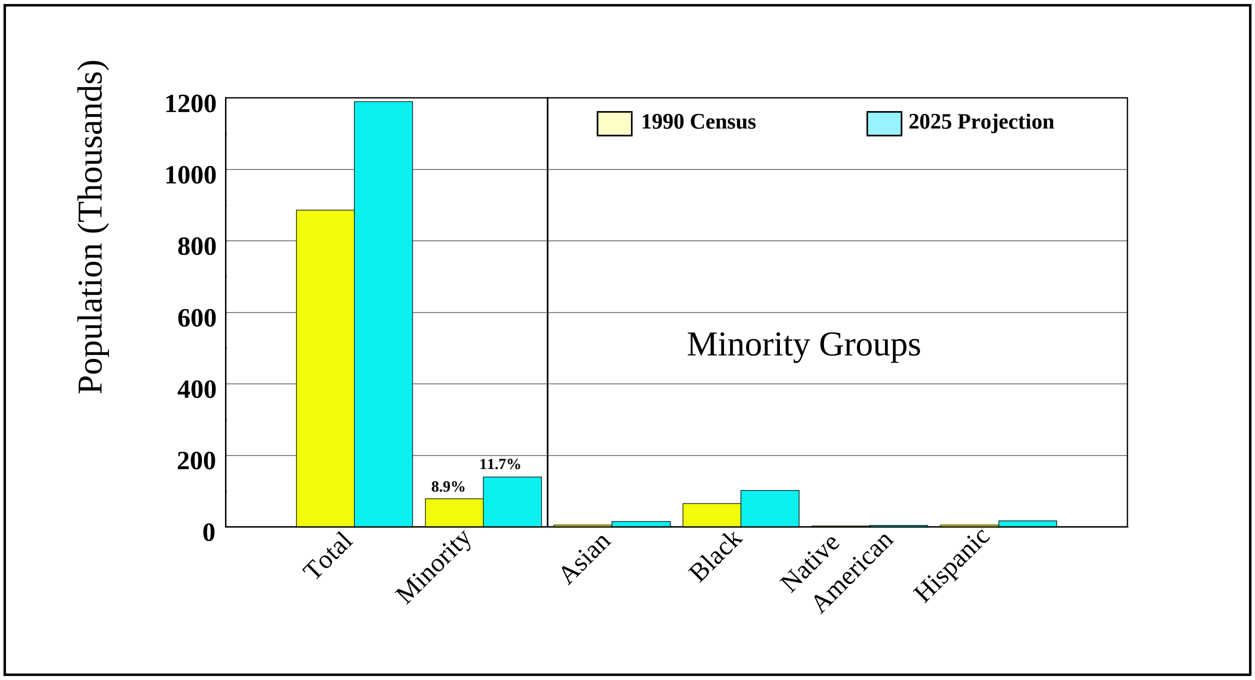

Figure G–1 Racial and Ethnic Composition of the Minority Population Residing Within 80 Kilometers (50 Miles) of the Watts Bar Site

Figure G–2 shows the location of minority populations residing near the Watts Bar site in 1990. It also shows the annual dose to an individual located 40 kilometers (25 miles) from a 3,400 Curie release with its source at the Watts Bar site. All of the annual doses shown in Figure G–2 are several orders of magnitude less than the annual dose due to natural background radiation and would be expected to pose small, if any, risks to the health of an individual. As indicated in Figure G–2, block groups for which the percentage of minority residents exceeds the corresponding national percentage are concentrated in the Chattanooga, Tennessee, area.

Figure G–3 shows data similar to that of Figure G–2, except that the annual doses displayed in Figure G–3 apply to an individual located 8 kilometers (5 miles) from the Watts Bar site. All of the annual doses shown in Figure G–3 are several orders of magnitude less than the annual dose from the natural background radiation and would be expected to result in small, if any, impacts on the health of an individual.

During the 1990 census, 13.6 percent of the residents within the potentially affected area surrounding the Watts Bar site reported incomes below the poverty threshold. Slightly over 13 percent of the national population reported incomes below the poverty threshold, and nearly 16 percent of the residents of Tennessee reported incomes below the poverty threshold during the same year. Thus, the percentage low-income population residing within the potentially affected area exceeded that for the nation, but is less than the corresponding percentage for Tennessee. **Figures G–4 and G–5** show the geographical distribution of low-income residents surrounding the Watts Bar site. Block groups for which the percentage of low-income residents exceeds the corresponding national percentage are located throughout the potentially affected area.

As discussed in Chapter 5, the production of tritium at the Watts Bar site would pose little risk to the public and the natural environment. Thus, selection of the Watts Bar site for the production of tritium would not be expected to pose disproportionately high and adverse risks to potentially affected minority and low-income populations residing near the Watts Bar site.

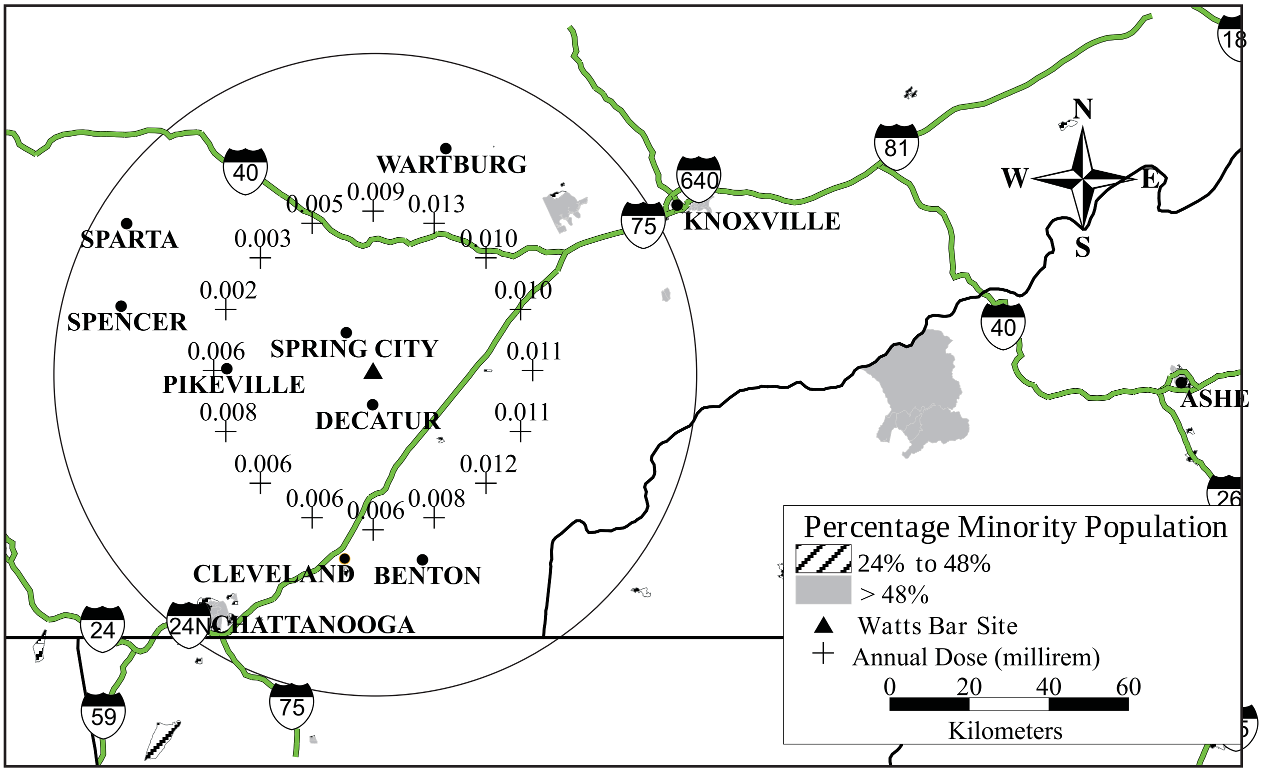

Figure G–2 Minority Population Residing Within 16 Kilometers (10 Miles) of the Watts Bar Site

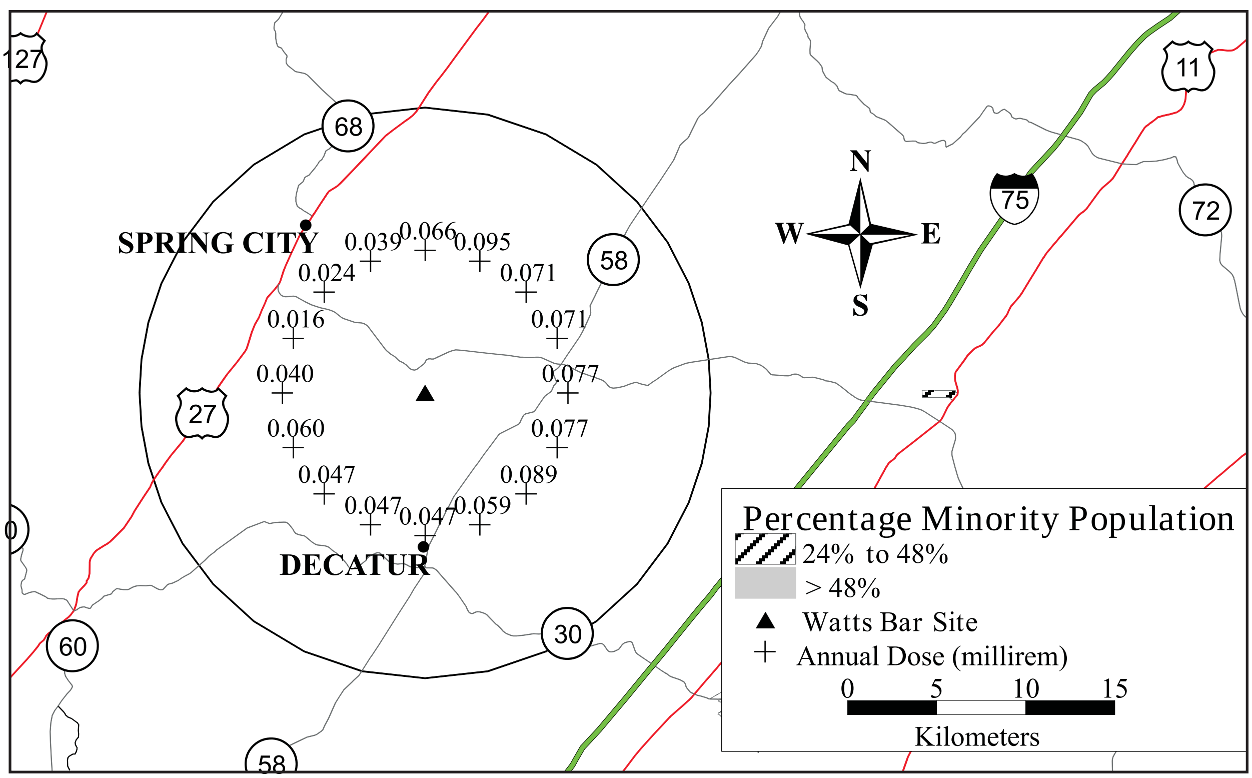

Figure G–3 Minority Population Residing Within 80 Kilometers (50 Miles) of the Watts Bar Site

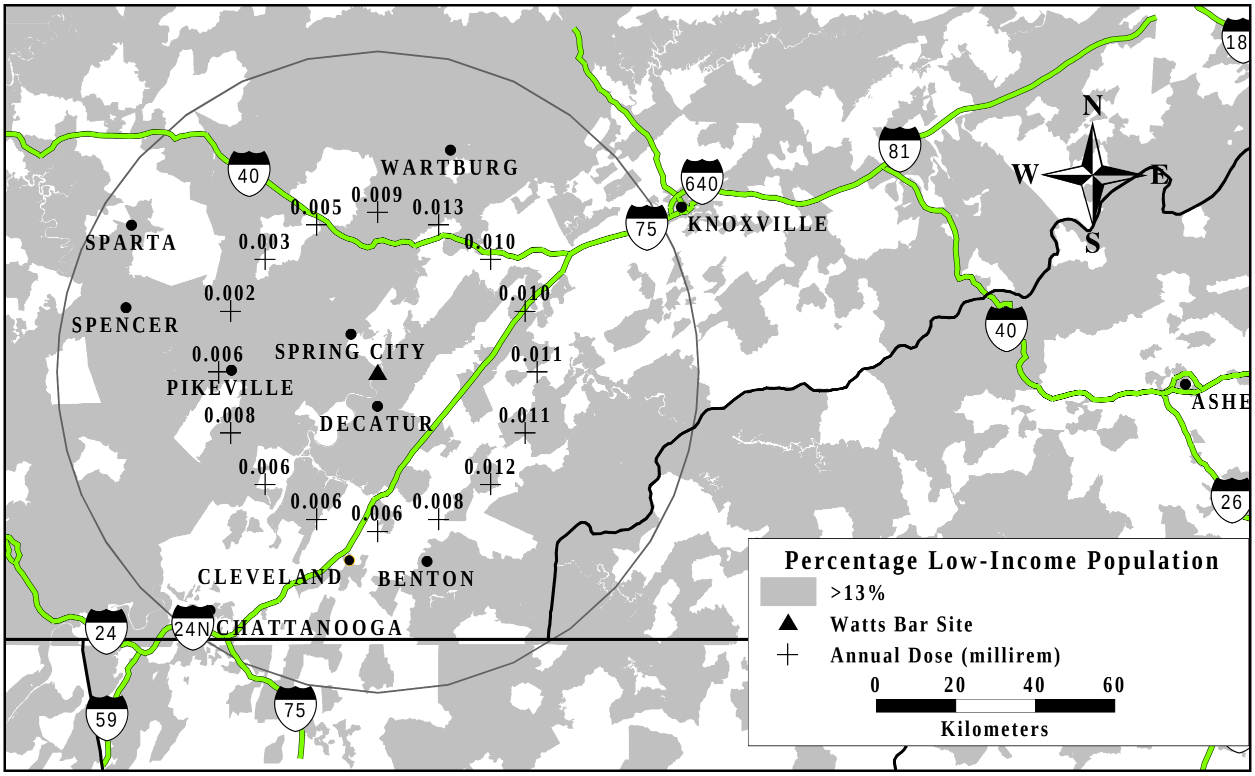

Figure G–4 Low-Income Population Residing Within 80 Kilometers (50 Miles) of the Watts Bar Site

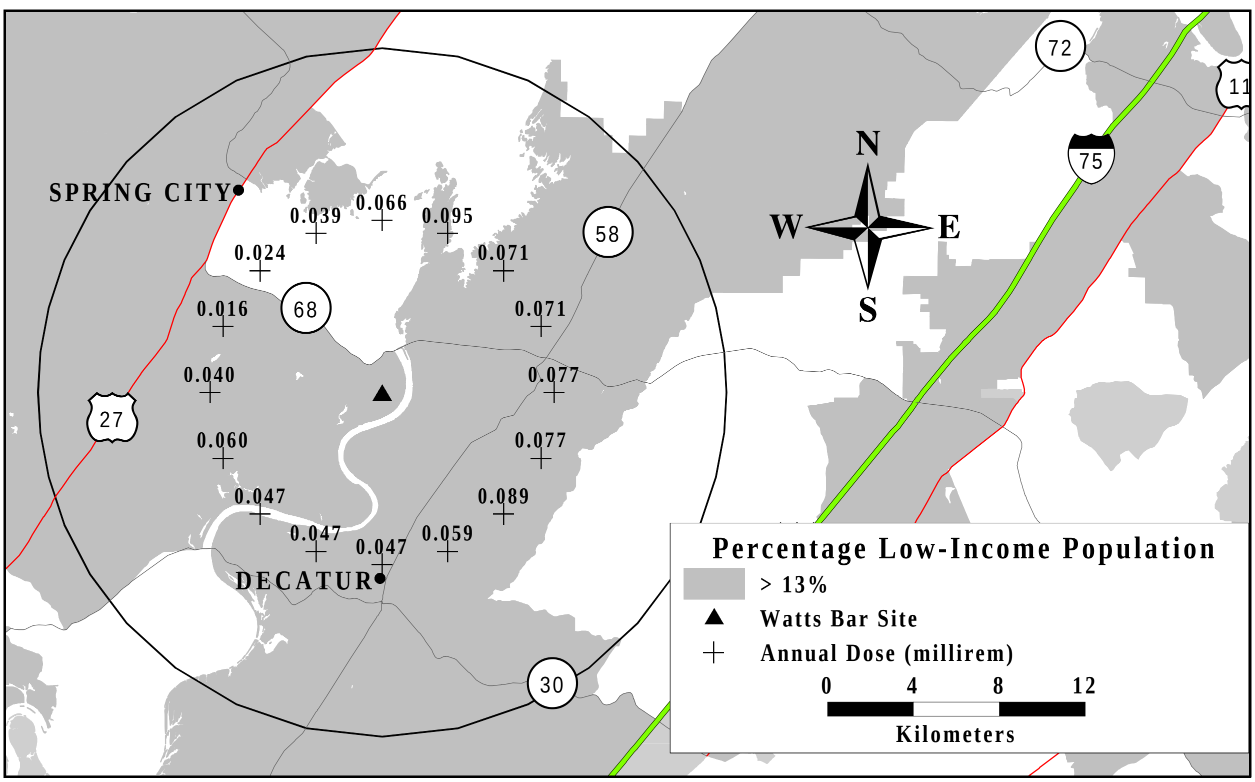

Figure G–5 Low-Income Population Residing Within 16 Kilometers (10 Miles) of the Watts Bar Site

G.5.2 Sequoyah Site

Figure G–6 shows the racial and ethnic composition of the minority population residing within 80 kilometers (50 miles) of the Sequoyah site in 1990 (DOC 1992) and those projected to reside in the potentially affected area in the year 2025. In the interval between 1990 and 2025, the percentage of the total population composed of minorities is projected to increase from 9.8 percent to 12.8 percent. For comparison, during the 1990 census, minorities were found to comprise approximately one-quarter of the total national population. By the year 2025, minorities are projected to comprise approximately one-third of the total national population. The percentage minority population residing in the potentially affected area surrounding the Sequoyah site was less than the corresponding national percentage in 1990, and is expected to remain so through the year 2025. Blacks are the largest minority group residing in the potentially affected area, while the Asian and Hispanic populations are projected to show the largest growth rates.

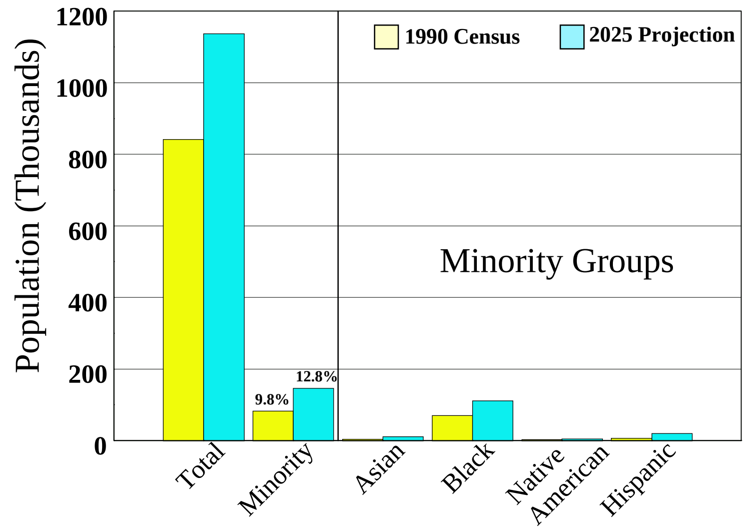

Figure G–6 Racial and Ethnic Composition of the Minority Population Residing Within 80 Kilometers (50 Miles) of the Sequoyah Site

Figure G–7 shows the location of minority populations and low-income populations residing near the Sequoyah site. It also shows the annual dose to an individual located 40 kilometers (25 miles) from a 3,400 Curie release with its source at the Sequoyah site. All of the annual doses shown in Figure G–7 are several orders of magnitude less than the annual dose from the natural background radiation and would be expected to pose small, if any, risks to the health of an individual. As indicated in Figure G–7, block groups for which the percentage of minority residents exceeds the corresponding national percentage are concentrated in the Chattanooga area.

Figure G–8 shows data similar to that in Figure G–7, except that the annual doses displayed in Figure G–8 apply to an individual located 8 kilometers (5 miles) from the Sequoyah site. All of the annual doses shown in Figure G–8 are several orders of magnitude less than the annual dose from the natural background radiation and would be expected to pose little, if any, risk to the health of an individual.

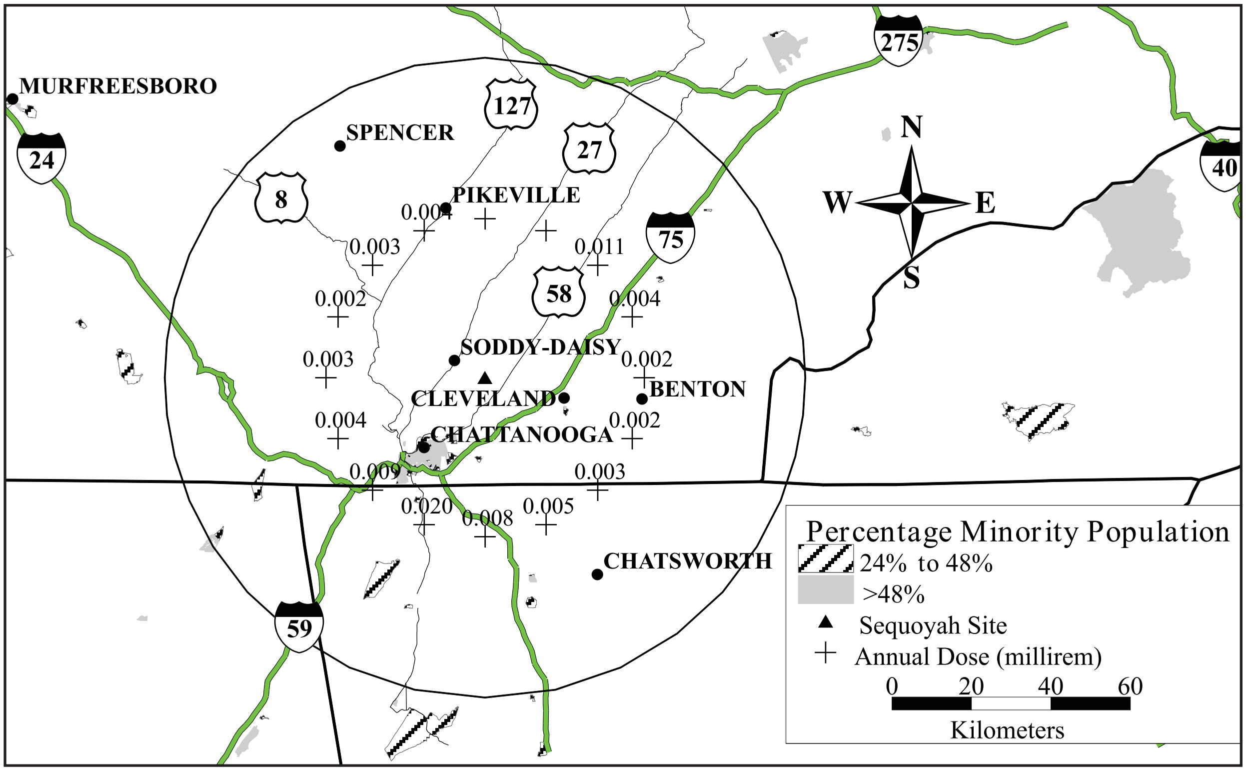

Figure G–7 Minority Population Residing Within 80 Kilometers (50 Miles) of the Sequoyah Site

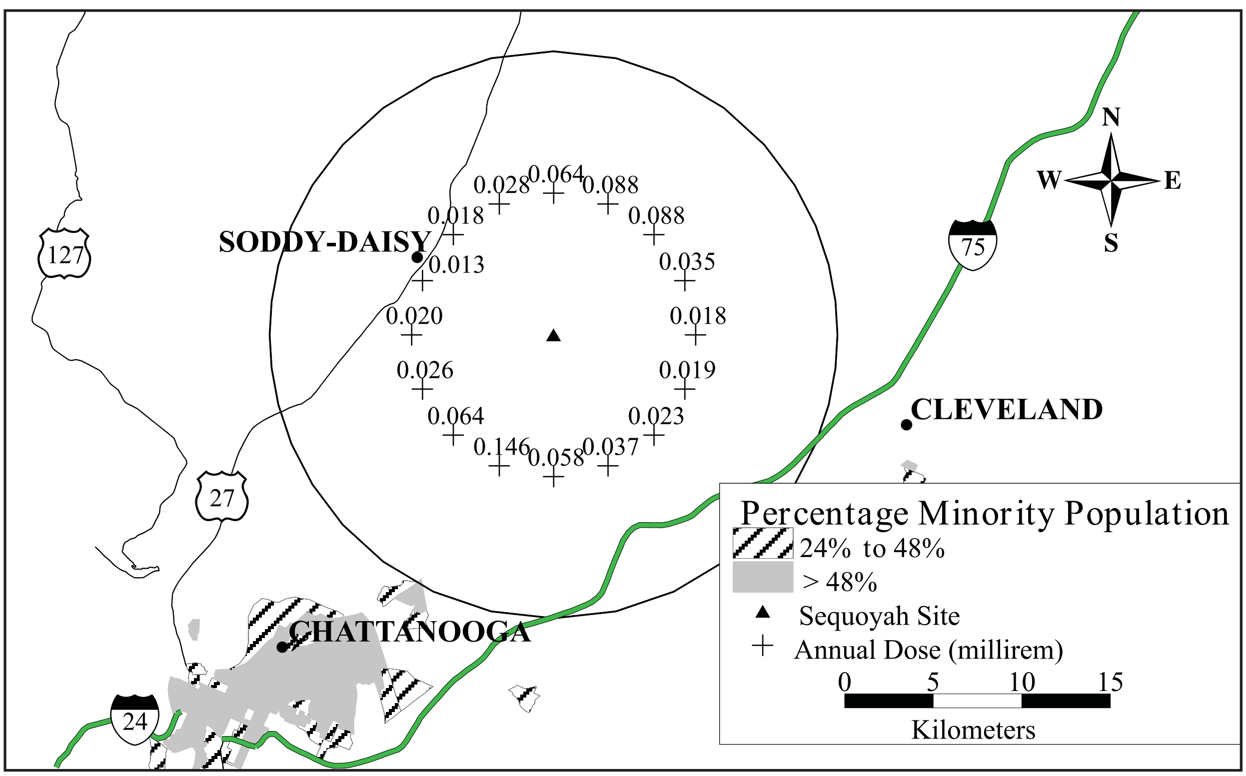

Figure G–8 Minority Population Residing Within 16 Kilometers (10 Miles) of the Sequoyah Site

During the 1990 census, 14.4 percent of the residents within the potentially affected area surrounding the Sequoyah site reported incomes below the poverty threshold. Slightly over 13 percent of the national population reported incomes below the poverty threshold, and nearly 16 percent of the residents of Tennessee reported incomes below the poverty threshold during the same year. Thus, the percentage low-income population residing within the potentially affected area exceeded that for the nation, but is less than the corresponding percentage for Tennessee. **Figures G–9** and **G–10** show the geographical distribution of low-income residents surrounding the Sequoyah site. Block groups for which the percentage of low-income residents exceeds the corresponding national percentage are located throughout the potentially affected area.

As discussed in Chapter 5, the production of tritium at the Sequoyah site would pose little risk to the public and the natural environment. Thus, selection of the Sequoyah site for the production of tritium would not be expected to pose disproportionately high and adverse risks to potentially affected minority and low-income populations residing near the Sequoyah site.

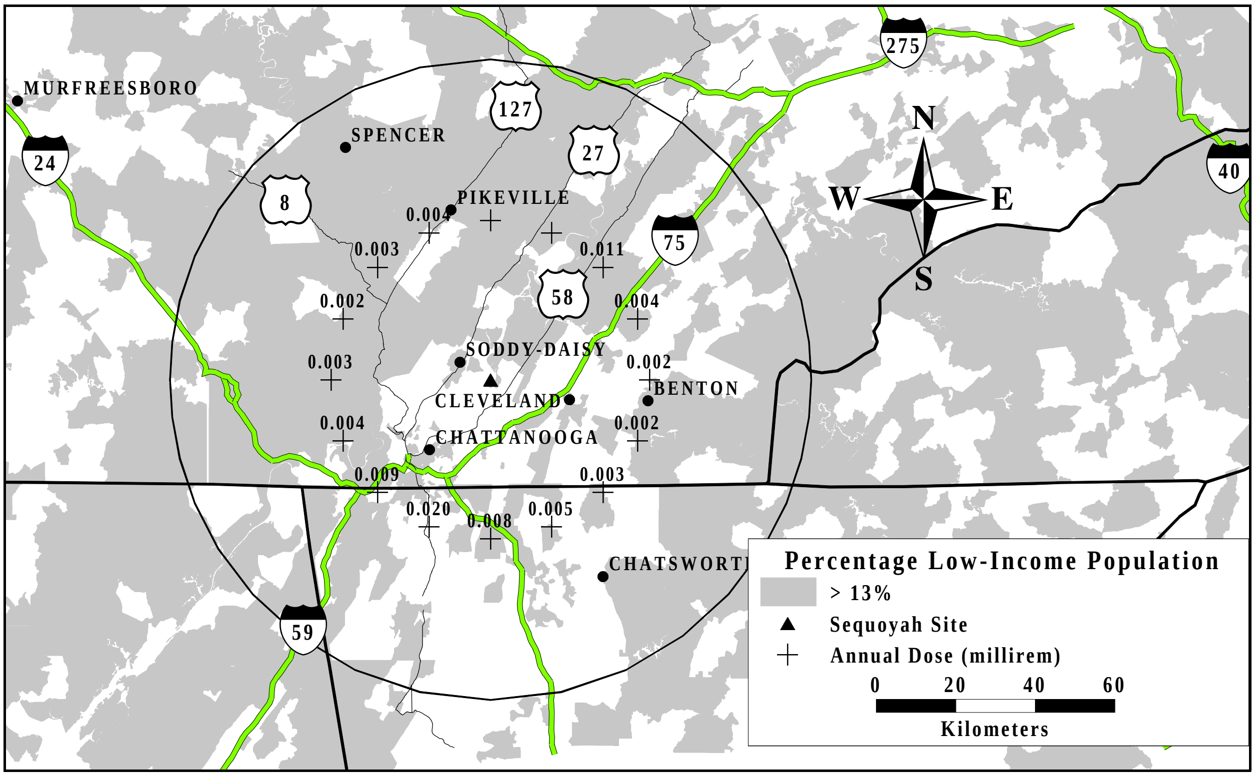

Figure G–9 Low-Income Population Residing Within 80 Kilometers (50 Miles) of the Sequoyah Site

G.5.3 Bellefonte

Figure G–11 shows the racial and ethnic composition of the minority population residing within 80 kilometers (50 miles) of the Bellefonte site in 1990 (DOC 1992) and those projected to reside in the potentially affected area by the year 2025. In the interval between 1990 and 2025, the percentage of the total population composed of minorities is projected to increase from 14.9 percent to 17.7 percent. For comparison, during the 1990 census, minorities were found to comprise approximately one-quarter of the total national population. By the year 2025, minorities are projected to comprise approximately one-third of the total national population. The percentage minority population residing in the potentially affected area surrounding the Bellefonte site was less than the corresponding national percentage in 1990, and is expected to remain so through the year 2025. Blacks are the largest minority group residing in the potentially affected area, while the Asian and Hispanic populations are projected to show the largest growth rates.

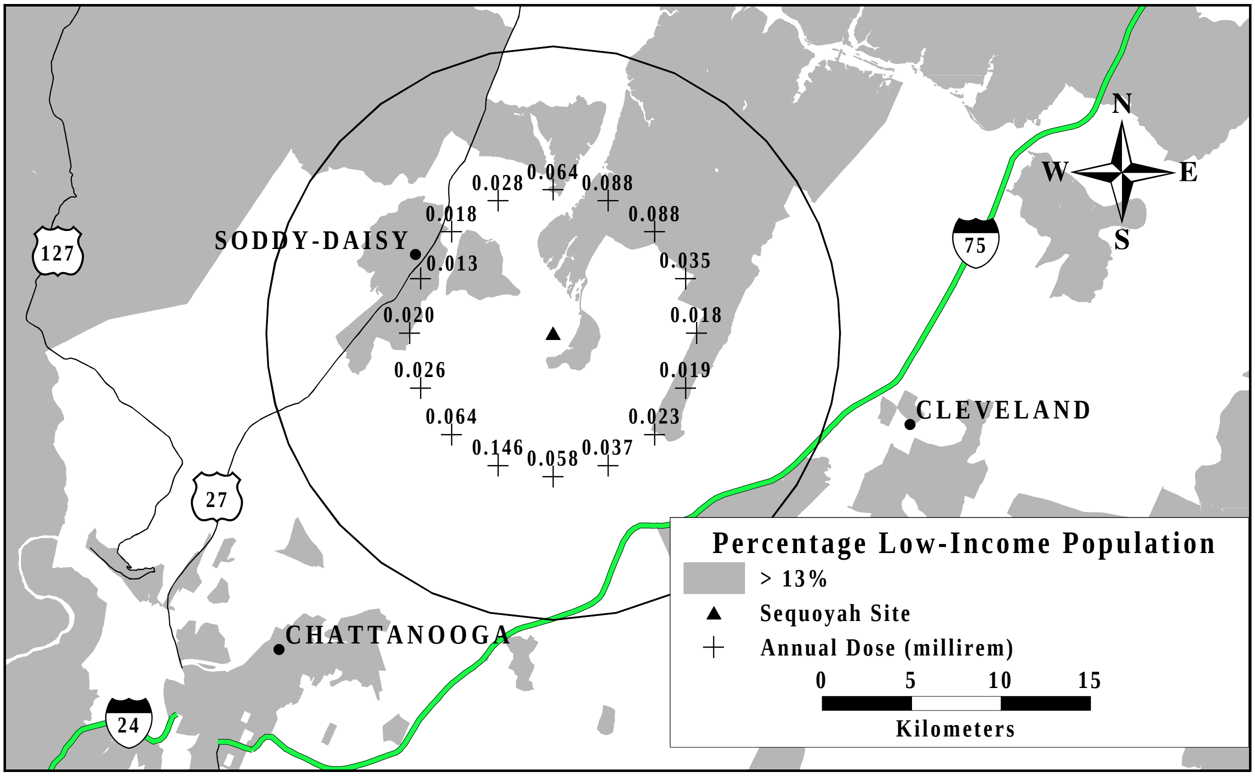

Figure G–10 Low-Income Population Residing Within 16 Kilometers (10 Miles) of the Sequoyah Site

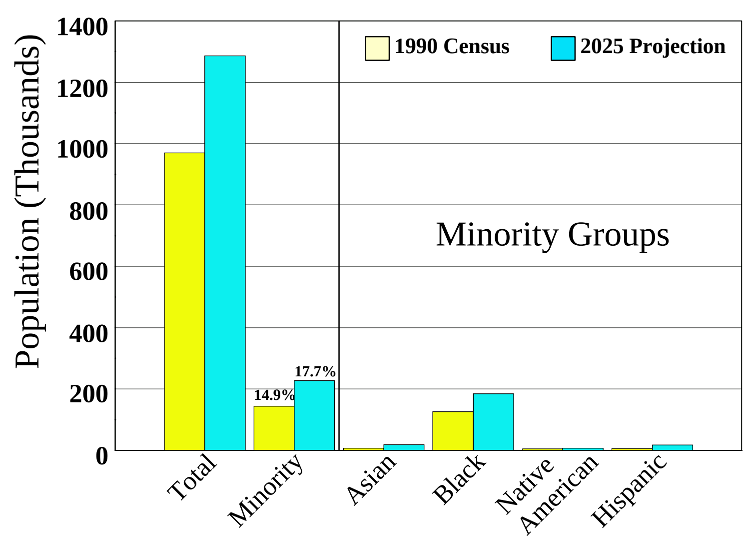

Figure G–11 Racial and Ethnic Composition of the Minority Population Residing Within 80 Kilometers (50 Miles) of the Bellefonte Site

Figure G–12 shows the location of minority populations residing near the Bellefonte site. Minority residents are concentrated in urban areas near Chattanooga and Huntsville-Decatur, Alabama. Throughout the potentially affected area, there are relatively few locations for which the percentage minority population exceeds the corresponding national percentage. Figure G–12 also shows the annual dose to an individual located 40 kilometers (25 miles) from a 3,400 Curie release with its source at the Bellefonte site. All of the annual doses shown in Figure G–12 are several orders of magnitude less than the annual dose from the natural background radiation and would be expected to pose little, if any, risk to the health of an individual.

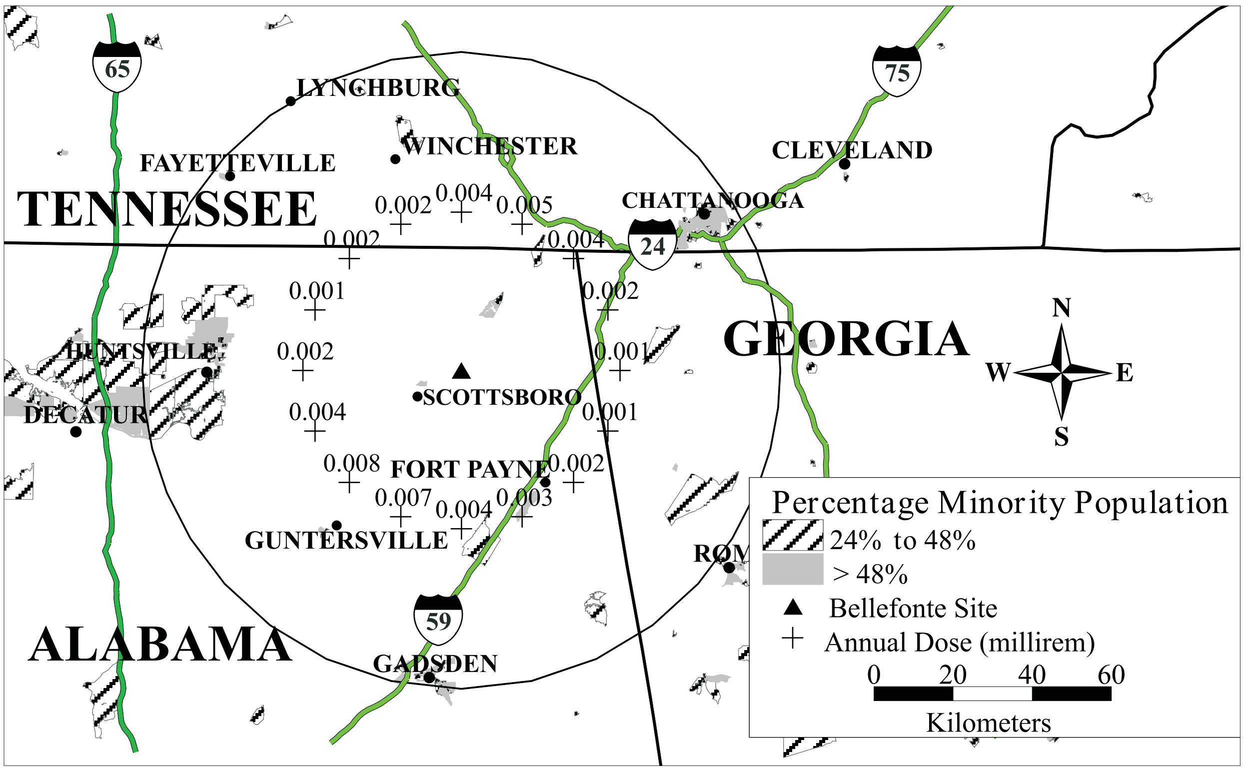

Figure G–12 Minority Population Residing Within 80 Kilometers (50 Miles) of the Bellefonte Site

Figure G–13 shows data similar to that of Figure G–12, except that the annual doses displayed in Figure G–13 apply to an individual located 8 kilometers (5 miles) from the Bellefonte site. All of the annual doses shown in Figure G–13 are several orders of magnitude less than the annual dose from the natural background radiation, and would be expected to pose little, if any, risk to the health of an individual.

During the 1990 census, 14.7 percent of the residents within the potentially affected area surrounding the Bellefonte site reported incomes below the poverty threshold. Slightly over 13 percent of the national population reported incomes below the poverty threshold, and approximately 18 percent of the residents of Alabama reported incomes below the poverty threshold during the same year. Thus, the percentage low-income population residing within the potentially affected area exceeded that for the nation, but is less than the corresponding percentage for Alabama. **Figures G–14 and G–15** show the geographical distribution of low-income residents surrounding the Bellefonte site. On the other hand, block groups for which the percentage of low-income residents exceeds the corresponding national percentage are located throughout the potentially affected area.

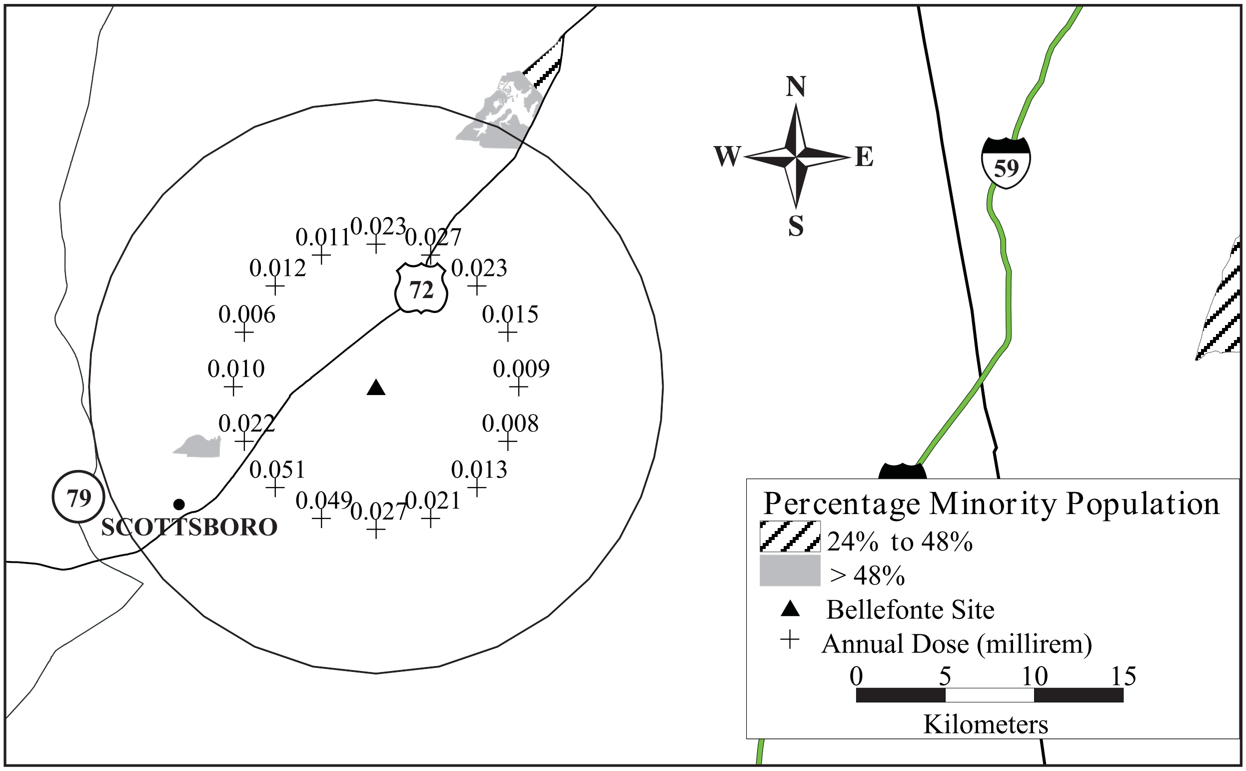

Figure G–13 Minority Population Residing Within 16 Kilometers (10 Miles) of the Bellefonte Site

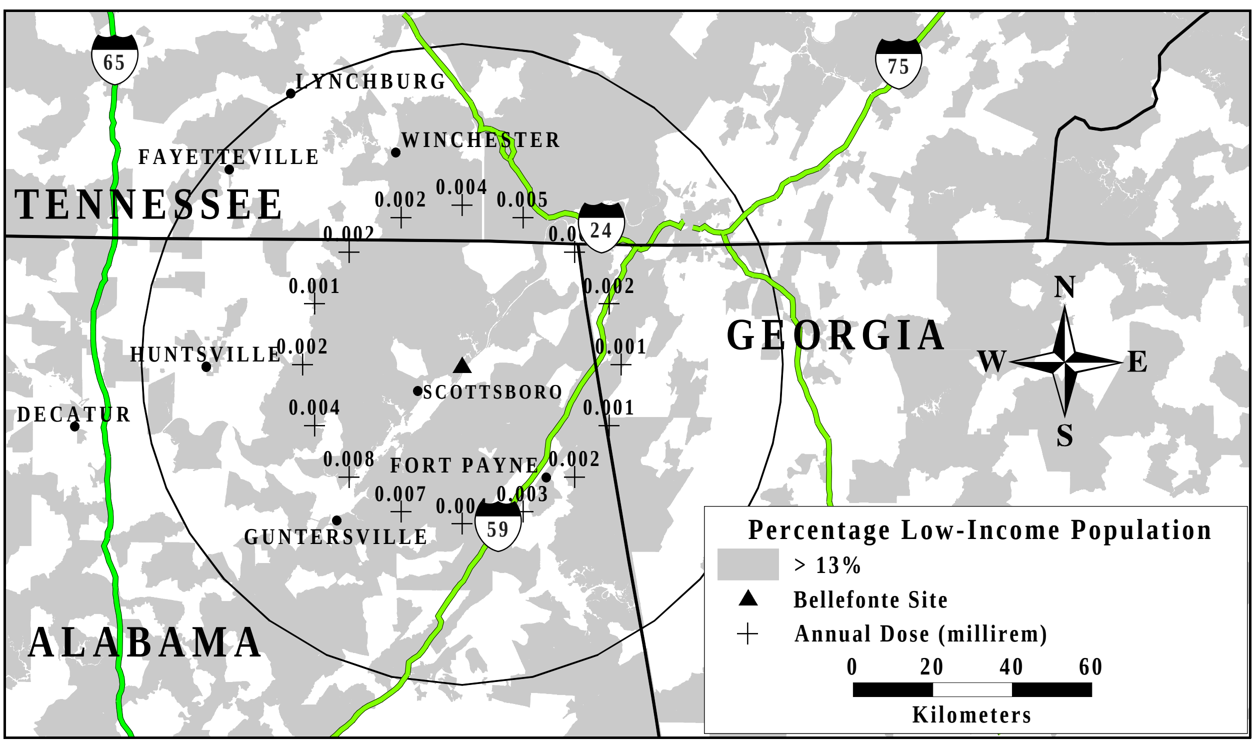

Figure G–14 Low-Income Population Residing Within 80 Kilometers (50 Miles) of the Bellefonte Site

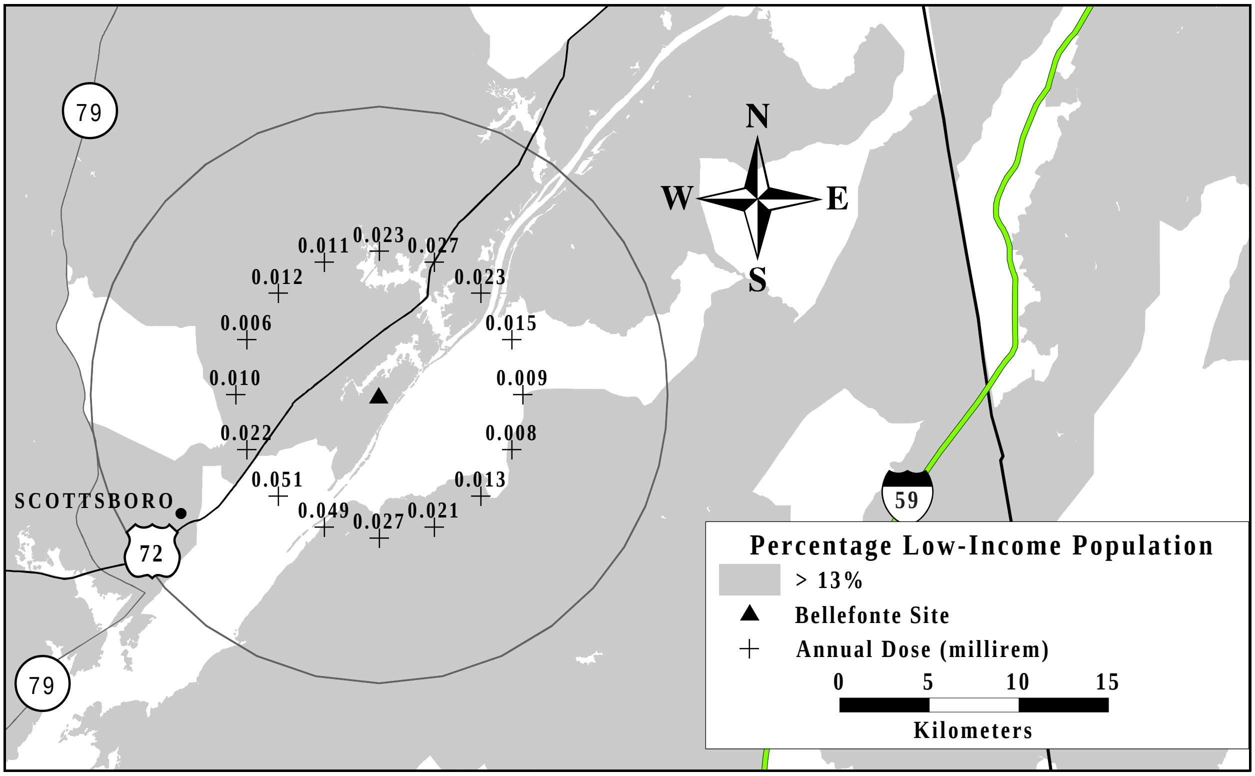

Figure G–15 Low-Income Population Residing Within 16 Kilometers (10 Miles) of the Bellefonte Site

As discussed in Chapter 5, the production of tritium at the Bellefonte site would pose small risks to the public and the natural environment. Thus, selection of the Bellefonte site for the production of tritium would not be expected to pose disproportionately high and adverse risks to potentially affected minority and low-income populations residing near the Bellefonte site.

G.6 RESULTS FOR TRANSPORTATION ROUTES

Overland transportation of tritium involves radiological and nonradiological risks to the public. **Tables G–1 through G–3** show minority and low-income populations residing along highway routes from Watts Bar, Sequoyah, and Bellefonte Nuclear Plants to the Savannah River Site in South Carolina. These tables show populations residing within the 1.6-kilometer (1-mile) corridor centered along highway routes from all three potential sites to the Savannah River Site. Data presented in the tables were resolved at the block-group level. Data for minority populations are projected for the year 2025 and data for low-income populations are taken from the 1990 Census. The distances along highway routes connecting the Savannah River Site with other sites are as follows: 558 kilometers (349 miles), Bellefonte; 497 kilometers (311 miles), Sequoyah; and 576 kilometers (360 miles), Watts Bar.

As discussed in Appendix E, it is unlikely that radiological and nonradiological harm to the general population, including low-income populations and minority populations, would result from highway transportation of tritium.

G.7 OTHER ENVIRONMENTAL IMPACTS

No significant adverse impacts to biotic resources, air resources, socioeconomics, land use, or cultural resources were identified in Chapter 5. Therefore, no disproportionately high or adverse impacts were identified for any segment of the population. None of the alternatives would have a significant adverse impact on the previously mentioned resources because, under all of the alternatives, a limited amount of previously undisturbed land would be used on and off the sites.

G.8 CUMULATIVE IMPACTS

Based on the analysis of the environmental impacts evaluated in this EIS, along with the impacts of other past, present, and reasonably foreseeable future activities, no reasonably foreseeable cumulative adverse impacts are expected to affect the surrounding minority and low-income populations.

Table G–1 Minority Populations Residing Near Highway Routes from Potential Sites to the Savannah River Site

Site	*Population Along Route*	*Minority Population Along Route*	*Percent Minority Population Along Route*
Watts Bar	296,423	122,972	41.5
Sequoyah	298,364	123,694	41.5
Bellefonte	303,417	129,701	43.0

Table G–2 Racial and Ethnic Composition of Minority Populations (2025) Residing Within 1.6 Kilometers (1 Mile) Along Highway from Potential Sites to the Savannah River Site

Site	*Total Pop.*	*Total Minority Pop.*	*Percent Minority Pop.*	*American Indian, Eskimo, or Aleut Pop.*	*Percent American Indian, Eskimo, or Aleut Pop.*	*Asian or Pacific Islander Pop.*	*Percent Asian or Pacific Islander Pop.*	*Black Pop.*	*Percent Black Pop.*	*Hispanic Origin Pop.*	*Percent Hispanic Origin Pop.*
Watts Bar	296,423	122,972	41.5	739	0.24	12,108	4	97,594	33	12,531	4
Sequoyah	298,364	123,694	41.5	720	0.24	12,368	4	98,146	33	12,460	4
Bellefonte	303,417	129,701	43.0	821	0.30	12,303	4	104,289	34	12,288	4

Table G–3 Low-Income Populations Residing Near Highway Routes from Potential Sites to the Savannah River Site

Site	*Population Along Route*	*Low-Income Population Along Route*	*Percent Low-Income Population Along Route*
Watts Bar	296,423	21,415	7
Sequoyah	298,364	21,489	7
Bellefonte	303,417	24,731	8

G.9 REFERENCES

CEQ (Council on Environmental Quality), 1997, *Environmental Guidance Under the National Environmental Policy Act*, Executive Office of the President, Washington, DC, December 10.

DOC (U.S. Department of Commerce), 1992, *1990 Census of Population and Housing, Summary Tape File 3 on CD-ROM*, Bureau of the Census, Washington, DC, May.

DOC (U.S. Department of Commerce), 1996, “Population Projections for States by Age, Sex, Race, and Hispanic Origin: 1995 to 2025" (available at http://www.census.gov/population/www/projections/ppl47.html), Population Division, October.

NEPA DISCLOSURE STATEMENT FOR PREPARATION OF EIS FOR THE PRODUCTION OF TRITIUM IN A COMMERCIAL LIGHT WATER REACTOR

CEQ regulations at 40 CFR 1506.5(c), which have been adopted by DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project," for the purposes of this disclosure, is defined in the March 23, 1981 guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project 'includes' any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 FR 18026-18038 at 18031.

In accordance with these requirements, the offeror and any proposed subcontractors hereby certify as follows: (check either (a) or (b) to assure consideration of your proposal)

(a) ✓ Offeror and any proposed subcontractor have no financial interest in the outcome of the project.

(b) ______ Offeror and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests:

1.
2.
3.

Certified by:

[signature]
Signature

Ibrahim H. Zeitoun, Ph.D.
Name

Project Manager and Corporate Vice President

April 15, 1998
Date

Science Applications International Corporation

COVER SHEET

Responsible Agency: United States Department of Energy

Cooperating Agency: Tennessee Valley Authority

Title: Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor

Contact: For additional information on this Final Environmental Impact Statement, write or call:

Jay Rose
Office of Defense Programs
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Attention: CLWR EIS
Telephone: (202) 586-5484

For copies of the CLWR Final EIS call: 1-800-332-0801.

For general information on the DOE National Environmental Policy Act (NEPA) process, write or call:

Carol M. Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Telephone: (202) 586-4600, or leave a message at: (800) 472-2756

Abstract: The U.S. Department of Energy (DOE) is responsible for providing the nation with nuclear weapons and ensuring that these weapons remain safe and reliable. Tritium, a radioactive isotope of hydrogen, is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile. Unlike other materials utilized in nuclear weapons, tritium decays at a rate of 5.5 percent per year. Accordingly, as long as the nation relies on a nuclear deterrent, the tritium in each nuclear weapon must be replenished periodically. Currently the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to continue supporting the nation's stockpile. The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS), DOE/EIS-0161, issued in October 1995, evaluated the alternatives for the siting, construction, and operation of tritium supply and recycling facilities at five DOE sites for four different production technologies. This Programmatic EIS also evaluated the impacts of using a commercial light water reactor (CLWR) without specifying a reactor location. In the Record of Decision for the Final Programmatic EIS (60 FR 63878), issued December 12, 1995, DOE decided to pursue a dual-track approach on the two most promising tritium supply alternatives: (1) to initiate purchase of an existing commercial reactor (operating or partially complete) or reactor irradiation services; and (2) to design, build, and test critical components of an accelerator system for tritium production. At that time, DOE announced that the final decision would be made by the Secretary of Energy at the end of 1998.

On December 22, 1998, Secretary of Energy Bill Richardson announced that the CLWR would be DOE's primary option for tritium production, and the proposed linear accelerator at the Savannah River Site would be the back-up option. The Secretary designated the Tennessee Valley Authority's (TVA) Watts Bar and Sequoyah Nuclear Plants as the Preferred Alternative for CLWR tritium production. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS to construct and operate a new tritium extraction capability at the Savannah River Site.

This *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) evaluates the environmental impacts associated with producing tritium at one or more of the following five CLWRs: (1) Watts Bar Nuclear Plant Unit 1 (Spring City, Tennessee); (2) Sequoyah Nuclear Plant Unit 1 (Soddy Daisy, Tennessee); (3) Sequoyah Nuclear Plant Unit 2 (Soddy Daisy, Tennessee); (4) Bellefonte Nuclear Plant Unit 1 (Hollywood, Alabama); and (5) Bellefonte Nuclear Plant Unit 2 (Hollywood, Alabama). Specifically, this EIS analyzes the potential environmental impacts associated with fabricating tritium-producing burnable absorber rods (TPBARs); transporting nonirradiated TPBARs from the fabrication facility to the reactor sites; irradiating TPBARs in the reactors; and transporting irradiated TPBARs from the reactors to the proposed tritium extraction facility at the Savannah River Site in South Carolina.

The public comment period on the CLWR Draft EIS extended from August 28 to October 27, 1998. During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. An additional public meeting was held in Evensville, Tennessee, on December 14, 1998. The CLWR Draft EIS was made available through mailings and requests to DOE's CLWR Office and at DOE's Public Reading Rooms. In preparing the CLWR Final EIS, DOE considered comments received via mail, fax, submission at public hearings, recorded telephone messages, and the Internet. In addition, comments and concerns identified during discussions at the public hearings were recorded by a court reporter and were transcribed for consideration by DOE.

The CLWR Final EIS contains revisions and new information in response to the comments on the CLWR Draft EIS and technical details disclosed since the Draft EIS was issued. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger changes. Volume 2 (Comment Response Document) of the CLWR Final EIS contains the comments received during the public review of the CLWR Draft EIS and DOE's responses to these comments.

No sooner than 30 days after the notice of filing this EIS with the U.S. Environmental Protection Agency, DOE expects to issue a Record of Decision.

PREFACE

The *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Final Programmatic EIS) (DOE/EIS-0161), which was completed in October 1995, assessed the potential environmental impacts of technology and siting alternatives for the production of tritium for national security purposes. On December 5, 1995, DOE issued a Record of Decision for the Final Programmatic EIS that selected the two most promising alternative technologies for tritium production and established a dual-track strategy that would, within 3 years, select one of those technologies to become the primary tritium supply technology. The other technology, if feasible, would be developed as a backup tritium source. Under the dual-track strategy, DOE would: (1) initiate the purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) design, build, and test critical components of an accelerator system for tritium production. Under the Final Programmatic EIS Record of Decision, any new facilities that might be required, i.e., an accelerator and/or a tritium extraction facility to support the commercial reactor alternative, would be constructed at DOE's Savannah River Site in South Carolina.

The Final Programmatic EIS described a two-phase strategy for compliance with the National Environmental Policy Act (NEPA). The first phase included completion of the Final Programmatic EIS and subsequent Record of Decision. The second phase included the preparation of site-specific NEPA documents tiered from the Final Programmatic EIS. These EISs address the environmental impacts of specific project proposals. As a result of the Final Programmatic EIS and the Record of Decision, DOE determined to prepare three site-specific EISs: the *Environmental Impact Statement, Accelerator Production of Tritium at the Savannah River Site* (APT) (DOE/EIS-0270), the *Environmental Impact Statement for the Production of Tritium in a Comercial Light Water Reactor* (CLWR) (DOE/EIS-0288), and the *Environment Impact Statement, Construction and Operation of a Tritium Extraction Facility at Savannah River Site* (TEF) (DOE/EIS-0271). Each of these EISs presents an analysis of alternatives which do not affect the alternatives in the other EISs, with one exception. This exception is one alternative in the TEF EIS which would require the use of space in the APT. For this alternative to be viable, the APT would have to be selected as the primary source of tritium.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and the Sequoyah Units 1 and 2 reactors near Soddy-Daisy, Tennessee, as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the “backup” technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. Finally, selection of the CLWR reaffirms the December 1995 Final Programmatic EIS Record of Decision to construct and operate a new tritium extraction capability at the Savannah River Site.

DOE has completed the final EISs for the APT, CLWR, and TEF. No sooner than 30 days after publication in the *Federal Register* of the Environmental Protection Agency’s Notice of Availability of the final EISs for APT, CLWR, and TEF, DOE intends to issue a consolidated Record of Decision to: (1) formalize the programmatic announcement made on December 22, 1998; and (2) announce project-specific decisions for the three EISs. These decisions will include, for the selected CLWR technology, the selection of specific CLWRs to be used for tritium supply and the location of a new tritium extraction capability at the Savannah River Site. For the backup APT technology, technical and siting decisions consistent with its backup role will be made.

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ACRONYMS AND ABBREVIATIONS

APT	Accelerator Production of Tritium
BEIR	Biological Effects of Ionizing Radiation
Bellefonte 1	Bellefonte Nuclear Plant Unit 1
Bellefonte 2	Bellefonte Nuclear Plant Unit 2
CFR	Code of Federal Regulations
CLWR	Commercial light water reactor
DOE	U.S. Department of Energy
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HEPA	High-efficiency particulate air
IAEA	International Atomic Energy Agency
ISFSI	Independent spent fuel storage installation
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
Sequoyah 1	Sequoyah Nuclear Plant Unit 1
Sequoyah 2	Sequoyah Nuclear Plant Unit 2
START	Strategic Arms Reduction Treaty
TPBAR	Tritium-producing burnable absorber rod
TVA	Tennessee Valley Authority
U.S.C.	United States Code
Watts Bar 1	Watts Bar Nuclear Plant Unit 1
Watts Bar 2	Watts Bar Nuclear Plant Unit 2

1. PUBLIC COMMENT PROCESS

This chapter of the Comment Response Document describes the public comment process for the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* and the procedures used to respond to those comments. Section 1.1 describes the means through which comments were acquired, summarized, and numbered. Section 1.2 discusses the public hearing format that was used to solicit comments from the public. Section 1.3 describes the organization of this document, including how the comments were categorized, addressed, and documented. Section 1.4 also provides guidance on the use of this document. Section 1.5 discusses the major comments received on the environmental impact statement. Section 1.6 includes a discussion of the major changes to the environmental impact statement that resulted from the public comment process. This chapter includes indexes of all comments received during the 60-day public comment period and the December 14, 1998, public meeting.

1.1 INTRODUCTION

In August 1998, the U.S. Department of Energy (DOE) published the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR Draft EIS). This document explained the need for a domestic tritium production source to maintain the United States' nuclear deterrent and described and analyzed the environmental impacts associated with tritium production at one or more nuclear power plants owned and operated by the Tennessee Valley Authority (TVA). The 60-day public comment period on the CLWR Draft EIS began on August 28, 1998, and ended on October 27, 1998.

During the comment period, public hearings were held in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. After the public comment period ended, a public meeting was held on December 14, 1998, in Evensville, Tennessee, to allow the public to comment on TVA proposals submitted to DOE in early December. **Figure 1-1** shows the locations and dates of the public hearings and meeting. In addition, the public was encouraged to submit comments via the U.S. mail service, e-mail to a special DOE web site on the Internet, a toll-free 800-number phone line, and a toll-free fax line. Section 1.5 includes a summary of the major comments received through the public comment process. Section 1.6 includes a summary of the changes that were made to the CLWR Draft EIS as a result of the public comment process.

December 14, 1998, Public Meeting

Prior to fulfilling the requirement to reach a technology decision by the end of 1998, Secretary of Energy Bill Richardson asked TVA to submit final proposals for the Watts Bar and Sequoyah reactors, as well as for the completion of TVA's Bellefonte reactor. These proposals were provided to DOE the first week in December 1998, after the close of the public comment period for the CLWR Draft EIS on October 27, 1998 (see Volume 1, Section 1.1.4 of the CLWR EIS). Upon receiving the proposals, the Secretary of Energy directed that this information be presented for public review and comment prior to his reaching the technology decision. To enable this, it was necessary to schedule and conduct the December 14, 1998, public meeting with a minimum of notice. At this meeting, DOE presented information on the new TVA proposals, answered questions, and accepted comments on the proposals and the tritium program in general. The public was encouraged to submit written, faxed, telephoned, and e-mailed comments on the new TVA proposals. All comments received as a result of the December 14, 1998, public meeting are presented separately in Chapter 2 of this volume (200 series and 800 series commentors); DOE's responses to the December 14, 1998, comments have been integrated with the public comment period responses in Chapter 3 of this volume.

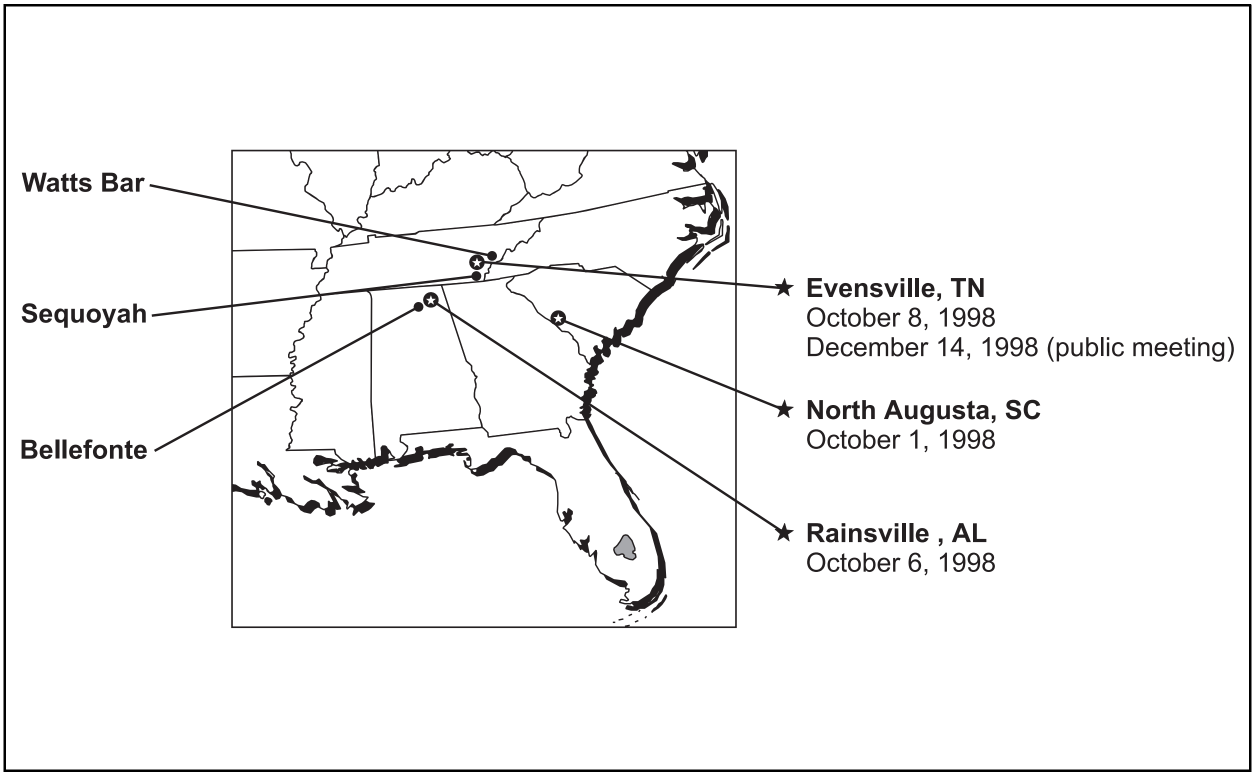

Figure 1-1 Public Hearing and Meeting Locations and Dates, 1998

The number of persons estimated in attendance at each hearing or meeting, together with the number of comments submitted and recorded, are presented in **Table 1-1**. These attendance estimates are based on the number of registration forms completed and returned at each hearing or meeting, as well as a rough "head count" of the audience, and may not include all those present.

Table 1–1 Public Hearing/Meeting Locations, Attendance, and Commentors

Location	*Date*	*No. in Attendance*	*Commentors*
North Augusta, SC	October 1, 1998	34	4
Rainsville, AL	October 6, 1998	200	27
Evensville, TN	October 8, 1998	59	14
Evensville, TN (public meeting)	December 14, 1998	71	36

All public hearing and meeting comments were combined with comments received by other means (mail, e-mail, 800-number, fax) during the comment period. Written comments were date-stamped and assigned a sequential document number. Chapter 2 of this volume contains copies of the comment documents received by DOE. **Table 1-2** provides an overview of the number of comments received and categorized by method of submission.

Table 1–2 Method of Comment Submission

Method	***Number of Submittals and Commentors***
Faxes	18
U.S. mail	51
1-800 number	34
E-mail	17
Hearings/meetings (written statements)	82
Total submittals	**203**

1.2 PUBLIC HEARING FORMAT

The public hearings used a format that allowed two-way interaction between DOE representatives and the public and encouraged public comments on the document. A neutral facilitator was present at each hearing to direct and clarify discussions and comments. A court reporter also was present at each hearing to record the proceedings and provide a transcript of the public comments and the dialogue between the public and the DOE and TVA representatives on hand. These transcripts are available in DOE Public Reading Rooms near each site and in Washington, DC.

The format used for each hearing included a presentation, question and answer session, and a public comment period. The hearing opened with a welcome from the facilitator, followed by a presentation on the proposed action by a DOE representative. The facilitator next opened the question and answer session to give the audience a chance to ask questions about the material presented. This was followed by the public comment session, during which attendees were given an opportunity to read a prepared statement of no more than five minutes. Modifications to the format were made at each of the public hearings to fulfill the special requests of attendees. Following the public hearings, statement summaries were prepared from the transcripts of each hearing and the comment documents submitted by the attendees (see Chapter 2 of this volume).

1.3 ORGANIZATION OF THIS COMMENT RESPONSE DOCUMENT

This Comment Response Document is organized into the following sections:

- Chapter 1 includes a description of the public comment process; the public hearing format; the organization of this document; the use of this document, including tables; the major comments received; and the changes made to the CLWR Draft EIS.

- Chapter 2 contains scanned copies of the comment documents received during the public comment period and the December 14, 1998, public meeting, as well as summaries of the comments received at the public hearings and the public meeting. Comments received as a result of the December 14, 1998, public meeting are presented separately (the 200 and 800 series).

- Chapter 3 includes the comment summaries and DOE's responses by category.

- Chapter 4 lists the references for this volume.

Tables are provided at the end of this chapter to assist commentors and other readers in locating individual comments concerning the CLWR EIS. The comments are categorized by issue (e.g., land or water resources) and organized under assigned category codes. **Table 1-3** lists the issue categories and corresponding category codes. Similar comments within the same issue category are presented under an assigned summary code.

Table 1–3 Issue Categories

Category Code	*Issue Category*
01	Policy issues
02	Purpose and need for tritium
03	Tritium requirements
04	Other production options
05	NEPA process
06	Reasonable alternatives selection
07	General support/opposition
08	DOE past practices
09	TVA past practices
10	Land, aesthetics, noise, soils, general environment
11	Air, water resources
12	Ecological resources
13	Socioeconomics, environmental justice
14	Occupational and public health and safety (normal conditions)
15	Occupational and public health and safety (accident conditions)
16	Waste management
17	Spent nuclear fuel management
18	Transportation
19	Design and fabrication of tritium-producing burnable absorber rods (TPBARs)
20	Decontamination and decommissioning
21	Reactor licensing issues
22	Safeguards and security
23	Cost issues
24	Miscellaneous

All comments appear in Chapter 2. Scanned images of the comments submitted via the U.S. mail service, e-mail, toll-free phone line, toll-free fax line, or personal submission at the public hearings are presented first. The scanned images are followed by summaries of oral comments submitted at the public hearings and meeting, listed according to dates (see **Table 1-4**). The commentor numbers correspond to the dates the comments were received, as indicated in Table 1-4.

Table 1–4 Assignment of Commentor Numbers

Comments Received (Dates)	***Commentor Numbers***
August 28, 1998, to November 13, 1998	001-147
October 1, 1998 (public hearing in North Augusta, South Carolina)	500-507
October 6, 1998 (public hearing in Rainsville, Alabama)	600-629
October 8, 1998 (public hearing in Evensville, Tennessee)	700-720
December 10, 1998, to December 17, 1998	200-255
December 14, 1998 (public meeting in Evensville, Tennessee)	800-835

Table 1-5 lists all commentors who made statements or submitted comments at the public hearings or during the public comment period and at the December 14, 1998, public meeting, including members of the public, representatives of organizations or agencies, and public officials. Commentors are listed alphabetically by their last name, along with the page on which their comments appear in Chapter 2, the numbers assigned to individual comments in each document or statement summary, the comment summary-response codes, and the page in Chapter 3 on which their comments are summarized and responded to by DOE and TVA. **Table 1-6** lists the Federal, state, and local officials and agencies, companies, organizations, and special interest groups that submitted comments. The commentors in Table 1-6 are listed alphabetically by organization, along with the names of the individuals who submitted the comments, the document number assigned, and the page on which the document appears in Chapter 2.

Table 1-7 is organized by comment summary-response code. Using the appropriate comment summary-response code, commentors can locate all of the comments that are reflected in each summary. The table also lists the page in Chapter 3 where each comment summary and corresponding response appears.

1.4 HOW TO USE THIS COMMENT RESPONSE DOCUMENT

This section will assist the reader in finding individual comments and the corresponding responses from DOE and TVA. The commentor begins by locating his or her name or organization in Table 1-5 or Table 1-6, respectively. Table 1-5 is an index of all commentors. Table 1-6 is an index of organizations and public officials. Both of these tables list the page number in Chapter 2 on which their comments appear. To locate other comments that address the same comment summary-response code, the commentor should use Table 1-7. This table lists the comment summary-response codes, the page in Chapter 3 on which the comment is addressed, and the other comment numbers addressed by each comment summary-response code.

For example, if Susan Gordon (commentor 137) wants to find her comments, she should go to Table 1-5 to find her name and the corresponding page in Chapter 2 on which her document appears. On page 2-101, Ms. Gordon would find her scanned document has been "side-barred" (published with vertical lines in the outer margin to identify individual comments) and her first comment has been coded for comment summary-response 08.02. Table 1-5 also provides Ms. Gordon with the number of comments identified, the comment summary-response code assigned to each comment, and the page number in Chapter 3 on which the corresponding comment summary and response are found. After obtaining the comment summary-response code from either the scanned document on page 2-101 or Table 1-5, Ms. Gordon would then turn to Chapter 3 to read DOE's response to her comment. Ms. Gordon could use Table 1-7 to locate other comments expressing similar concerns. For this example, comment summary-response code 08.02 on page 3-34 also addresses the following comments: 36-1, 41-4, 58-2, 103-3, 132-2, 136-3, 137-1, 211-3, 217-3, 252-3, 507-2, 707-7, 720-2, 800-9, and 803-3. These comments are listed numerically by commentor (first number followed by the dash) in Chapter 2.

1.5 Major Comments on the CLWR Draft EIS

During the public comment period, approximately 800 comments were received. An additional 230 comments were received in conjunction with the December 14, 1998, public meeting. Most of the comments focused on a limited number of major issues. These issues and DOE's responses as well as other related comments, are found in Chapter 3 of this volume and are summarized below.

By far, a majority of comments supported the completion and operation of the Bellefonte Nuclear Plant for tritium production because it would promote economic development in a depressed area and provide other, similar benefits. Other commentors generally opposed the completion of the Bellefonte plant as a nuclear power plant, particularly for tritium production. In response to these comments, DOE acknowledged there is both public support and opposition for the Bellefonte alternative. The CLWR EIS addresses all of the benefits cited by the commentors who favored the Bellefonte alternative, as well as the concerns expressed by opponents. DOE's responses to these and other related comments are found in Chapter 3, under Category 7: General Support/Opposition.

The cost-effectiveness of the CLWR and the Accelerator Production of Tritium (APT) alternatives was another frequent theme among many commentors. Most asked for cost-related information and/or expressed the opinion that cost should be the major determining factor in a tritium production decision. In addition, some commentors questioned the accuracy of the cost information that DOE provided at the public hearings and the December 14, 1998, public meeting, and many believed there was little possibility that TVA could complete the Bellefonte plant for the cost estimates cited. Other commentors stated they felt the large expenditures required for CLWR tritium production would be better spent on other, more urgent social needs such as education and environmental restoration. Some commentors were concerned about possible costs to TVA ratepayers resulting from tritium production.

In response to the cost-related comments, DOE stated that the CLWR EIS was prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's regulations on implementing NEPA (40 CFR 1500 through 1508), and DOE's NEPA regulations (10 CFR 1021). None of these regulations require the inclusion of a cost analysis in an EIS. As discussed in Volume 1, Section 3.2.1, the basic objective of the CLWR EIS is to provide the public and DOE decisionmakers with a description of the reasonable alternatives for CLWR tritium production and information about their potential impacts on public health and safety and the environment. While cost could be an important factor in the ultimate Record of Decision, the purpose of this and other EISs is to address the environmental consequences of the proposed action. However, DOE distributed cost information comparing the CLWR and APT alternatives (DOE 1998c) at the public hearings in October 1998, and this information is available upon request. In response to comments concerning the accuracy of TVA's cost estimates for completing the Bellefonte plant, DOE considers TVA's cost estimates to be both accurate and conservative, given that the plant is nearly complete and TVA's cost estimates were evaluated by an external reviewer. In response to comments that CLWR funds would be better spent on other, more urgent social needs, DOE noted that Congress determines how funds are allocated, and DOE does not determine Federal spending priorities. Furthermore, such spending priorities are beyond the scope of this EIS. In response to the concerns of TVA ratepayers about potential costs resulting from tritium production, DOE responded that no additional costs to ratepayers are expected. DOE's responses to the cost-related public comments are found in Chapter 3, under Category 23: Cost Issues.

Many commentors questioned the need for nuclear weapons and/or the present need for tritium. Other commentors expressed a belief that the amount of tritium needed to support current and future nuclear weapons stockpiles is less than the amount stated in the CLWR EIS. In response, DOE cited its responsibilities for maintaining the nation's nuclear weapons stockpile under the Atomic Energy Act of 1954 and the requirements of the 1996 Nuclear Weapons Stockpile Plan and accompanying Presidential Decision Directive, which established the size and composition of the nation's nuclear weapons stockpile and the need for a new tritium production source by approximately 2005. DOE stated that sufficient quantities of tritium can be obtained no longer from weapons being retired from the existing stockpile, as cited in the most recent Presidential Decision Directive. DOE's responses to comments concerning the need for tritium are found in Chapter 3, under Category 2: Purpose and Need for Tritium.

Several commentors expressed concern that tritium production in a commercial reactor would violate U.S. policy regarding the separation of commercial and military uses of nuclear energy, would hinder nonproliferation efforts, and would encourage other nations to use their own commercial facilities for nuclear weapons purposes. In response to these concerns, DOE cited the conclusions of a high-level study entitled *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress* (DOE 1998b). This interagency review concluded that any nonproliferation issues associated with the production of tritium in a CLWR were manageable and that DOE should continue to pursue the CLWR option, as stated in Volume 1, Chapter 1, Section 1.3.5. DOE also stated that there is no U.S. policy, law, or treaty that prohibits the production of tritium that ultimately will be used in weapons in a commercial reactor. In addition, DOE stated that the United States is a declared weapons state, and the purpose of nonproliferation efforts is to keep nonweapons states from acquiring nuclear weapons while the declared weapons states work toward total disarmament. DOE noted that other nations already operate dual-purpose reactors that serve both civilian and military needs. DOE's responses to comments on nonproliferation, the separation of civilian and military nuclear facilities, and other policy issues are found in Chapter 3, under Category 1: Policy Issues.

Many commentors were concerned about public and occupational health and safety issues. Some specifically questioned TVA's past history and practices related to plant safety. In response to these concerns, DOE stated that the environmental impacts and potential radiological doses to both workers and the public resulting from tritium production would be well below the limits considered acceptable by Federal and state regulatory authorities. Public and occupational health and safety issues are discussed in Volume 1, Chapter 5, of the CLWR EIS. DOE also stated that prior to irradiation of any TPBARs, a U.S. Nuclear Regulatory Commission (NRC) safety evaluation would be required to amend the operating license of the reactors for tritium production. This review specifically would look at all potential health and safety issues. DOE's responses to public and occupational health and safety comments are found in Chapter 3, under Category 14: Occupational and Public Health and Safety - Normal Conditions.

Several commentors stated that DOE has a history of polluting and contaminating every site they have operated and wanted to know why the proposed action would be any different. In response, DOE acknowledged having a number of older facilities in need of environmental cleanup, and an aggressive cleanup program is underway to upgrade these facilities and ensure their continued compliance with Federal and state regulations. All of the CLWR tritium production alternatives involve the use of state-of-the-art TVA reactors. These reactors have excellent environmental compliance records and exemplary environmental, health, and safety programs to ensure their continued compliance with Federal and state regulations. In addition, DOE expressed confidence that tritium production in a CLWR would be safe and is technically straightforward. To commentors who expressed concern that CLWR tritium production expenditures would drain DOE's budget for its facility cleanup activities, DOE responded that the funding for both of these programs would come from separate Congressional appropriations. Funding for CLWR tritium production would not be obtained from funding already allocated for facility cleanup activities. DOE's responses to comments about past DOE practices and conflicts between DOE's cleanup activities and tritium production are found in Chapter 3, under Category 8: Past DOE Practices.

Some commentors suggested that the CLWR EIS was deficient and inadequate as a NEPA document. In response, DOE stated that it believes that the EIS is adequate and fully complies with NEPA. The EIS evaluates all reasonably foreseeable environmental impacts for all reasonable alternatives, in accordance with the Council on Environmental Quality's regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. DOE's responses to NEPA-related comments are found in Chapter 3, under Category 5: NEPA Process.

Other commentors stated that the relationship between the CLWR, APT (DOE 1999a,) and Tritium Extraction Facility (DOE 1999b) EISs was not clearly explained in the CLWR Draft EIS. In response, DOE added a Preface to the CLWR Final EIS to better describe the relationship between the CLWR EIS, the APT EIS (DOE 1999a), and the Tritium Extraction Facility EIS (DOE 1999b) . This Preface also addresses Energy Secretary Richardson's December 22, 1998, announcement that the CLWR would be the primary tritium supply technology (DOE 1998d). DOE's responses to comments concerning the relationship between the CLWR, APT, and Tritium Extraction Facility EISs is found in Chapter 3, under Category 5: NEPA Process (comment summary-response code 05.01).

Several commentors were concerned about the additional spent nuclear fuel that would be generated by tritium production. DOE responded that additional spent nuclear fuel would be generated if more than 2,000 TPBARs were irradiated in a single reactor, as stated in Volume 1, Section 3.2.1, of the CLWR Final EIS. DOE also stated that the CLWR EIS evaluates the environmental impacts of additional spent fuel generation resulting from a maximum number of 3,400 TPBARs. DOE stated that it would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel. In the event a suitable repository is not available, as required by law, the additional spent nuclear fuel generated as a result of tritium production would be stored on site in a dry cask independent spent fuel storage installation. DOE's responses to spent nuclear fuel comments are found in Chapter 3, under Category 17: Spent Fuel Management.

Several commentors suggested that the production of tritium in a CLWR would make TVA reactors an attractive target for terrorists and that DOE should address the consequences of such an attack in the EIS. In response, DOE stated that, prior to loading TPBARs in TVA's Watts Bar reactor as part of the Lead Test Assembly Program, a thorough security review was conducted. This review found existing security provisions to be adequate to protect against such a threat. Prior to utilizing Watts Bar or other TVA reactors for tritium production, additional DOE and NRC reviews would be required to ensure adequate safeguard and security. DOE's responses to these and other security-related comments are found in Chapter 3, under Category 22: Safeguards and Security.

1.6 CHANGES FROM THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

In response to comments on the CLWR Draft EIS and as a result of information that was unavailable at the time of the issuance of the Draft, Volume 1 of the CLWR Final EIS contains revisions and new information. These revisions and new information are indicated by a double underline for minor word changes or by a sidebar in the margin for sentence or larger changes. A brief discussion of the most important changes is provided in the following paragraphs.

TPBAR Failures

In analyzing the potential releases of tritium to the environment from the proposed action, the CLWR Draft EIS assumed that two of the TPBARs under irradiation would fail and the entire inventory of tritium would be available to be released to the environment under normal operating conditions. The same two-TPBAR failure assumption was made in the analysis of transportation accidents. The assumption was based on the failure statistics of standard burnable absorber rods, i.e., two failures out of 29,700 rods through July 1980. Since the issuance of the CLWR Draft EIS, additional information obtained from Westinghouse revealed that both failures were attributed to early manufacturing defects that have been corrected. The failures were attributed to slumping of the absorber material--a condition that cannot occur in the TPBARs. Since the two early failures, more than 500,000 Westinghouse burnable absorber rods have been used without a single observed failure. Consequently, the CLWR Final EIS still analyzes the impacts to the health and safety of the public from the potential failure of two TPBARs, but characterizes the event of such a failure as an abnormal event during an irradiation cycle, rather than a continuous, normal-operation occurrence. This change in assumptions results in changes in the potential tritium releases and estimated doses to the public under normal reactor operation and some accident conditions (i.e., the nonreactor design-basis accident) for all reactor alternatives.

The Secretary's Technology Announcement

The CLWR Draft EIS was issued in August 1998. At the time, the decision on the primary and backup technologies to be used for tritium production had not been made. On December 22, 1998, Energy Secretary Bill Richardson announced that the CLWR would be DOE's primary option for tritium production and the proposed linear accelerator at the Savannah River Site would be the backup option (DOE 1998d). In addition, the Secretary designated TVA's Watts Bar and Sequoyah Nuclear Plants as the preferred CLWR facilities. The CLWR Final EIS was revised to reflect the Secretary's announcement decision and include the Preferred Alternative. Changes were made primarily in the introductory sections of the CLWR Final EIS for accuracy. The evaluation of the impacts was not affected.

Clarification of TVA Proposals

In response to public comments about the status of the TVA proposals to provide irradiation services or the sale of a CLWR, Volume 1, Section 1.1.4, of the CLWR EIS was revised. The discussion of the procurement process clarifies that DOE is considering only the purchase of irradiation services, not the purchase of a reactor. Additionally, the section clarifies that TVA submitted several proposals to DOE during the ongoing negotiations. An earlier TVA proposal for the use of Watts Bar expired. However, in December 1998, TVA submitted another offer to DOE to provide irradiation services at Watts Bar and Sequoyah, as well as additional proposals for Bellefonte. TVA's offer to provide irradiation services at one or more of the three proposed sites is still viable.

Nonproliferation Policy Issues

In response to public comments requesting DOE to provide examples of the commingling of civilian nuclear programs with military nuclear programs, Volume 1, Section 1.3.5, of the CLWR EIS was revised. The discussion of nonproliferation now includes an explanation and some background information on the issue, as well as examples of the commingling of civilian and military uses of nuclear power.

Water Quality Analysis

In response to public comments expressing concern about impacts to public water withdrawals downstream of the Bellefonte Nuclear Plant, sections of Chapters 4 and 5 in Volume 1 were revised. The discussions of surface water use for Bellefonte (Volume 1, Section 4.2.3.4) identifies nearby intakes downstream. The discussions of potential impacts to surface water near the three reactor sites (Volume 1, Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4) include the tritium concentration at various locations downstream. In addition, Volume 1, Section 5.2.3.4 was revised to include potential chemical concentrations downstream of Bellefonte.

Accident Analysis

During the preparation of the CLWR Final EIS, data related to the design and fabrication of the TPBARs indicated that the release of tritium from an accidental breach of a TPBAR more likely would be time-dependent than instantaneous and finite, as was assumed in the Draft EIS (PNNL 1999). Consequently, the analyses for the TPBAR handling accident and the transportation cask handling accident at the reactor site (Volume 1, Appendix D) and the transportation cask accident en route (Volume 1, Appendix E) were revised to reflect the more recent data.

Environmental Justice

Figures in Volume 1, Appendix G were revised to improve their quality. New figures were added to show the location of minority and low-income populations within a 16.1-kilometer (10-mile) radius. In addition, a representative average individual dose at 40.2 kilometers (25 miles) to each of the 16 principal directions has been overlaid onto the 80.5-kilometer (50-mile) radius to show the potential dose to minority and low-income populations.

Tritium Requirements and Supply

In response to public comments expressing concern about the disparity between the amount of tritium needed and the amount that could be supplied by one CLWR, Volume 1, Section 3.2.1 was revised. The discussion explains that the exact amount of tritium needed is classified information, however, for the purposes of analysis, it is not expected to exceed 3 kilograms per year (6.6 pounds per year). It further clarifies that one reactor with 3,400 TPBARs would be expected to satisfy a steady-state tritium requirement in most years.

Comparison of the APT and CLWR Alternatives

In response to public comments requesting additional information about the No Action Alternative, Volume 1, Section 3.2.6 was expanded to include a table comparing the impacts of producing tritium under the accelerator and CLWR options. A document comparing the costs of the technology options is available upon request from DOE (DOE 1998c).

Source of Uranium-235 for Tritium Production

In response to public comments concerning the source of blended-down uranium-235 that could be used as nuclear fuel for tritium production, Volume 1, chapter 5, Section 5.2.7 was revised for clarification. A discussion of the environmental impacts resulting from blending-down activities of highly enriched uranium was also added.

Mitigation Measures

The CLWR Draft EIS discusses the need for mitigation measures, if such need were warranted, right after the presentation of the impacts for each environmental resource,. A new Volume 1, Section 5.5 was added to the CLWR Final EIS to summarize these discussions.

Sensitivity Analysis

An additional variation from the baseline analysis has been included in Volume 1, Section 5.2.9 of the CLWR EIS, i.e., the possibility of producing tritium at some date later than 2005.

Miscellaneous Revisions and Editorial Changes

Several sections in the CLWR Final EIS were revised to reflect the availability of more recent data, or to include corrections to erroneous information, improvements in the presentation, and other editorial changes. None of these revisions affect the environmental impact assessment of the EIS. The sections with these types of revisions are:

3.2.3	Reasonable Alternatives
4.2.1.1	Affected Environment, Land Resources, Watts Bar
4.2.1.3	Affected Environment, Air Quality, Watts Bar
4.2.1.8	Affected Environment, Socioeconomics, Watts Bar
4.2.2.1	Affected Environment, Land Resources, Sequoyah
4.2.2.3	Affected Environment, Air Quality, Sequoyah
4.2.2.4	Affected Environment, Water Resources, Sequoyah
4.2.2.6	Affected Environment, Ecological Resources, Sequoyah
4.2.2.8	Affected Environment, Socioeconomics, Sequoyah
4.2.3.3	Affected Environment, Air Quality, Bellefonte
4.2.3.4	Affected Environment, Water Resources, Bellefonte
4.2.3.6	Affected Environment, Ecological Resources, Bellefonte
5.2.1.8	Environmental Consequences, Socioeconomics, Watts Bar
5.2.3.6	Environmental Consequences, Ecological Resources, Bellefonte
5.2.3.8	Environmental Consequences, Socioeconomics, Bellefonte
5.2.3.9	Environmental Consequences, Public and Occupational Health and Safety, Chemical Hazards, Bellefonte
	Environmental Consequences, Public and Occupational Health and Safety, Energizing Transmission Lines, Bellefonte
5.2.7	Fabrication of TPBARs
5.3	Cumulative Impacts
6.2.2	Environmental Protection Permits
6.3.1	Environmental Protection, Endangered Species Act
	Environmental Protection, National Historic Preservation Act
6.3.3	Worker Safety and Health
6.4	DOE Regulations and Orders
6.5.2.1	NRC Performance, Civil Penalties-Watts Bar 1
6.5.3.1	NRC Performance, NRC Notices of Violation and Enforcement Action, Sequoyah
Chapter 7	References
A.3.2	Physical Description of the TPBAR
Appendix B	Methods for Assessing Environmental Impacts
C.3.4	Radiological Releases to the Environment and Associated Impacts
D.1.1.10	Beyond Design-Basis Accident
G.5	Environmental Justice Analysis, Results for the Sites

Table 1–5 Index of Commentors

Name of Commentor	*Document or Statement Summary on Chapter 2 Page Number*	*Comment Number*	*Comment Summary-Response Code*	*Comment Summary and Response on Chapter 3 Page Number*
Abraham, Steve Distah, AL	2-22	38-1	07.03	3-31
Aderholt, Robert, U.S. Congressman Washington, DC	2-37	54-1	07.03	3-31
Aderholt, Robert, U.S. Congressman Washington, DC	2-194	609-1	07.03	3-31
Allen, Ronald Homosassa, FL	2-80	114-1	23.15	3-89
Ambrose, Jackie Huntsville, AL	2-20	35-1	07.03	3-31
Anderson, Charles	2-193	601-1	14.21	3-58
Anderson, Philip, Mayor Dutton, AL	2-38	55-1	07.03	3-31
Anderson, Philip, Mayor Dutton, AL	2-196	613-1	07.03	3-31
Anonymous Scottsboro	2-11	17-1 17-2	07.03 14.04	3-31 3-52
Anonymous (1)	2-17	28-1	07.02	3-30
Anonymous (2) Knoxville, TN	2-34	48-1 48-2 48-3	02.01 01.04 14.04	3-8 3-2 3-52
Anonymous (3)	2-54	79-1	07.03	3-31
Anonymous (4)	2-54	80-1 80-2 80-3	14.04 22.01 15.03	3-52 3-84 3-61
Anonymous (5) North Alabama	2-108	144-1	07.03	3-31
Anonymous (6) TN	2-127	228-1	07.03	3-31
Anonymous (7)	2-127	229-1	07.07	3-32
Anonymous (8)	2-128	230-1 230-2	07.07 23.23	3-32 3-91
Anonymous (9)	2-128	231-1 231-2	07.03 05.26	3-31 3-23
Arrington, James Spring City, TN	2-71	97-1	01.03	3-2
Barron, Lowell, State Senator	2-195	611-1	07.03	3-31
Beasley, Leroy Soddy-Daisy, TN	2-196	614-1	07.03	3-31
Beasley, Leroy Soddy-Daisy, TN	2-209	710-1 710-2	07.04 07.03	3-31 3-31

Name of Commentor	*Document or Statement Summary on Chapter 2 Page Number*	*Comment Number*	*Comment Summary-Response Code*	*Comment Summary and Response on Chapter 3 Page Number*
Belcher, Jeffrey Nashville, TN	2-16	27-1	18.09	3-75
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2. COMMENT DOCUMENTS

This chapter is a compilation of all the comments that the Department of Energy (DOE) received during the public comment period on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*. Comments received concerning the December 14, 1998, public meeting are also presented in this chapter.

All comments received during the public comment period are presented in this chapter in the order in which they were received and processed. Scanned images of documents received via U.S. mail, fax, e-mail, voice mail, or handed in at public hearings are presented first. These documents are followed by summaries of the comments made at the three public hearings and the public meeting. Numbers were assigned to each document and speaker, and these numbers are keyed to Table 1–5, the Index of Commentors.

The commentors are presented in this chapter in numerical order. Commentor numbers are listed at the top of each scanned image beside the name of the commentor and before the commentor's name in the public hearings/meeting comment summaries in the latter half of this chapter. Commentors who submitted comments during the public comment period are numbered 1-147. Commentors who submitted comments concerning the December 14, 1998, public meeting are numbered 200-255. Commentors who spoke at the public hearings are numbered 500-507 (October 1, 1998, North Augusta, South Carolina); 600-629 (October 6, 1998, Rainsville, Alabama); and 700-720 (October 8, 1998, Evensville, Tennessee). Commentors who spoke at the December 14, 1998, public meeting in Evensville, Tennessee are numbered 800-835.

The comments made by each commentor are identified by number and comment summary-response code in the right margin of each document and under the commentor's name in the public hearings/meeting comment summaries. The first number represents the comment number followed by a slash, and the other numbers represent the comment summary-response code. These codes can be used in Chapter 3 to locate the comment summary and response to each comment. Section 1.3 of this volume further describes the organization of this Comment Response Document and discusses the tables provided in Chapter 1 to assist the reader.

Commentor No. 1: Hank Tiller

THE SUPERIOR SALES FORCE
"Where only the best is good enough."
Allstate Insurance Company
Hank Tiller, Agency Manager
4810B Hixson Pike • Hixson, TN 37343
(423)877-6491

Allstate
You're in good hands.

TO: U.S. Department of Energy

FROM: Hank Tiller

COMMENTS:
Let's take this project to an accelerator in South Carolina. Tennessee doesn't need to produce tritium. 1/04.01

DATE: 8/21/98

NUMBER OF PAGES (Including this cover sheet) 1

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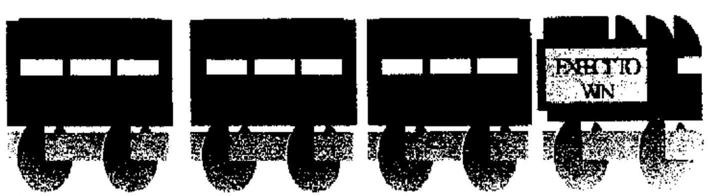
THE CHATTANOOGA LINE



HERE COMES THE SUPERIOR SALES FORCE

Commentor No. 2: Leah R. Karpen

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: 1. It goes against national policy to produce materials for weapons at a commercial reactor. 1/01.09

2. At a time when the U.S. should be reducing its nuclear stockpile, it is appalling to me that the Department of Energy is even considering manufacturing tritium. 2/02.01

3. The money that is being spent, and has already been spent, on this project could better be spent on housing and social needs. 3/23.13

4. I am completely opposed to the project at ANY site. 4/01.01

5. Why is the Government not listening to the people? 5/05.21

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (Mrs.) Leah R. Karpen (optional)
Organization: Women's International League for Peace and Freedom
Address: 400 Charlotte Street #803
City: Asheville State: NC Zip Code: 28801-1452
Work phone: ----- Home phone: 828-254-5489
Fax: 828-254-5489
E-Mail Address:

7/4/98

Commentor No. 3: R. P. Borsody

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: IN THE PAST DELIVERY SYSTEMS REQUIRED THE LIGHTEST POSSIBLE WARHEADS, ESPECIALLY WITH THE USE OF MULTIPLE WARHEAD PLATFORMS.
CURRENT TREATIES AND THOSE UNDER CONSIDERATION WILL LIMIT WARHEADS TO 1 PER MISSILE SO TOTAL THROW-WEIGHT CAN BE CALCULATED BY OTHER NATIONS.
IN SO MUCH AS OUR LAUNCH SYSTEMS CAN HANDLE THE INCREASED WEIGHT, BOOSTING USING TRITIUM IS NO LONGER NEEDED. THE REMOVAL OF WARHEADS AS THEY ARE DECOMMISSIONED WILL FREE UP A LOT OF LONG-LIVED RADIOACTIVIES WHOSE USE IS ONLY GOOD IF PUT BACK INTO WARHEADS. 1/01.03

IT IS FOR THESE FACTS THAT I PROTEST THE USE OF TRITIUM AND THE SPENDING OF FUNDS TO CREATE MORE OF IT. 2/23.13
SIZE OF WARHEADS YIELDS CAN BE BEST SERVED BY USING LONG-LIVED RADIOACTIVIES INSTEAD OF TRITIUM BOOSTING. 1(cont'd)

THANK YOU FOR ALLOWING ME TO COMMENT ON THIS SUBJECT. I WAS INVOLVED WITH NUCLEAR WEAPONS FOR A SHORT WHILE WITH THE USAF AND HOPE TO ONE DAY SEE THEM REMOVED FROM A 1st STRIKE CAPACITY.

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: R. P. Borsody (optional)
Organization: S.P.A.C.E. - P.S.I.
Address: PO Box 1036
City: DACULA State: GA Zip Code: 30019
Work phone: Home phone: 770-277-6902
Fax:
E-Mail Address:

7/4/98

Commentor No. 4: W. Lee Poe, Jr.

807 E. Rollingwood Rd.
Aiken, S. C. 29801
August 28.1998

Mr. Jay Rose
Office of Defense Programs
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, D. C. 20585

FAX 1-800-631-0612

Attn: CLWR EIS

Dear Mr. Rose:

Re: Preliminary Information on CLWR EIS in Preparation for Public Meeting

I would like to thank you for scheduling a public meeting on this EIS in North Augusta, S.C.. I look forward to attending the meeting on October 1, 1998. When I received the draft EIS earlier this week, I immediately read it with great interest. I found several areas so far in the D-EIS that I wish you would supply me additional information on before the October 1 meeting. It would make your intended meeting more valuable to me. The areas of information are described below.

1) In the Summary volume, you indicated that there was an EIS prepared to evaluate the conversion of Bellefonte to fossil fuel. Please send me a copy of the EIS (title apparently is "Final Environmental Impact Statement for the Bellefonte Conversion Project") and a copy of the ROD associated with this EIS. 1/05.22

2) I would also like you to send me information on the lead test assembly program. In particular I would like information on:
   - What was done in the PNNL tests to show that the tritium targets are satisfactory targets and they do not leak tritium during irradiation and the tritium can be quantitatively recovered and a copy of those results. 2/19.02
   - Information on the structural design to keep the TPBARs stable in the reactor. (The figures shown in the CLWR EIS make this target design look as if it is a cantileverd-top-attached target. This makes me conclude it is subjected to damage during irradiation from water flow vibration.) 3/19.03
   - Information on the benefit DOE or TVA have obtained and expects to obtain from the Watts Bar irradiation. (For example, has the Watts Bar effluents increased in tritium releases since the TPBAR irradiation was started?) From the 4/05.10

Commentor No. 4: W. Lee Poe, Jr. (Cont'd)

information contained in Section S.1.6.1.2, irradiation tests started in September 1997 and with an 18 month irradiation cycle should be discharged in March 1999. This discharge is after the scheduled time for the Secretary of Energy decision that I read so much about in the local newspaper that affect the APT and the CLWR EISs and the Tritium Extraction EIS. What I hear quoted is a decision in December 1998. *4 (cont'd)*

3) DOE has linked the tritium production EISs together. This action is made obvious in that the CLWR EIS has as its no action alternative the APT production and the FEIS on the APT seems to show the No Action to be production in the CLWR. No where have I seen a real no action alternative. (The draft APT EIS had a sort of No Action Alternative but it was removed in the final EIS.) Coupling this to what I read about the Secretaries decision coupling these two EISs and the Tritium Extraction EIS makes the public wonder about NEPA linking. Please provide me information on why this approach has been made by DOE. *5/05.01* *6/05.02* *5 (cont'd)*

4) Section S.1.5.4 describes nonproliferation considerations. In my hurried review of the body of the EIS, I was unable to find more information. Please provide me with Congressional or Presidential positions on this subject at the time AEC regulatory authority was given to the NRC and the rest of military support mission was given to ERDA and then DOE. It seemed to me this was the time that the decision to separate commercial power from weapon production was made. *7/01.08* Also provide me with information on the decision to produce power in the dual purpose N-Reactor. {It seems quite a different thing to produce electric power in a government reactor that has a primary mission to produce weapon material than producing tritium (a weapon material) in a commercial reactor.} That latter point seems to be DOE's justification in the referenced section. Also please provide me whatever recent nonproliferation studies that relate to this point. Is it logical to initiate use of commercial reactors to produce weapon materials now that DOE doesn't have that capability within the Department? *8/01.09*

5) I hope that DOE will have tables at the public meetings that compare the impacts of producing tritium in CLWR and the APT. It seems to me that is one of the major comparative assists in the NEPA decision on this EIS and on the APT EIS. *9/04.03*

6) The one thing that has made the local press lately is the CLWR and APT costs. Seems to be a large argument on the subject. Please provide me some early information that will help me understand the issue. Also please send me both cost analyses on the same basis. If they are not on the same bases, please identify for me the differences and DOE's estimate of how those differences play into the cost judgments. *10/23.15*

Sincerely

W. Lee Poe, Jr.

W. Lee Poe, Jr.

Commentor No. 5: G.J. Billmeier, Jr., M.D.

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: THE DOE CLAIMED IN 1988 THAT NATIONAL SECURITY WOULD BE JEOPARDIZED IF TRITIUM PRODUCTION DID NOT RESUME SWIFTLY. HOWEVER NO CRISIS HAS RESULTED. THE CURRENT CLAIM BY DOE TO RESUME TRITIUM PRODUCTION AT AS MANY AS 5 REACTOR SITES WOULD LIKELY COST TENS OF BILLIONS OF DOLLARS TO SUPPLY OUR CURRENT ARSENAL OF SOME 23,000 WARHEADS.
THE CONGRESSIONAL RECORD OF JUNE 17, 1992 (VOL 138 NO. 87) STATES IN PART "THE TIME HAS COME WHEN WE ARE SHIFTING DECISIVELY AWAY FROM A HALF-CENTURY OF GROWING DEPENDENCY ON NUCLEAR WEAPONS — OUR OBJECTIVE SHOULD BE TO CURTAIL NUCLEAR WEAPONS' FUNCTION IN MILITARY DOCTRINE, TO HOLD OPEN RATHER THAN SEAL OFF OPTIONS FOR FURTHER REDUCTIONS IN NUMBERS OF NUCLEAR WEAPONS — TO SHARPLY CUT BACK ON TESTING TO A LEVEL ABSOLUTELY CONSISTENT WITH NO MORE THAN THE MINIMUM REQUIRED FOR SAFETY & RELIABILITY, AND TO EVENTUALLY SUSPEND PRODUCTION OF BOMB-GRADE FISSIONABLE MATERIALS UNDER THE TERMS OF AN INTERNATIONAL AGREEMENT." (US SENATE COMMITTEE ON ARMED SERVICES) *1/02.01*
WE NEED TO BAN PRODUCTION OF ALL BOMB MATERIALS INCLUDING TRITIUM. ANY CONTINUATION OF SUCH PRODUCTION CARRIES HIGH RISK POTENTIAL FOR BOTH ENVIRONMENTAL HAZARD & NUCLEAR WAR. *2/01.01*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: G.J. BILLMEIER, JR MD (optional)
*Organization: PHYSICIANS FOR SOCIAL RESPONSIBILITY
Address: 6248 POPLAR AVE.
City: MEMPHIS State: TN Zip Code: 38119
Work phone: 901-761-1880 Home phone:
Fax: 906-683-2048
E-Mail Address:
*AMERICAN ACADEMY OF PEDIATRICS
*INTERNATIONAL PHYSICIANS FOR THE PREVENTION OF NUCLEAR WAR 7/4/98

Commentor No. 6: Clark Coan

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments:

The No Action Alternative is clearly the preferred alternative for the following reasons:

(1) The probability of new arms control agreements providing for substantial cuts in the number of nuclear weapons deployed is high. The Abolition 2000 movement, which calls for a Nuclear Weapons Convention phasing out nuclear weapons, is gaining momentum, particularly after the testing by India and Pakistan. Furthermore, the near-launch of nuclear weapons in January, 1995 by the Russians is giving impetus to de-alerting the strategic forces (removing warheads from delivery vehicles to prevent accidental launches). Thus, the need for tritium (assuming continued recycling of the gas from decommissioned warheads) will decline rapidly in the next few years negating the need for new production. **1/02.01**

(2) The Savannah River Reservation is already severely contaminated with radioactive materials and has to be considered a national sacrifice zone along with Hanford in Washington State. If the National Security Council and the DOE decide to proceed with new tritium production, there is no reason to sacrifice another region of the nation. The human populations and biosphere near Savannah River have already been negatively impacted. There is no valid reason to subject the people and ecosystems of Eastern Tennessee and Northern Alabama to additional exposure to radioactivity. **2/04.01**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

OVER

(optional)

Name: MR CLARK COAN
Organization: THE SOUTHWIND GROUP
Address: PO BOX 44-2043
City: LAWRENCE KS 66044
Work phone:
Fax:
E-Mail Address:

AUG 24 '98

7/4/98

3) The barrier between civilian commercial nuclear power and production for military needs should not be breached. If it is, civilian reactors become targets for attack by terrorists and foreign powers. **3/01.09** **4/22.01**

Commentor No. 7: Nathan Coggins

Nathan & Kathey Coggins Family
255 Taylor Bridge Rd
Jonesborough,TN 37659

7/29/98

U.S. DOE
Commercial Light Water Reactor Project
Attn: Steven Sohinki
POB 44539
Washington, DC 20026-4539

RE: Response to mailing 7/15/98

Gentlemen:

I am sorry I was unaware of the comment period which I could have overlooked. I imagine a response at this time would be to no avail. As a response at anytime from a non influential taxpayer such as our family, is in my opinion to no avail.

For what it is worth, DOE & TVA should not mix power generating with weapons production. **1/01.09** Plus how many times will we need to destroy the world. Is not the old technology that used Plutonium and Uranium to destroy Nagasaki and Hiroshima sufficient to destroy our next target? Is the tritium use only job security as it only last a short while? **2/01.01**

This stuff is way over my head but I personally detest the waste that goes on at both agencies. When I see my small savings account depleted for taxes. Then hear stories of Westinghouse soaking the govt for 4 billion over 4 yrs to start a reactor at Savannah River and 100 million for a cooling tower that was used for only three months. Plus hiring soviet Nuclear Engineers to keep them from going to work for some other country.

All these efforts to show strength to would be attackers from foreign countries may be a waste of time if the unrest within the U.S. is overlooked. The projected cost of 384m will be exceeded by who knows how much.

We work hard, try to live right and be honest enough to pay for our fair share of being a US citizen and it hurts deeply when we see all the waste and injustices that takes place. I ask you to please become a productive member of our society and stop fleecing the taxpayers. When you are lobbying to spend these millions, billions. Please think of our family who shops at yard sales for clothing for our kids and raises a garden and cans food for winter. Not because we necessarily have to but because it is being a good steward of the money that has **3/23.13**

Commentor No. 7: Nathan Coggins (Cont'd)

been entrusted to us by God. How much greater is your responsibility to be frugal with hard working taxpayers money. | 3 (cont'd)

Sincerely,

Nathan Coggins

Commentor No. 8: Charles F. Evans

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I would like to see Bellfonte completed as a Tritium plant. It would help us and the Gov. The light water reactor would supply power that we need. If you go with S.C. it would be all cost and no help to this area. | 1/07.01

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Charlie F Evans (optional)
Organization: Boilermaker's Local 454 Chatt, TN
Address: 385 County Rd 231
City: Hollywood, AL State: AL Zip Code: 35752
Work phone: 423-756-6000 Home phone: 256-437-2403
Fax:
E-Mail Address: CHUCK EV@ BELLSOUTH.NET

7/4/98

Commentor No. 9: Leah R. Karpen

Leah R. Karpen
400 Charlotte St #803
Asheville NC
28801
Phone: 828-254-5489
FAX: 828-254-5489
email:

Wednesday, August 12, 1998

Mr. Stephen M. Sohinki, Director
Office of Commercial Light Water
Reactor Production
P.O. Box 44539
Washington, DC 20026-4539

Der Mr. Sohinki:

Production of Tritium

When I received your letter of July 15, 1998, I was appalled to learn that plans are proceeding for producing tritium. Further, to produce it in commercial light water reactors goes against national policy, which separates military production from commercial. *1/01.09*

There has been no castablished need for tritium. The United States should be reducing its nuclear stockpiles rather than adding to or replenishing them. *2/02.01*

Therefore, I oppose the project in totality.

Sincerely yours,

Leah R. Karpen

Leah R. Karpen

P.S. Please send me notice of meetings on the draft EIS.

Commentor No. 10: Rick Paschal

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I would first like to emphasize that I no longer do any pipe work and have been in automobile sales business for the past five years. Also I live only 5 miles (as the crow flies) from the Bellefonte plant. I just want you to understand that I still will probably (not return) to the construction trade of pipe fitting which keeps me from being totally biased. I'm still partially biased because of the economic impact because I do live in this area.

After reading the summary of the Draft Env. Impact Statement it would seem to me that Bellefonte 1 + 2 are the (ONLY) logical places to produce the tritium. I noticed the low impact on the environment and the social impact and that is good but the most favorable thing I read is how Bellefonte (1 + 2) can be finished in the construction stage to facilitate the needs of a tritium producing plant which would [illegible] make Bellefonte 1 + 2 the (ONLY) logical choice to make! *1/07.03*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: RICK PASCHAL (optional)
Organization: L.U. # 498
Address: 363 Co Rd 59
City: Dutton State: AL Zip Code: 35744
Work phone: 256-657-2143 Home phone: 256-657-2143
Fax: 256-657-5593
E-Mail Address: RPASCHAL @ HiWAAY.net

7/4/98

Commentor No. 11: Sharon & Gerry Thomas, Jr.

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: My husband or myself is not for using Bellefonte for production of tritium. I had rather it be used for a natural gas facility. I dont want this in my backyard or area. Its come in our ~~[illegible]~~ drinking water. **1/07.06** **2/14.04**

Natural gas facility is what we need. **1(cont'd)**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Sharon & Gerry L. Thomas, Jr. (optional)
Organization: ——
Address: 4488 CO. Rd. 81
City: Flat Rock State: Al. Zip Code: 35966
Work phone: Home phone: (256) 632-2231
Fax:
E-Mail Address:

7/4/98

Commentor No. 12: Joyce Coffey

Comments Received via "800" Number

Date:	Aug 31, 1998 (7:08pm)
Name:	Joyce Coffey
Organization:	
Address:	624 "Chalsey" Road 141 Hollywood, AL 35752
Phone #:	(256) 437-8027
Fax #:	
Comment #:	

Comment:

I'm calling to make a statement against tritium at Bellefonte. I am a school teacher that teaches on the mountain above Hollywood and I live near Hollywood. Any, any, any chance of radioactivity being loose in the area is unacceptable--our jobs are not needed that badly. If we need jobs and need to use the plant which has sat idle for a number of years, the natural gas project would be the only acceptable way to go for the residents of this area. We were told when a paper-mill moved into the area that we would have no smog and no odor; however, in our beautiful valley, when there's fog, we have odor. We certainly do not need another plume to desecrate this beautiful valley. Thank you. **1/.07.03** **2/14.04** **3/07.06** **4/10.01**

Commentor No. 13: Suzanne Marshall

September 15, 1998

U.S Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
P.O. Box 44539
Washington, DC 20026-4539

Dear Mr Sohinki,

I write in opposition to production of tritium in any TVA commercial light water reactor in the U.S. Your Draft Environmental Impact Statement on the Production of Tritium in a Commercial Light Water Reactor does not protect completely the health of the public or the environment from the effects of tritium, a radioactive form of water that can flow through the food chain, emit radiation into ecosystems, plants, animals and humans. It can then cause cancers, genetic **1/14.04**

mutations and problems in unborn babies. *There is no safe dose.* The only way to avoid the lethal effects of tritium and other nuclear wastes is to halt all production of these substances and their waste. AND since all of the DOE's former tritium production plants have had accidents resulting in leaks into the environment, there is no doubt that commercial reactors inherently unsuited for weapons production will leak and destroy the Tennessee River, the Tennessee Valley and our lives. **2/15.03**

Tritium production is not needed. Tritium from old warheads can be recycled which will serve to maintain our arsenal until 2015. With continued arms negotiations, even less tritium will be **3/02.01**

needed in the future. Certainly, commercial reactors were not designed for any phase of weapons production. Producing tritium at commercial plants like at Bellefonte, AL or Watts Barr, TN would lead to increased safety and security issues that cannot be adequately addressed **4/22.01**

I implore you to halt plans for tritium production in any TVA or any commercial reactor. It is not safe **2(cont'd)**

and it will violate the Atomic Energy Act, the intent of which was to keep commercial and nuclear power separate for reasons of non-proliferation, safety and security. **5/01.09**

Sincerely,

Suzanne Marshall

Suzanne Marshall
700 8th Avenue NE
Jacksonville, Al 36265

256-782-0424

Commentor No. 14: Peter Gray

Peter L. Gray
P. O. Box 968
Aiken, SC 29801

October 16, 1998

"Production of Tritium in a Commercial Light Water Reactor"
draft DOE/EIS - 0288D

There are three reasons for not using a Commercial Light Water Reactor to make tritium.

Non-proliferation is the first reason. We should set an example for the world not to make weapons in civilian facilities. It is U.S. policy that separation of civil and military facilities be maintained.

We accept the concept of peace coming from war, but not the reverse. Using facilities originally developed for military missions later on for civilian purposes is acceptable. In this EIS, DOE cites four examples of this:

- "N-Reactor at Hanford" started life as a military facility to make plutonium and later make electricity. This is not comparable to converting a civilian LWR to make tritium.
- "The dual use nature of the U.S. enrichment program" It made U-235 for bombs. Later, it supplied civilian LWRs and research reactors.
- "The use of defense program plutonium production reactors to produce radio-isotopes for civilian purposes" Radio-isotopes are a boon to civilian life in the U.S.
- "The sale of tritium produced in defense reactors in the U.S. commercial market" Self-powered exit lights on aircraft to guide passengers in an emergency and other civilian uses come from these sales.

All of these go in the "military-to-civilian" direction. Notice that DOE does not cite any example of going in the "civilian-to-military" direction.

All DOE does on the non-proliferation is use rather legalistic, hairsplitting language to say it's okay.

The bible says in Isaiah 2-4: "they shall beat their swords into plowshares."

Can you imagine telling North Korea to end their nuclear weapons program, giving them two CLWRs if they do so and then we make tritium in a U.S. CLWR? What about setting examples for Pakistan, India and other countries? We need to espouse actions on a high moral, ethical plane. We must not use legalistic loopholes to attempt to justify what we and DOE both know is wrong.

DOE must not use any U.S. Commercial Light Water Reactor for future tritium production, whether owned by a private company or by the TVA, whose whole history is one of civilian projects. Sure, the TVA sold electricity to the Oak Ridge Gaseous Diffusion Plant, but other vendors sold pipe, concrete, motors, instruments, etc. Doing so does not turn them into military facilities. The ownership of TVA by the U.S. government does not justify calling a TVA reactor a military installation, nor does the question of who bought its electricity. **1/01.09**

Licensing Delays is the second reason. When the AEC was split up in the 1970s, production went to DOE. NRC got licensing and oversight of civilian facilities. One facet of the split was to not hamstring our military complex with licensing issues and delays. The civilian nuclear electric industry is rife with NRC delays. What makes the DOE think that the NRC will not delay any DOE defense programs assigned to a CLWR? **2/21.05**

Notice that these first two reasons for not using a CLWR apply only to a CLWR but not to the accelerator. It is not encumbered with either non-proliferation issues or licensing problems.

Commentor No. 14: Peter L. Gray (Cont'd)

The third reason to reject the CLWR, and DOE's other option, the accelerator, is discussed immediately below. It applies equally to both of these options.

Cost is the third reason. The CLWR might cost about $2 billion or more and the accelerator about $2.5 to 4.5 billion. If cost is to be the real discriminator, the DOE owns another, considerably less expensive tritium production concept. One that will cost about $600 million. Or less than 1/3 of either of the DOE's current choices.

DOE recently stated:

> "The department is committed to doing a comprehensive, unbiased analysis of the various options for tritium production. Then-Acting Secretary Moler insisted that the decision be made on its merits (underlines are mine)."

DOE is studying the CLWR and accelerator, but they own a third option and are ignoring it. It was invented in January 1992 but was covered up by the SRS prime contractor. It never received a review of its merits:

1. *Safety* The unit is passively safe. It eliminates or reduces significantly all Design Basis and Severe Accidents.
2. *Small* It would require about 20 acres compared to 500 for the accelerator.
3. *Proven* All parts of the design have been proven through many years of use in the nuclear field.
4. *Environmentally Friendly* It would use about 15 MW of electric input, not 600 with the accelerator, thus generating considerably fewer greenhouse gases.
5. *Lowest Cost* Four comparable designs have been costed. Extrapolation indicates about $600 million for this unit.
6. *Radiopharmaceutical Production* This unit can make all the radioisotopes the U.S. desires and now buys from Canada because we've never had that capacity within our borders.

Following an EIS-0161 meeting in April 1995, DOE committed in its EIS answers in October 1995 to consider this design. But they have not done so. In conversations with senior persons, I've learned that most do not even know of its existence. I've requested objective, technically-based, independent, non-biased reviews of it. The requests have been denied.

As a taxpayer, I object. I challenge the DOE to follow through on its 1995 commitment to this unit. It deserves a full review. It should be used for new tritium production in the U.S. Its cost is the lowest. 3/04.02

Final Non-Proliferation Comment Special Nuclear Material (SNM) includes highly-enriched uranium and plutonium but not tritium. Tritium is called "by-product" material. DOE rests part of its case on the basis of this definition to say using a CLWR is not contrary to non-proliferation policy. This is a very specious argument. All nuclear weapons in the U.S. arsenal need a fissile component (either uranium or plutonium). They also need a fusion component, tritium; that is why DOE is planning to make more. Semantic definitions cut no ice. Sure, tritium is not fissile, but it does undergo fusion. What, really, is the difference? Call tritium SNM. Stop playing word games. 1(cont'd)

Conclusion Non-proliferation issues, possible licensing delays and cost dictate against a CLWR. Low cost also dictates against the accelerator. Low cost certainly favors SRS and the 1992 design.

So, is it 2 billion for TVA, 2.5 billion for an accelerator or 600 million for this DOE-owned idea?

Use the SRS with nearly 45 years of tritium experience where we are ready to serve the nation again; capably, safely, efficiently, cost-effectively and in an environmentally sound manner. 3(cont'd)

Sincerely,

Peter Gray

Commentor No. 15: Betty Hasty

and Editor | 259-1020 Ext. 25 | Sunday, August 30, 1998

The Daily Sentinel - Scottsboro Newspaper

COMMERCIAL LIGHT WATER REACTOR PROJECT

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- **calling toll-free and leaving your comments via voice mail, 1-800-332-0801**

Comments: ① I believe the completion of BLN for anything other than Nuclear Power will be a gross waste of already spent billions of tax payer dollars. ② I prefer to leave tritium away from BLN but could accept it if needed. 1/07.03 ③ John Robinson is a fine man and a good representative for Jackson Co. in all other respects but, I believe his wife's family history of personal animosity toward TVA/BLN, (and the location of his home) negates him as the district representative for or against TVA/Bellefonte Nuclear Plant.

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Betty S. Hasty (optional)
Organization: Ret. TVA/BLN Employee
Address: 1608 E. Ridge
City: Scottsboro State: AL Zip Code: 35768
Work phone: N/A Home phone: 256-574-6412
Fax:
E-Mail Address: Cc JOHN FRANK HURT etc. (Mrs Robinson's Relatives)

Commentor No. 16: Cameron G. Sherer

COMMERCIAL LIGHT WATER REACTOR PROJECT

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- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: The Tritium Accelerator has several advantages over the production of Tritium in a Commercial Light Water Reactor. Some of those advantages are no nuclear waste, no spent fuel rods to store and protect, safer process, provide isotopes for medical purposes, politically acceptable. 1/04.01

Please consider the Accelerator option over the CLWR. I appreciate the DOE in allowing public comment on this issue.

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Cameron G. Sherer (optional)
Organization: Westinghouse Savannah River Co.
Address: 4634A Hardy McManus Rd.
City: Evans State: Ga. Zip Code: 30809
Work phone: (803) 952-4954 Home phone: (706) 863-9489
Fax:
E-Mail Address:

7/4/98

Commentor No. 17: Anonymous

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I think the best thing to do with the BelleFonte is to tear it down and spend no more money on that project. I personally don't want the production of Tritium on that property. Believe me, the ones that want it is just for the money that contractors pay them under the table. 1/07.03

Probably with your knowledge. My answer is no. I don't want my drinking water polluted with that kind of plant. You wanted input, and I'm giving it. I will not give my name yet, but I do live in the city limits of Scottsboro, AL. 2/14.04

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization:
Address:
City: Scottsboro State: AL Zip Code: 35769
Work phone: Home phone:
Fax:
E-Mail Address:

Mail to:
U.S. Department of Energy, Commercial Light Water Reactor Project Office,
ATTN: Stephen Sohinki
P.O. Box 44539,
Washington, D.C., 20026-4539

Commentor No. 18: Elizabeth R. Brown

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I don't want DOE to build an Accelerator at S.C. 1/04.01

I'm also against opposed to irradiated TPBAR assemblies being transported from CLWR sites to the SRS for tritium extraction, etc. and also to the radioactive waste that is associated with these, being transported for disposal at the SRS, or the Barnwell "dump" site. 2/08.01 3/18.08

Since the "clean-up" work (to repair environmental damage and stabilizing nuclear materials) at the Savannah River Site facility doesn't seem to be accomplishing its goal, and supposedly cost over $44 Billion, and take 40 years to complete, our State doesn't need any more nuclear/radioactive waste to be stored here. 2(cont'd)

As a lay person I'm concerned with environmental factors, the health and safety of the population along the transport routes, but particularly it folks near the vicinity of the Savannah River plant site, now and for future generations. But also monetary costs. 4/18.11

Finally I don't want South Carolina to become DOE's or anyone else's "dump" or storage facility for nuclear and radioactive waste. The cleanup work would never be completed. (Thank you) 2(cont'd)

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Elizabeth R Brown Past Chr Legislative Action Committee (optional)
Organization: SPEEII, Charleston Academy
Address: 12 Yeaton Ave.
City: Charleston State: S.C. Zip Code: 29407
Work phone: — Home phone: 843-763-6544
Fax: —
E-Mail Address: —

9/7/98

7/4/98

Commentor No. 19: R. C. Dawson

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: Rather than continuing the maintenance of an expensive and probably illegal stockpile of weapons of mass destruction, stop making tritium altogether, let the weapons become ineffective.

THAT WOULD HAVE A POSTIVE IMPACT ON THE ENVIRONMENT. 1/01.01

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: R. C. Dawson, 1874 Avon St, Los Angeles CA 90026-1832 (optional)
Organization:
Address:
City: State: Zip Code:
Work phone: Home phone:
Fax:
E-Mail Address:

7/4/98

Commentor No. 20: Joan O. King

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments:

I have followed nuclear issues for a number of years and have a fairly extensive layman's knowledge of what is involved. I am very concerned at any move on the part of our government that violate lines set up by President Eisenhower at the end of World War II separating commercial and military nuclear programs. I am not convinced there is any pressing need for tritium. Future military needs can be handled within the military establishment. *1/01.09* *2/02.01*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: JOAN O KING (optional)
Organization: LWV - OTHERS
Address: 304 Manor Drive
City: Sautee State: GA Zip Code: 30571
Work phone: 706-878-3459 Home phone: same
Fax: same
E-Mail Address: joank @ stc.net

7/4/98

Commentor No. 21: Mrs. W. H. Robinson

ner and Editor 259-1020 Ext. 25 Sunday, August 30, 1998

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- **faxing your comments to 1-800-631-0612**
- **commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62**
- **calling toll-free and leaving your comments via voice mail, 1-800-332-0801**

Comments: NO to Tritium!

No to Tritium! *1/02.01*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Mrs W. H. Robinson (optional)
~~Organization:~~ Personal
Address: 1756 Skyline Dr.
City: Scottsboro, AL State: Zip Code: 35768
Work phone: Home phone: 259-5342
Fax: Robinson
E-Mail Address: 1756 Skyline Shores Drive
Scottsboro, AL 35769

Commentor No. 22: C. S. Sanford

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: p. 25, par. 2 states that Watts Bar 1 radiation exposure within 50 miles is 0.55 person-rem/yr. How was this value derived? 1/14.07

p. 5-33, Watts Bar 1 - radioactive effluent is given as 14,850 curies per year. Is the surface water impacted by this effluent and, if yes, then why is not there a change to water quality conditions? 2/11.08

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: C. S. Sanford (optional)
Organization: S & A
Address: 1803 Primrose Ave
City: Nashville State: TN Zip Code: 37212
Work phone: Home phone: 615-383-8428
Fax:
E-Mail Address:

7/4/98

Commentor No. 23: Bob Schowalter

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I have reviewed the draft EIS and know a little bit about the proposal for TVA to use Bellefonte NP to produce tritium for DOE.

It seems to me that it is the logical way to go. Bellefonte is a govt facility with billions of dollars already invested. As I understand it it will cost DOE less to help pay for completing Bellefonte than the other alternative. Plus DOE will get a share of the power revenues. From an economic standpoint it seems to ~~like~~ be an obvious choice. 1/07.03

I know there are other considerations. The fuel rods would have to be transported to S.C. to remove the tritium, as I understand it, and this would involve some risk. I think they would have to be transported somewhere anyway for disposal, so I don't know how much additional risk is involved. 2/18.01 I understand there are political considerations involving the use of a commercial reactor for making the tritium. So what! TVA is a creature of the federal govt. They have provided power for military purposes and to support atomic energy programs for more than 50 years. 3/07.02

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Bob Schowalter (optional)
Organization: TVA
Address: 11608 Midhurst Dr.
City: Knoxville State: TN Zip Code: 37922
Work phone: (423) 673-2257 Home phone: (423) 966-6016
Fax: 2210 (work)
E-Mail Address:

P.S. I was an HVAC design engineer on Bellefonte many years ago, and I think it's a shame to not use a valuable asset like Bellefonte.

7/4/98

Commentor No. 24: Denny R. Stiefel

COMMENT FORM

COMMERCIAL LIGHT WATER REACTOR PROJECT

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I attended the meeting about Bellefonte in [illegible] at the [illegible] county. I would very much like the Bellefonte nuclear plant to be complete. The people here want the plant here. We have the qualified people to complete the plant & we need the jobs. **1/07.03**

Sincerely,

Denny R. Stiefel

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Denny R. Stiefel (optional)
Organization: pipefitting [illegible] 1969 Local Union 498
Address: 1475 Co. Rd 538
City: Fyffe, Al State: Al Zip Code: 35971
Work phone: 256-546-6791 Home phone: 256-623-6164
Fax:
E-Mail Address:

7/4/98

Commentor No. 25: Rhonda D. Wright, M.D.

Rhonda D. Wright, M. D.

3363 Narrow Lane Road
Montgomery, AL 36111-1507

Phone (334) 286-4894
e-mail rdwright@aol.com

September 06, 1998

Mr. Stephen Sohinki
U. S. Department of Energy
Commercial Light Water Reactor Project Office
P. O. Box 44539
Washington, D. C. 20026-4539

Dear Mr. Sohinki:

This letter is in opposition to the proposal to use the TVA's unfinished Bellefonte plant, or any other commercial nuclear reactor, for the production of tritium. I regard this as a dangerous and highly undesirable course of action for several reasons.

The first is the ability of tritium as an isotope of hydrogen to combine with oxygen and make a radioactive form of water, which can then become incorporated into all parts of the human body including DNA. In concert with the DOE's demonstrated inability to prevent tritium-releasing accidents at its other production facilities, there is a near-certainty that tritium production at the Bellefonte plant would result in radioactive contamination of the Tennessee River and in a seriously increased risk of cancer and birth defects to those whose drinking water is derived from this river. Such accidents are all the more likely to occur at a facility which was not designed for this purpose from the beginning. **1/15.02**

The second reason is that production of tritium at a commercial nuclear plant will result in the production of much more nuclear waste -- three times more high-level waste than the plant would produce under normal operating conditions, by the DOE's own estimate, and at least 50% more low-level waste as well. **2/17.02** Disposal of nuclear waste is already a serious problem, one which this proposal can only exacerbate. **3/16.05**

The third reason is that production of tritium in a commercial facility violates the spirit, if not the letter, of the Atomic Energy Act and sets a bad precedent with regard to entanglement of civilian and military nuclear facilities. This action will make meaningless the opposition of the U.S. to the use of civilian plants for weapons production by such countries as Iraq, North Korea, India, and Egypt. **4/01.09**

Sincerely,

Rhonda D. Wright, M.D.

Rhonda D. Wright, M.D.

Commentor No. 26: Nate Schwenk

COMMERCIAL LIGHT WATER REACTOR PROJECT

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Comments: I understand that TVA has withdrawn Watts Bar and Sequoyah as suggested sites, leaving only Bellefonte.

I believe this is the best option. I currently live just over 2 miles from Watts Bar and feel quite safe and confident that the plant is being operated safely. 2/09.01

I hope the professional nay-sayers and anti-nukes are stopped. TVA proposal could be satisfactory to them. This would be a great event for North Alabama and TVA – WIN-WIN. Savannah River will still have the extraction facility – and clean up from other projects. 3/07.03

1/06.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Nate Schwenk (optional)
Organization:
Address: 2701 Old Stage Rd
City: Spring City State: TN Zip Code: 37381
Work phone: 423 365 8198 Home phone: 423 365 2612
Fax:
E-Mail Address: schwenkn@volstate.net nlschwenk@tva.gov

7/4/98

Commentor No. 27: Jeffrey Belcher

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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Comments: Thank you for the opportunity to provide comments on this document. The effects on highway facilities from transportation of the Hazardous Material was adequately addressed. As a suggestion the document should include how a possible spill during transportation would be dealt with and also what would be the impacts to public health if a spill did occur on our highways. 1/18.09

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization: Federal Highway Administration (FHWA)
Address: 249 Cumberland Bend Dr.
City: Nashville State: TN Zip Code: 37228
Work phone: (615) 736-7539 Home phone:
Fax: (615) 736-5467
E-Mail Address: jeffrey.belcher@fhwa.dot.gov

7/4/98

Commentor No. 28: Anonymous (1)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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Comments: Having attended the public meetings at Rainsville + Rhea County High school + listening to every comment I fully support the production of Tritium in a Commercial light water reactor. **1/07.02**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization:
Address:
City: State: Zip Code:
Work phone: Home phone:
Fax:
E-Mail Address:

7/4/98

Commentor No. 29: John Tucker

Comments Received via "800" Number

Date:	9/23/98 (7:19pm)
Name:	John Tucker
Organization:	Athens Limestone Medical Associates in North Alabama
Address:	No address given
Phone #: **Fax #:**	No phone/fax number given
Comment #:	

Comment:

I am totally against your plan to start a tritium reactor at Bellefonte near Scottsboro, AL. I think you are going to poison the entire environment. I think you need to take your little project elsewhere. **1/10.03**

Thank you.

Commentor No. 30: Jim Sexton

Comments Received via "800" Number

Date:	9/23/98 (7:41pm)
Name:	Jim Sexton
Organization:	
Address:	11011 Kain Road 47 Florence, AL 35634
Phone #: **Fax #:**	256-757-5658
Comment #:	

Comment:

I am calling to make a comment on the idea of making this tritium at the Bellefonte site. I am totally against it for many reasons, one of which is the safety of people around the area and also because I do not believe in making weapons of war. I think tritium there would be a big mistake. *1/14.04* *2/01.01*

Commentor No. 31: Kenneth W. Crase

First Name	MI	Last Name	Title
Kenneth	W	Crase	Technical Advisor, Health Physics Technology

Organization
Westinghouse Savannah River Company

Address
Bldg. 707-48B
Savannah River Site

City	State or Province	Postal Code	Country	Email Address
Aiken	SC	29808-		kenneth.crase@

Home Phone	Work Phone	Work Extension	Fax Number
	803-952-7892		

Date Updated
8/27/98 12:03:30 PM

Notes
I do not disagree with the assessments of impacts contained within the Draft EIS for the Production of Tritium in a Commercial Light Water Reactor, including those for radiation exposures to workers and the public. However, I do believe there is at least one area where costs may not have been folded in to your assessment. The commercial reactor industry does not already possess the infrastructure and experience in dealing with the magnitude of tritium contamination and exposures. To achieve the low radiation exposure impact you have indicated in the draft EIS, additional resources and experience would have to be obtained to adequately handle the changes in the worker and environmental radiation protection programs. There may be other similar ancillary areas of cost impact not dealt with in the draft EIS. I recommend you fold these support costs into your evaluation of commercial reactor generation of tritium versus other means of production. *1/14.08*

Commentor No. 32: Alexis Zigler

First Name Alexis | **MI** | **Last Name** Zigler | **Title**

Organization

Address
3608 Clark Drive

City	State or Province	Postal Code	Country	Email Address
Sarasota	FL	34234-	USA	lexus51@juno.co

Home Phone	Work Phone	Work Extension	Fax Number
941-351-8570			

Date Updated
8/25/98 11:13:21 AM

Notes
The light water project is a violation of the Atomic Energy Act. It is not legal to be producing weapons grade material in
commercial nuclear facilities. **1/01.09**
The United States cannot credibly preach nuclear non-proliferation to nations such as India and Pakistan while continuing to develop our own nuclear stockpile. Our actions in this regard only increase the likelihood that nuclear weapons will be used in the future, whether by terrorists or by governments. **2/01.04**
The light water program also represents an increased likelihood of environmental contamination. We need to be moving
as quickly as possible to non-polluting energy sources, not further developing nuclear energy. The light water program
is going to produce materials that will find their way into the food chain and cause harmful effects there.
I am strongly opposed to the program.
Thank you, Alexis Zigler **3/07.05**

Commentor No. 33: Mary Stanfill

Comments Received via "800" Number

Date:	9/24/98 (8:31am)
Name:	Mary Stanfill
Organization:	
Address:	2422 Tuxedo Drive Huntsville, AL 35810
Phone #:	
Fax #:	
Comment #:	

Comment:

My concern is that Bellefonte should not be used for anything to do with producing anything for warfare and that the tritium could cause cancer, **1/07.03** cause the environment to be polluted and I want to encourage people to know that to live by the sword, they must die by the sword. **2/14.04**

Commentor No. 34: Robert Sparks

Comments Received via "800" Number

Date:	9/24/98 (8:59am)
Name:	Robert Sparks
Organization:	
Address:	59 Prentice Circle, NE Arab, AL 35016
Phone #: **Fax #:**	
Comment #:	

Comment:

I'm calling in relation to the tritium project going on in Scottsboro which is about 25 miles from me and I just wanted to give my comment on it and I am not in favor of it proceeding. Thank you. ***1/07.03***

Commentor No. 35: Jackie Ambrose

Comments Received via "800" Number

Date:	9/24/98 (9:02am)
Name:	Jackie Ambrose
Organization:	
Address:	Huntsville, AL
Phone #: **Fax #:**	No phone/fax number given
Comment #:	

Comment:

This is to do with the thing on television about opening the Bellefonte plant for tritium gas plant radium or whatever - This is to protest it. I'm totally against it. We have enough to deal with, with the other things we had in this area for years. Thank you. ***1/07.03***

Commentor No. 36: W. D. Scarbrough

Comments Received via "800" Number

Date:	9/24/98 (11:09am)
Name:	W.D. Scarbrough
Organization:	
Address:	3503 Sparkman Drive, NW Huntsville, AL 35810
Phone #: **Fax #:**	256-852-9350
Comment #:	

Comment:

Would like information concerning your program on tritium production. I'm not necessarily opposed, but the Department of Energy and other agencies do not have a good record in protecting the environment - Savannah River is just but one example. ***1/08.02***

Commentor No. 37: James William Cod

Comments Received via "800" Number

Date:	9/24/98 (11:29am)
Name:	James William Cod
Organization:	
Address:	1203 Fern Street Athens, AL 35613
Phone #: **Fax #:**	
Comment #:	

Comment:

I was told or at least I read off the television that this was the number to call about the tritium plant proposed by TVA for Bellefonte in Jackson County up near Scottsboro, so that's what I'm really calling about. I'm calling to say that I would not like to see this program put into affect on the Tennessee River because I'm afraid of the long-term--- short-term it's gonna give employment up there but long-term, I'm afraid of the after affects so really that's what I'm calling about. ***1/10.03***

Commentor No. 38: Steve Abraham

Comments Received via "800" Number

Date:	9/24/98 (11:55am)
Name:	Steve Abraham
Organization:	
Address:	1115 County Road 358 Distah, AL 35765
Phone #: **Fax #:**	
Comment #:	

Comment:

Yes, I just wanted to reply to the Bellefonte where they want to make tritium and I am kinda against it because we haven't found out enough information about the tritium to satisfy my curiosity. If you have any information on that, I would appreciate some of it. Thank you. ***1/07.03***

Commentor No. 39: Diane McFarland

Comments Received via "800" Number

Date:	9/25/98 (3:00)
Name:	Diane McFarland
Organization:	
Address:	709 Love Branch Road Harvest, AL 35749
Phone #: **Fax #:**	No phone/fax number given
Comment #:	

Comment:

I am very concerned about the Bellefonte Plant being reactivated. I just don't think it is a smart idea. I think these things have too long a life span and I read about the cancer rates up and…I work for Corps of Engineers and we do the environmental clean-ups and our Project Managers are in charge of chemical demilitarization that's going on in Johnston Atoll and Umatilla and now Anniston. I just think we should learn a lesson - don't make more of this stuff. Anniston's having a problem with it seeping through the walls. I don't mean to be an alarmist, I just think there should be another way without making these things that have such a long life span. Our children, we want clean water, clean air. I just don't think we can keep making this stuff - can't there be another way? I'd like to be informed or if I can help enlighten others about the dangers. I don't know anything other than it's got a long life span and it's not gonna go away when we create these things. We can find other jobs for people - please. Thank you for listening and I'm just a little citizen. I appreciate anything you can do. Thank you very much. ***1/14.04***

Commentor No. 40: James R. Finley

Address ID Number 39

Salutation	Mr.
First Name	James
Middle Initial	R
Last Name	Finley
Title	
Organization	
Address	400 Fairhope Drive NWArab, AL 35016
City	Arab
State or Province	AL
Postal Code	35016-4407
Country	USA
EmailAddress	finleyj@mindspring.com
Home Phone	Unlisted
Work Phone	(256) 931-0286
Work Extension	
Fax Number	
Date Updated	9/28/98 7:24:45 AM
Comment	I am a concerned citizen who wants the DOE to do the thing that is right for the country. If TVA plant would be more cost effective, then for a real change why do we not do what will save billions of dollars and then used the saved money to do something about the clean up of all the old facilities?

1/23.13

Commentor No. 41: Robert W. Van Wyck

Radiological Consultant

Robert W. Van Wyck, Certified Health Physicist
709 Helmsdale Place, North
Brentwood, TN 37027
Tel. 615-373-9176

Sept. 20, 1998

Stephen M. Sohinki, Director
CLWR Project Office
US Dept. of Energy
PO Box 44539
Washington DC 20026-4539

Comments On The Draft Environmental Impact Statement For The Production Of Tritium In A Commercial Light Water Reactor

Dear Mr. Sohinki:

Thank you for the opportunity to express my comments on the above Draft EIS in a timely manner. I previously sent comments to you in a letter but they were too late to be incorporated in the Draft EIS. For your information, none have been adequately addressed and should be in the final EIS.

These specific comments are:

1. The global impact from the further proliferation of atomic weapons throughout the world has not been adequately and honestly addressed and should be.

Since the beginning of the atomic era, our Country has maintained a steadfast policy that peaceful uses of nuclear technology will not be used for manufacture of atomic weapons. Utilization of a CLWR for tritium production is in direct conflict with this policy. If this long standing policy is changed, it will open the door for anyone to manufacture atomic weapons materials from commercial reactors leading to a major increase in atomic weaponry throughout the world. The potential for this to occur, and any resultant impact, should be a first consideration for evauatilon in the EIS.

1/01.09

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The EIS attempts to address this issue in S.1.5.4 but evades the concerns. Item 1 in this section says use of a CLWR for tritium production is not prohibited by law or international treaty. While this may be true, it would still be in direct contradiction of our long standing policy, practice and stated intention. For example, how can our country encourage North Korea to utilize one of our nuclear reactors to produce electricity, as we have done, and not expect them to follow our proposed example and use it also for weapons production?
Item 2 reports the historical use of defense materials and technology for peaceful uses. Historically, it has been standard practice to utilize technology developed from defense research for peaceful uses. However, it is clear that none of these "examples" involve the opposite, as is now proposed, to use peaceful uses for weapons production. This proposal will be a "first" to my knowledge. **1(cont'd)**
Item 3 attempts to argue that maintaining separation between US civil and military activities could be adequately addressed, given particular circumstance involved, but none is given. Further, a weak argument is given that the TVA is owned by the US Government and therefore production in a TVA facility makes it "roughly" comparable to past instances of government owned dual-purpose nuclear facilities. Nothing could be further from the truth. The DOE makes atomic weapons, paid for by tax payers. The TVA makes electricity for distribution throughout the southeast region it serves and is paid for by ratepayers.

2. The EIS has not addressed the enhanced security provisions that will be required and the significantly increased potential danger to populations surrounding the site if a CLWR is used for weapons manufacture. Emergency preparedness is addressed for each of the proposed TVA sites but only from the perspective of a plant accident and fails to address the primary increased risk if the site is used for weapons manufacture. Our enemies in the past have had weapons sites pre-targeted for nuclear bombing in the event of war and it is reasonable to assume that the sites are still pre-targeted or can be re-targeted with little difficulty. At a minimum, the EIS should include an evaluation of the impact on surrounding populations in the event of a direct or near direct blast of an external atomic weapon used to destroy the facility. **2/22.01**

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3. A new safety analysis will have to be performed to consider the potential increased internal pressure in the reactor vessel during a melt-down that could result from partial fusion of the large quantities of tritium in a degraded core with uncontrolled re-criticality. TMI temperature data should be used in the analysis. Although "Beyond Design Basis Accidents" were analyzed, the analysis was done using the MACCS2 accident analysis computer code for a standard PWR core. However, if a significant increase of energy can be released in the reactor vessel due to fusion of tritium gas in the core during a meltdown accompanied with uncontrolled re-criticality, the code would not be useful for assessment of accident conditions. **3/15.04**

Issue of Concern Discussed But Not Evaluated In The EIS

1. There is serious concern regarding the ability of the DOE and the TVA to carry out this project successfully. The EIS needs to point out changes in these organizations that have or will be taking place to give assurance that the project will be handled properly and in accordance with this EIS.
The stated purpose of the EIS is to analyze the potential consequences to the environment associated with the project. I submit that part of the analysis should be an evaluation of the specified candidates capabilities to successfully carry out the project.

DOE
The DOE, for one reason or another, has largely failed to accomplish any meaningful nuclear progress in recent years. As stated in S.1.5.2, over a dozen reactors for the production of nuclear materials at its many sites have been shut down and are no longer available despite the outlay of billions of dollars. Also as stated, the SRP K Reactor was discontinued in 1988 for major environmental, safety and health upgrades. Since the SRP site has already been contaminated beyond any reasonable or economical expectation for clean-up, it is difficult to see where a major environmental upgrade would be needed for continued tritium production. More than 10 years have lapsed since the DOE lost its capability to produce tritium and is unable to do so except for this proposed scheme. Likewise, the DOE has been unable to develop a Long Term Nuclear Disposal Site in Nevada even though it is **4/08.02**

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located adjacent to the site where hundreds of nuclear weapons have already been exploded underground (already making the area a long term nuclear waste storage site) and millions of dollars have been spent on "environmental studies". Frankly, the capability of the DOE, under its present leadership, staffing limitations, nuclear knowledge and past experience, raises serious doubts as to its current capability to carry out the project in an environmentally acceptable manner. With all the problems now being faced by the DOE in the non-nuclear energy area, it is not surprising that nuclear and defense matters are not paramount. Perhaps the time has come for Congress to reconsider the mission of the DOE in light of today's problems, and set up an agency that will insure nuclear materials needs are being met. With every "little" country now capable of being a nuclear power, it is important for them to know that a first priority has been given to maintaining our nuclear arsenal in a ready condition. 4(cont'd)

TVA

The TVA has faced a number of problems in developing its nuclear program. In Section 6.5.3.1, it is stated that in 1985 TVA was required to shut down 5 reactors including Sequoyah 1 and 2 because of charges of mismanagement and inattention to safety requirements. The Brown Ferry Plant fire is not even mentioned. This section also discusses continued problems at TVA operating plants including the assessment of monetary fines. The NRC lists a large number of "violations" at Sequoyah 1 and 2 from 1993 through 1997 the sum total of which shows the continued unwillingness or inability of TVA to manage its nuclear program. Recently, a "whistleblower" at the Watts Bar plants received a death threat (Sunday issue of THE TENNESSEAN, Sept. 6, 1998). This is just the latest of the "whisleblowers" who have tried to call management's attention to plant problems. In view of this operating record, serious doubts exist as to the ability of TVA to carry out the project in an environmentally acceptable manner. 5/09.02

Specific comments relating to Summary Document

(comments relate directly to the letter and number code assigned to paragraphs in the Summary Document).

S.1.5.4 - See comments above on Page 1, item 1 relating to the non-proliferation issue. 1(cont'd)

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S.1.5.5 - Producing tritium in a TVA reactor is not consistent with the Congressional purposes that established the TVA. Its establishment in 1933 had no bearing whatsoever to "national defense". Later, however, it was further developed to insure a reliable supply of electricity for Oak Ridge. This insinuation should be removed. 6/09.03

S.1.6.1.1 - The DOE's record of decision to proceed with this proposal was based on information available prior to 1995. There are other potential options available and issues perhaps not considered that suggests that this decision ought to be re-opened and re-evaluated based on information available today. See also comments relating to S.3.2.3 on Page 6. 7/05.03

S.2 - The last paragraph makes no sense and should be removed. See comments above under S.1.5.5 regarding support of national defense by TVA. 6(cont'd)

S.3.1.1 - Under Accident Conditions, it should spell out that a reanalysis of the DBA would be needed because of reactivity changes to the core (no mention is made of the use of boron as a chemical shim early in core life and its relationship with the TPBARs, nor of the increased reactivity needed, if any, to accomplish the project. Further, as noted above, an evaluation of the potential energy release from fusion in a degraded core during a "beyond design basis accident" needs to be made and factored into emergency planning as may be needed. 8/15.05

The potential impact on workers involved in fuel operations needs to be evaluated since it is likely that air supplied plastic suits may be needed for their protection due to increased tritium oxide levels in the air above the refueling water canal and fuel storage pool. Adequacy of air supply, the need for communication systems and the potential for increased chance of error, all need to be included in the evaluation. 9/14.09

A potential impact not mentioned is the affect of different metals such as Zircaloy on corrosion interaction with parts of the core and on other primary systems. 8(cont'd)

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S.3.2.3 - The no-action alternatives are based on the DOE record of decision from a 1995 document. In hind site, it may be desirable to re-evaluate the decisions reached. There are other alternatives and very good reasons to consider them. For example:

o The manufacture of tritium is an important ingredient in our nuclear defense capability and needs to be protected against stoppage. This can best be accomplished by using redundancy and developing a manufacturing facility at two different sites.

o It makes no sense to obligate tax payers to "clean up" another nuclear defense site (probable costs to decommission an existing or new reactor site will likely exceed $ 1 billion) when the DOE already has a number of defense related sites that cannot be economically recovered.

o A nuclear power reactor cannot serve two masters. Either it is dedicated to making electricity and tritium manufacture takes a back seat, or it can be used to manufacture tritium and electricity generation would take a back seat. The later is what is needed for our defense program. 7(cont'd)

o It makes no sense to buy into or use technology and equipment already more than twenty five years old (all of the TVA plants whether operating or not). What does make sense is for the DOE to undertake the design construction and operation of two tritium manufacturing facilities, each one at a different site to insure redundancy, with one of the facilities designed for electric generation. This would enable the DOE to wheel into a grid any excess electric power that might become available, but its primary purpose would be tritium production. Furthermore, additional electricity can be provided to the grid if there is a need to further reduce tritium production.

o The DOE should not rely on an organization that exhibits mismanagement and inattention to safety matters to operate a facility important to our defense needs. Instead, a new facility would provide an opportunity to design, build and operate a facility with concerned management that will give full attention to safety matters.

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In summary, there are other manufacturing options, although probably more costly, that are much more sensible that should be considered. Reopening of the Record of Decision could enable better alternatives to be evaluated with a 1998 perspective. 7(cont'd)

S.3.2.4.3 - The Bellefonte plant design and equipment are more that 25 years old. An evaluation of this aged equipment needs to be made, particularly with respect to the reactor vessel, to determine if it can be used safely. In addition, an evaluation of the twenty five year old instrumentation is needed to determine that the wiring and components have not degraded and are capable of meeting today's safety requirements. 10/21.02

It should be noted that utilization of the site for nuclear reactors would immediately impose an eventual burden of an estimated $ 1 billion just for decommissioning. A question arises as to who will pay for it, the taxpayer or the ratepayer, or a combination of both? 11/20.04

The following comments refer to specific sections of the Impact Statement:

1.3.3 - This section discusses DOE's past failure to be a good steward of our nuclear facilities for the manufacture of tritium. No reasons are given for this failure. The EIS needs to discuss what steps have been taken to assure that DOE will handle this project successfullyand under good stewardship. 4(cont'd)

1.3.5 - This section discusses the weak non-proliferation arguments discussed previously on Page 1, item 1, 1(cont'd)

3.2.5 - There is no mention of the role of the Refueling Water Storage Tank in the hold-up of tritium as a liquid waste. This applies to all of the reactor options. If not vented or disposed of, the tritium in this tank, and subsequently in the refueling water, can increase with each refueling and would require personnel to wear air supplied plastic suits for protection during this operation. This would be an impediment in refueling operations. 9(cont'd)

4.2.2.4 - A significant source of tritium release to the river can occur if the reactor continues to operate with primary to secondary leakage and the 12/14.10

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cooling tower is being bypassed. Alternately, a significant increase of airborne tritium oxide will occur if the cooling tower is in full use. This is an important distinction that needs to be made when evaluating the radiation impact on persons off site (as well as on-site). A projected use pattern should be incoporated into projected dose calculations based on past meteorological data and projected power level of the reactor.

Projected estimates of tritium concentration should be made at each of the drinking water supply intakes downstream of the site based on cooling tower use and projected buildup of tritium in Chickamauga Lake during various net flows.

Table 4-21 lists the sources of background radiation exposure to individuals in the vacinity of the Sequoyah site. In reality, the table lists the average exposure to the US population from these sources and not actual "measured" levels at the site. This point should be clarified so as not to be misleading.

There are 8 municipal water supplies downstream from the Bellefonte site. A similar analysis should be made of the projected tritium concentration at each intake based on cooling tower usage, river flow, dam hold-up and meteorological conditions, as suggested for the Sequoyah site. ***12(cont'd)***

5.2.5.4 - The socioeconomic section suggests that the cost of decommissioning will be in the range of about 600 to $ 700 million. In view of the uncertainties in this number, I have increased the estimate I used up to $ 1 billion, a reasonable increase. The important point is that this obligation is incurred on start-up and is not necessary since the DOE already has thousands of acres dedicated for weapons manufacturing..

It is not clear whether this cost will be incurred by the taxpayer or the rate payer, an important distinction for those of us using TVA electricity. ***11(cont'd)***

Table 5-49 on page 5-110 should also list under the beyond-design-basis accident an evaluation of energy release from possible fusion of tritium in the core, using TMI temperature data in the event of a re-criticality of the degraded core. ***3(cont'd)***

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6.5.2.1 - This section clearly shows the problems of TVA mismanagement as outlined in many NRC inspections and orders. There is no assurance that significant improvement has been achieved. It is difficult to understand why DOE would consider entrusting tritium production, an item vital to our defense, to the nuclear part of this agency. ***5(cont'd)***

Appendix A, Page A-18- The last paragraph indicates that more new fuel assemblies may have to be loaded into the core during each refueling and that the enrichment of these assemblies may need to be increased. This indicates that an analysis should be included of flux density, the interaction of chemical shim control on this density over time, and the total impact of this added reactivity on control systems. In addition, a safety analysis is needed to determine the increased risk to personnel as a result of an out-of-core criticality incident and the steps taken to prevent one from occurring. ***13/15.06***

Appendix D, Page D-4 - A non-reactor incident that requires evaluation is initiated from refueling. Most tritium in the reactor vessel will be in the form of an oxide and will become mixed with the refueling water. With significant leakage, the tritium vapor over the refueling pit, and subsequently in the spent fuel pool may require personnel to wear plastic suits during routine operation. This will cause potential operating problems that should be evaluated. In addition, ventilation from the containment area and the spent fuel pit should be evaluated.

Design of the refueling water storage tank, not mentioned any where, is an important potential release point for tritium in liquid or vapor form. The analysis needs to consider the build-up of tritium in this water with subsequent refuelings and the potential impact on workers and the environment. ***9(cont'd)***

Appendix F, Page F-8 - The third box down, refers to comments previously recieved, similar to mine, that the DOE is probably not capable as it now exists to carry out this project in an environmentally safe manner. I fully agree with those who offered these comments. Although the response given by the DOE is that DOE is fully committed to carry our its responsibilities, the fact remains that the DOE has been a poor steward of our nuclear facilities and has not carried out its responsibilities in the past. ***4(cont'd)***

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There is no assurance that it will do so in the future. See my comments and concern given previously (Page 3, item 1) regarding the ability of the DOE to carry out this mission. The response given to these concerns about the DOE does not provide an adaquate responce and perhaps demonstrates on their part a negative reaction to honest concerns. What is needed in response is some assurance, based on facts, that the DOE in now prepared to stop fumbling around with our nuclear program and has the resources and capability to make positive progress. If DOE is unable to provide this assurance, then Congress find another way to assure our nuclear defense system will remain viable. **4(cont'd)**

Thank you for your consideration of these comments on the Draft EIS.

Sincerely,

R W Van Wyck

Robert W. Van Wyck

CC's With Summary to:
- State Senator Keith Jordan
- U. S. Senator Bill Frist
- U.S. Senator Fred Thompson
- U.S. Rep. Bart Gordon

Commentor No. 42: Gene & Barbara Price

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- X returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: We have read the Draft Environmental Impact Statement in its entirety and have read numerous newspaper articles written by Scientific Authority that state that the production of Tritium at the Bellefonte Plant would be a "Serious Threat" to our community.

We have not heard of any reason for the production to be produced here other than it would provide jobs for local people.

The danger far outweighs the employment issue.

Therefore: We strongly urge you not to use the Bellefonte location! **1/07.03**

Sincerely — Gene Price

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Gene + Barbara Price (optional)
Organization:
Address: 88 Nerberg Rd.
City: Guntersville State: AL Zip Code: 35976
Work phone: Home phone: 582-8462
Fax:
E-Mail Address:

7/4/98

Commentor No. 43: Call-In

Comments Received via "800" Number

Date:	Oct 1, 1998 (11:30am)
Name:	Mr. John????couldn't understand his name--have called and left message to please call the 800 number again and slowly speak his name
Organization:	
Address:	Augusta, GA
Phone #: **Fax #:**	(706) 738-3459
Comment #:	

Comment:

I'm sitting here reading in the papers - I'm with the Navy - and for the life of me, I do not understand this latest and greatest of Bill Clinton's move to further dismantle the military and the whole 9 yards in this tritium mess. The Savannah River Site already has things in place to do the tritium and I believe this is nothing more than the Democrat's and nonsense to divert people's attentions elsewhere more or less to punish the voting Republican's. And that I believe is the bottom line for all this nonsense of going commercial to do what SRS has been doing all along concerning this tritium nonsense which is so typical of the Clinton administration. *1/04.01*

Commentor No. 44: W. Lee Poe, Jr.

10/1/98

Comments for CLWR EIS Meeting
By: W. Lee Poe, Jr.
807 E. Rollingwood Rd.
Aiken, South Carolina 29801

Mr. Rose, Department of Energy, and Stakeholders of the Savannah River Region I would like to provide the following comments on the Commercial Light Water Reactor draft environmental impact statement. Before starting with my comments I would like to thank Mr. Rose for his prompt attention to my request for additional information shortly after I received the draft EIS and having other information sent to me from TVA. This information was either referenced in the DEIS or was discussed in the local press. Information was requested in the following areas:

- Conversion and use of Bellefonte as a fossil plant producing electric power.
- PNNL test data on TPBARs (assemblies used to produce tritium in CLWR).
- Nonproliferation considerations of using CLWR.
- Cost analysis.

I requested two further issues, one I had hoped DOE would provide me their logic on why was DOE linking the APT, CLWR, and tritium extraction facility (TEF). *1/05.01* The other was a request for a comparative table showing the environmental impacts of APT and CLWR + RTF at tonight's meeting. I had requested this information to assist me in reaching my conclusion on which approach is best so I can provide my input to DOE on these matters. *2/04.03*

I am still reviewing the information I received but I wanted to provide you with my conclusions tonight, albeit it they may change as I continue to review the available material, on these subjects. I draw the following conclusions. I will attempt to cite the location on the concern in this comment paper but I will not bore the stakeholders with those details in my verbal presentation.

I would like to provide the following comments:

1. DOE has decided to link three EISs, the CLWR + TEF and the APT. They state in the CLWR EIS (p 1-12, Section 1.5.2.1) that if DOE decides not to proceed with the CLWR then DOE will build the APT to produce tritium. The APT EIS was issued in December 1997. They further state (p 1-13, Section 1.5.2.2) that if the CLWR is selected as the primary tritium technology, the TPBARs will be sent to the TEF. Now that is what I call EIS linking. *1(cont'd)* To provide my judgments to DOE, it is necessary to fully read and retain information on each alternative in each of the EISs and produce a comparison table. DOE, you need to provide your stakeholders with tabular guides to help in that situation if you want good comments. *2(cont'd)*

Commentor No. 44: W. Lee Poe, Jr. (Cont'd)

2. Now to complicate the above point, the EISs includes information on primary and back-up technologies. In the CLWR EIS (p 1-13, Section 1.5.2.3) it is stated that if the CLWR is selected as the back-up technology to the APT, a new extraction capacity would required as a stand-alone facility or in combination with the accelerator. 3/05.04

3. The CLWR (p1-12, Section 1.5.2.1) indicates that the FEIS will be issued in December of this year. From what I have heard and read in local newspapers, The Energy Secretary plans to reach a decision on these three tritium EISs in December of this year. I have heard two stories on how this could occur; 1) the decision reached and then the FEISs will be completed and 2) the FEISs will be finalized and the decision will be reached as part of the ROD. If the first approach is the correct, DOE should use the public process to gain stakeholder input to the decision process but not preparing the FEISs. Don't spend the money of preparing the FEISs. The second approach assumes that DOE follows the normal process of finalizing the EISs with proposed actions, then the decision-makers make the decision and incorporate it into the ROD. The timing of completing this EIS and making the decision in this second approach with both decisions occurring in December does not seem consistent. The main point here is that the time spent in commenting should be used by DOE in making the decision. 4/05.29

4. The CLWR EIS is difficult to understand particularly in concert with the above discussed decision. It describes in great detail a number of alternatives (p 3-12) - 18 are described in Table 3-2, which basically are one reactor, two reactors, or three reactors and a very short paragraph on the No-Action Alternative (Section 3.2.4). The impacts of each of the 18 alternatives consume the bulk of the EIS. The impacts shown for the No Action are only summarily given and referenced to the APT EIS. This approach makes evaluation of this EIS difficult. 5/06.06

5. The CLRW EIS states that tritium could be produced in any one of the 105 CLWRs currently licensed to operate (Section 3.2.2) but that the design of the TPBARs reduces irradiation to pressurized water reactors (eliminating boiling water reactors) and only TVA responded to the DOE's RFP to identify utilities interested in either producing tritium or having a reactor available for DOE purchase. The CLWR further indicates that five TVA PWR were to be considered in this EIS; all others having been deleted due to lack of interest by the utilities.

   TVA Chairman Crowell defined TVA's response to the DOE RFP differently. In his letter to U. S. Senator Sessions of Alabama, he says TVA submitted two proposals 1) a <u>"revenue offer"</u> to produce tritium at Bellefonte and if needed at the Watts Bar Nuclear Plant and 2) a <u>"service offer"</u> to produce tritium at only Watts Bar. Chairman Crowell further states that TVA allowed the <u>"service offer"</u> to expire and extended the <u>"revenue offer"</u> through July 1, 1998. If this information Chairman Crowell provided to Senator Sessions is correct, why did DOE evaluate alternatives other than those associated with Bellefonte and Watts Bar. The DOE logic of 6/06.03

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eliminating all PWR other than those of the TVA and then listing TVA reactors that TVA says are not available seems inconsistent. 6(cont'd)

6. If the inter-agency communication is as bad as indicated above, I must question the validly of an alternative that uses the TVA system to produce the nations tritium.

7. The number of TPBARs that must be irradiated to meet the tritium demand is unclear. In one place (p 3-11, Section 3.2.3), it is stated as 6,000 in 18 months or 4,000 per year. In other places it talks about 3,400 per year for each reactor. If both numbers are correct, tritium production will require irradiation in two reactors. Many places in the CLWR EIS talk about 1 or more reactors. If it requires two reactors to meet the tritium demand, DOE should talk about two reactors not 1 or more. If irradiation requires two reactors to meet the tritium demand, the TVA approach is not a viable alternative since they have withdrawn all of the TVA reactors other than Bellefonte. 7/03.03 6(cont'd)

8. The information contained in the CLWR EIS and the PNNL information sent me (PNNL-11419) seems to indicate that the TPBARs are reasonably engineered to retain tritium. 3,400 TPBARs will be irradiated in a single reactor each year. Each of these TPBARs is designed to hold up to 1.2 grams of tritium and have a design leak-rate of <6.7 Ci of tritium per TPBAR rod. If not damaged, the leakage from the TPBARs will be <22,780 Ci of tritium per year. This is considerably more than the 1,890 Ci shown in CLWR EIS Table 3-13. Why the difference? 8/19.04

   The EIS describes the "gettered" TPBAR as so good that the produced tritium gas is quickly captured in the solid zirconium material and there is essentially no tritium gas in the rod (p 1-9, Section 1.3.4). This system is so effective that the rods will have to be heated to 1,000°C (1,800°F) under a full vacuum to recover the tritium captured. The TEF EIS (Appendix A) describes the design temperature maximum on the extraction furnace to be 1,100°C. Operating equipment routinely within 10% of the maximum temperatures is not a good practice. This EIS should discuss evidence used by DOE to show that high tritium recovery from the TPBARs can be achieved with reasonable furnace life. If you cannot recover the tritium, its production is worthless. 9/19.05

9. Again I want to thank you for providing me with a copy of the cost data comparing CLWR option to the APT that Acting Secretary Moler provided to Senator Thurmond in mid July. As I review the data from that letter, I see two worrisome points. 10/23.15
   - The first is that for Bellefonte a credit is given that significantly reduces the life cycle cost. An equivalent adjustment is not given for the other CLWRs (in existing commercial reactors) nor for the APT. I suspect this is a payback to DOE for the electricity sold from that reactor. I also suspect that other uses of the accelerator would also provide a financial return. I seems unfair to give a credit for the Bellefonte plant and not for the APT.
   - If the irradiation requires two CLWRs to meet the tritium requirements, the CLWR costs increase significantly. What is DOE doing, betting that the tritium demand will decrease significantly thus a single reactor will suffice? I hate to

Commentor No. 44: W. Lee Poe, Jr. (Cont'd)

think it might be anything more sinister. In any event, the DOE should be open on these issues. 10(cont'd)

10. Again thank you for providing me a copy of the Report to Congress titled "Interagency Review of Nonproliferation Implications of Alternative Tritium Production Technologies." I find that it augments the terse statements in the CLWR EIS. I suggest that the report be included in the FEIS as an appendix. It points out correctly that maintaining separation between nuclear power and weapon production has supported the U. S. leadership in the International Atomic Energy Agency and other multilaterial organizations involved in civil nuclear activities. It goes on to show that tritium is not legally covered since it is not a special nuclear material. It then provides exceptions to the policy to date (Hanford N-Reactor, U. S. Uranium Enrichment, etc.) It makes the point that because TVA is government agency and the reactor is owned by the government, tritium irradiation would be an extension of past practices of "using government-owned facilities simultaneously for civil and military purposes. This conclusion may be legally the same but I draw a much different conclusion. I conclude this alternative is establishing a damaging new policy. That irradiating a nuclear weapon component in facility designed primarily to produce electric power is OK. I hate to think about how this might be used by other nations. The electricity production will consume a large portion of the neutrons generated by the reactor and the tritium can be considered a secondary product. 11/01.09

Thank you for the opportunity to present my views on this draft EIS. I hope they will be of some value to you in the decision on tritium technology.

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Commentor No. 45: Gary Stooksbury

ECONOMIC DEVELOPMENT PARTNERSHIP
Serving Aiken & Edgefield Counties

Fred E. Humes
Director

Statement for the Record
Draft Environmental Impact Statement
Production of Tritium in a Commercial Light Water Reactor

My Name is Gary Stooksbury and I am a Director of the Economic Development Partnership of Aiken and Edgefield Counties of South Carolina. My organization is proud of Savannah River Site's past role in supporting our national defense and making the world a safer place. We believe that the Site can continue to have a positive impact in addressing the many challenges still remaining. None are more important than (1) assuring a reliable supply of tritium for our national defense and (2) preventing the spread of nuclear weapons technology and materials throughout the world. Unfortunately, the Department of Energy's proposed action in this EIS will undermine both of these objectives: it will put in jeopardy an assured supply of tritium for our national defense and it will encourage other nations to use their civilian nuclear programs to produce materials for nuclear weapons. I want to briefly explain my organization's basis for objecting to the use of Commercial Light Water Reactors for tritium production and I will provide specific comments on inadequacies in the draft EIS document.

Program Policy Issues

As your documents note, tritium is absolutely necessary for the proper functioning of modern nuclear weapons, and without an adequate supply, our nuclear shield would be greatly diminished. DOE has set out to evaluate alternate technologies to meet this need, and has narrowed the choice to two options; the CLWR and the Accelerator - the Dual Path approach. My organization and others have serious reservations about the ability and appropriateness of the CLWR option to meet the Tritium mission. Specifically

1. CLWR will severely undermine this nations ability to pursue international nonproliferation objectives. 1/01.04

   - While we are dissuading others from producing military materials in their civilian nuclear programs, we, **for the first time in our history,** are proposing to adopt that very same course Other nations will rightly accuse the United States of hypocrisy.

   - The Interagency Review which examined this question was flawed in its logic and vague in its conclusion. It erroneously implies that because we have previously converted weapons facilities to civilian applications it is acceptable to do the converse. It concludes that these concerns could be "satisfactorily

1

Post Office Box 1708 Aiken, SC 29802 171 University Parkway USCA
(803) 648-3362 FAX (803) 641-3369 ecodevpart@aol.com

Commentor No. 45: Gary Stooksbury (Cont'd)

addressed" without stating if we will lose leverage with other nations who are contemplating nuclear weapons programs.

- If our actions cause even one nation to disregard restraint and to initiate or continue to make weapons materials in commercial nuclear reactors, we have suffered a foreign policy defeat with profound impacts for the world at large. **1(cont'd)**

A worldwide outcry will result if the United States backs away from its strong nonproliferation stance, and eventually will require that the CLWR be abandoned - **with damage to our world image and adverse impacts on our nuclear stockpile.**

2. We believe that there are significant uncertainties in the ability to license a CLWR to produce tritium for use in nuclear weapons.

   - First there will be public concern over the new safety and environmental hazards resulting from the routine and accidental releases of tritium from the reactor system. **2/21.06**

   - Secondly, many citizens are very uncomfortable with the idea of co-mingling military purposes in a civilian reactor

There is no assurance that NRC will issue a license (or license amendment) for this endeavor. Again, this would cause the **CLWR option to be abandoned with adverse impacts on our nuclear stockpile.**

3. Our third issue is costs. DOE has significantly underestimated the capital costs associated with the CLWR option.

   - Much "hype" has been attributed to the supposed lower cost estimate for the CLWR option, **but that estimate has never been revealed and subjected to independent third-party review.**

   - The DOE Draft EIS discusses at length the use of TVA's Watts Barr and Sequoyah nuclear facilities, yet it has been widely reported that TVA has withdrawn those facilities. **3/23.17**

   - DOE cites the TVA estimate of $2.446 Billion to complete the Bellefonte I Reactor, which, according to the EIS document, cannot meet the START I tritium requirements, and then compares that estimate to the APT which will produce adequate tritium to meet START I requirements. Completion of both the Bellefonte I and II reactor units will be required to produce three kilograms of tritium per year, with capital costs in excess of $6 Billion.

   - It has been reported that another nuclear utility has estimated that over $4 Billion would be required to complete Bellefonte I. .

Commentor No. 45: Gary Stooksbury (Cont'd)

- The GAO states that TVA estimates are very unreliable, with overruns of several hundred percent being experienced for plants which TVA asserted to be 80% complete.

- The Congress Research Service review raises a serious question on the ability of the Bellefonte to generate sufficient revenues to offset operating costs - much less amortize construction. **3(cont'd)**

- On the other hand, estimates for the APT have been subject to public review and validated by DOE.

It is our opinion that capital costs for the Bellefonte reactors will be significantly more than for APT, and life-cycle costs will be comparable. **The available cost data supports the APT option for tritium production**

In summary, we conclude that there are no programmatic advantages to the CLWR option, but rather it has serious, if not fatal deficiencies. The Department of Energy has a Dual Path strategy in name only because the **CLWR option leads to a dead end.** **4/04.01**

Deficiencies in the Draft EIS

We believe that the Draft EIS has not addressed the full range of expected safety and environmental impacts associated with the CLWR option and therefore is deficient with respect to requirements the National Environmental Policy Act and implementing Council on Environmental Quality regulations. Specifically:

1. You have not identified and assessed the world-wide environmental impacts that would result from a federal action to approve the CLWR option.

   - Adoption of the CLWR option will undermine international nonproliferation objectives, and result in a higher probability that some nations will initiate or continue nuclear weapons research, testing and production programs. **5/05.07**

   - Adoption of the CLWR option will result in a higher probability that some nations will initiate or continue to actively pursue production of materials for nuclear weapons in their civilian nuclear facilities.

   - The increased incidence of nuclear weapons research, testing and materials production programs by non-nuclear states, will have **environmental impacts which must be analyzed and included in this EIS.**

2. The evaluation of Human Health Effects from Facility Accidents (Appendix D) is not adequate, with three deficiencies: **6/15.07**

Commentor No. 45: Gary Stooksbury (Cont'd)

- The basis for estimating that 10 percent of tritium released from the melted targets will be in the oxide form within the containment atmosphere is not documented (Table D-1). In some past safety analysis reports, DOE has assumed that 100% of released tritium is in the oxide form and available for release to the environment. Please fully explain the basis for your assumption and revise your analysis.

- Elemental tritium may be available in the containment atmosphere and released to the environment. Your analysis needs to quantify the estimated release of elemental tritium and resultant safety and environmental effects.

- Your analysis does not address the disposition of tritium remaining in the reactor facility after the first thirty days (Table D-2). Since tritium is very mobile and cannot be easily removed from contaminated coolant water, how much additional tritium will be released to the environment, and with what effects? Also, what is the long-term disposition mechanism and associated environmental impacts for tritium which remains within the containment structure?

The draft EIS need to be corrected to address the environmental impacts associated with the disposition of all tritium released in a design basis accident.

6(cont'd)

3. The draft EIS does not evaluate the environmental impacts of all program options under consideration.

- Your Draft EIS states that a one reactor option could not produce the required three kilograms of tritium per year; and your safety and environmental analysis is based on using two or more reactors. *7/03.03*

- As noted earlier, DOE budget projections assume that the tritium need can be met with one reactor. *8/23.15*

- When asked about this discrepancy DOE stated that a special TPBAR design and fuel cycle, **different from that described in the draft EIS**, is being contemplated which will allow one reactor to make three kilograms of tritium per year. This option is not identified and evaluated in the draft EIS.

If a one reactor option is being considered, then this EIS needs to be corrected to describe and analyze the appropriate TPBAR design and fuel cycle. If two or more reactors are needed, then DOE's program and budget planning needs to reflect that fact.

7(cont'd)

Thank you for the opportunity to comment on this draft EIS.

4

Commentor No. 46: Jason J. West

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: In addressing the so-called non proliferation issue, This arguably is more important to me than the costs. The United States shouldn't have to tip-toe around foreign nations or justify our actions to them. Nations such as N. Korea, Libya, and Iraq don't need an excuse to persue nuclear weapons and attempting to implement a program that is in no way questionable will weaken the very goal that such a program would try to accomplish, the national defense. In ~~[illegible]~~ assessing the military use of civilian sites and saying is in violation of nonproliferation, I see a case of not seeing the forest for the trees. If the Ukraine or Great Britain or China wanted to follow a similar program how could that possibly violate nonproliferation. Nations that do not have the bomb should not even be concerned, because of the very fact that they Dont Have The Bomb! This tritium production proposal has nothing to do with nuclear nonproliferation. In my opinion saying that the rest of the world cannot make the distinction between fissionable materials and tritium is insinuating that the rest of the world is full of fools which would be a foolish assumption for DoD or DOE to make. *1/01.04*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Jason J West (optional)
Organization: Student
Address: 554 Palm Cr.
City: Aiken State: SC Zip Code: [illegible]
Work phone: Home phone: [illegible]
Fax:
E-Mail Address:

7/4/98

Commentor No. 47: Xerxes Wahl

Comments Received via "800" Number

Date:	October 5, 1998
Name:	Xerxes Wahl
Organization:	
Address:	8971 Lentzville Rd. Athens, AL 35614
Phone #: **Fax #:** **Comment #:**	(256) 729-8867

Comment:

I am against that personally. I don't see why we need more of it when it's my understanding we're already dismantling a lot of nuclear weapons that have been made already which I'm not sure that is a good idea or not but since we're doing that, I don't see why we need to make new ones. Since I live near that Plant here, I'm against it. If you need to get in contact with me, that would be great, if not, that's fine too. Good bye. *1/02.01* *2/07.03*

Commentor No. 48: Anonymous (2)

AddressID: 40

Date Updated: 9/28/98 7:49:40 PM

First Name:

MI:

Last Name:

Title:

Organization:

Address:

City: knoxville

State or Province: TN

Postal Code: 37919-

Country: USA

Work Phone:

Fax Number:

Email Address: Arista12@aol.com

Home Phone:

Notes: I think that the goal of producing more tritium to " add to the nuclear stockpile" is ridiculous The United states does not need any more nuclear warheads. We currently own 8500.Increasing that number would be in direct violation of not only of a nonproliferation treaty, signed by President Nixon in 1970. but also a more recent ruling by the International Court of Justice (1996) that the United States is obligated to pursue disarmament. More tritium means more bombs, and who are we planning on blowing up anyway? As I'm sure you are aware of, tritium is not something you want produced near you or your family because of its harmful effects on people(genetic abnormalities , health problems etc.)However, where ever tritium is produced there will be people, and those people will be effected as a result . Write back if there is a real person reading this, if not you'll be hearing from me anyway! *1/02.01* *2/01.04* *3/14.04*

arista12@aol.com

Commentor No. 49: Stewart Horn

Comments Received via "800" Number

Date:	Oct 6, 1998
Name:	Stewart Horn
Organization:	
Address:	498 Keel Hollow Road New Hope, AL 35760
Phone #: **Fax #:**	(256) 955-2114 (work); (256) 723-4960 (home)
Comment #:	

Comment:

I am very opposed to the use of Bellefonte as a tritium plant. I know the reactor there was designed probably 25 years ago or 20 years ago at least, if not earlier. So the reactor design is old and outdated. I think it would place all of the people in this area in jeopardy to harm from a potential accident especially using an outdated reactor design. I know that this plant will put radiation into the water and to the air. My understanding is the reason it was stopped before was because of the high cost in meeting environmental requirements, so does that means they won't be met now? I'm very interested in receiving documentation on what the plan is. I would be interested in receiving information about the location of the public hearing, which apparently is going to be on Tuesday night, October 6. Please call me with that information if possible ahead of the meeting so that I could possibly attend. Thank you very much. Please send any information that you have, relative to the use of Bellefonte in this way. Thank you.

1/21.02

2/09.04

Commentor No. 50: Mike Wahl

Comments Received via "800" Number

Date:	October 7, 1998
Name:	Mike Wahl
Organization:	
Address:	8971 Lentzville Rd. Athens, AL 35614
Phone #: **Fax #:**	(256) 729-8867
Comment #:	

Comment:

I would like to express for myself and my family the desire that the Bellefonte Plant not be used for tritium production. Our North Alabama area already has one nuclear plant whereby we have no successful way of removing waste from that facility. Until those sorts of problems are resolved, Alabama has no business being involved with another facility that deals with that general sort of environmental endangerment. Thank you.

1/16.04

Commentor No. 51: Herman & Sylvia Zaage

To the Dept. of Energy
FAX: 1-800-631-0612

Please honor the Atomic Energy Act, Section 57e, and cancel the plans for using commercial nuclear reactors for the development of Tritium for nuclear weapons. This is a serious public health issue. Tritium contamination has been linked with developmental, reproductive and other health problems. ***1/01.09*** ***2/14.04***

Thank you.

Herman & Sylvia Zaage
160 Simonson Ave.
Staten Island NY 10303
sylhz@aol.com

Commentor No. 52: Ms. Bizzarri

Comments Received via "800" Number

Date:	Oct 12, 1998
Name:	Ms. Bizzarri
Organization:	
Address:	Tuxedo Park, NY
Phone #: **Fax #:**	(914) 351-2652
Comment #:	

Comment:

I'm calling to leave this message. Please honor the Atomic Energy Act, Section 57e, and cancel the plans for using commercial nuclear reactors for the development of tritium for nuclear weapons. I'd like to stress too that tritium contamination has been linked to developmental reproductive and other health problems. Thank you. ***1/01.09*** ***2/14.04***

Commentor No. 53: Judith Hallock

Comments Received via "800" Number

Date:	Oct 12, 1998
Name:	Judith Hallock
Organization:	
Address:	269 Running Creek Cove Woodier, NC 28789
Phone #: **Fax #:**	(828) 586-3146
Comment #:	

Comment:

I think this is a terrible idea. I don't think we would be violating the nuclear non-proliferation treaty, which obligates all nuclear nations to pursue complete disarmament by producing weapons-grade tritium in commercial reactors and/or by the accelerator that Strom Thurmond wants built in South Carolina. *1/01.04* We don't need to produce tritium, it has a short-half life. We need to make it when we need it, right now we don't need it, we've got plenty of weapons. *2/02.01* It cost huge amounts of money, it's dangerous, the production is dangerous, and the storage is dangerous. There are genetic abnormalities and other health problems that have been linked in laboratory animals to tritium and I am very much opposed for these reasons to making tritium in commercial reactors or in accelerators. *3/23.13* *4/14.04* We already have 8,500 warheads. I don't think we need anymore. I think that's plenty. If we need it later, we can talk about it, but right now, I don't think we need to be in a hurry to produce tritium. Thank you very much. Goodbye. *2(cont'd)*

Commentor No. 54: Congressman Robert Aderholt

CONGRESSMAN ROBERT ADERHOLT
10/6/98

STATEMENT TO BE READ AT RAINSVILLE

I have been pleased to work with the Alabama delegation and Members from Tennessee and with TVA to help prevent a great injustice in the defense authorization bill for fiscal year 1999. As you know, some Members of Congress and Senators support building a facility in South Carolina to use a particle accelerator for producing tritium. Supporters of this option tried to pass bill language which would have prevented the use of any commercial light water reactor for producing tritium. Clearly, all the facts, from safety, to national defense readiness, to budgetary issues point to the completion of the Bellefonte plant as the best option. I spoke on the House floor, sent two staff members to the Bellefonte plant, spoke with NBC News, and lobbied other Members through several letters to my colleagues. Several Members of Congress and Senators have been very involved. I especially appreciate the outstanding leadership of Senator Jeff Sessions. I have also enjoyed working with TVA and a number of community leaders on this effort. A significant battle was won when the Graham language was removed from the final bill, but between now and October 1, 1999, we must continue to defend the truth about this situation and educate other Members of Congress. I look forward to continuing to work with TVA, the Alabama delegation, and community leaders on this effort. Completing the plant at Bellefonte to produce tritium is simply the right thing to do for the U.S. taxpayers, and its completion would have an enormous, potential benefit for north Alabama. *1/07.03*

Commentor No. 55: Mayor Philip Anderson

As mayor, of the Town of Dutton, it is my opinion that the production of Tritium in the Bellefonte Commercial Light Water Reactor at the Bellefonte Nuclear Plant would be a very big plus for all of Jackson County and the surrounding areas.

I am asking the Department of Energy to give serious consideration in using the Bellefonte Plant for Tritium Production.

1/07.03

Philip Anderson
Mayor

Commentor No. 56: Melvin L. Brewer

IRON WORKERS LOCAL UNION NO. 704

INTERNATIONAL ASSOCIATION OF BRIDGE, STRUCTURAL, ORNAMENTAL AND REINFORCING IRON WORKERS
2715 BELLE ARBOR AVENUE CHATTANOOGA, TENNESSEE 37406
MELVIN L. BREWER
Business Manager
423 / 622-2111 FAX 423 / 622-2112

Good Evening

I am Melvin Brewer, Business Manager of Local 704 of the International Association of Bridge, Structural, Ornamental and Reinforcing Ironworkers from Chattanooga, TN.

On behalf of our 600 plus members I would like to voice our support for the proposed Commercial Light Water Reactor for the production of Tritium Gas at Bellefonte.

Savannah River Site does not meet the 2005 production of tritium mandated by the President and Congress.

Accelerator Production of tritium requires a 500MW power source for operation. Bellefont will actually produce power.

As the safety of the plant, TVA has an excellent record. Accident risk for Bellefonte is one fatal cancel every 245 million years and transportation risk is less than one fatal cancer per 100,00 years.

Additional low-level waste is about 1% of TVA current volume.

While the accelerator is an un-proven method, Commercial light water method has been proved at Watts Bar. With Watts Bar and Sequoyah as a back-up, this plan will insure the country's supply of tritium for it's National Defense needs.

As Tritium production in a commercial reactor is not prohibited by International nor the United States law. Therefore, the benefits out weight the risk.

1/07.03

THANK YOU!

Commentor No. 57: U.S. Congressman Bud Cramer

COMMITTEE ON
APPROPRIATIONS

E-MAIL: budmail@mail.house.gov
WEB PAGE: http://www.house.gov/cramer/welcome.html

BUD CRAMER
5TH DISTRICT OF ALABAMA
U.S. HOUSE OF REPRESENTATIVES
October 6, 1998

Dear friends:

I am pleased to have this opportunity once again to offer my strong support for the completion of the Bellefonte plant to produce tritium.

I believe that the Department of Energy's environmental impact study clearly shows that Bellefonte is a safe, practical choice for tritium production.

The Congressional Budget Office recently released a report that shows how Bellefonte is an economically sound choice as well.

When you add the strengths that Bellefonte has to offer with the work ethic and quality of life in northeast Alabama, I think it is plain to see that our community is the ideal choice for this project.

The completion of Bellefonte would create 800 permanent jobs and 2500 construction jobs in our area. We recognize that tritium production offers not only an extraordinary economic opportunity for our community. This is also an enormous responsibility that is critical to the defense of the United States. I know that our local communities possess the talent and tools to make this program a major success.

Congress is quickly approaching the end of this year's legislative session. I regret that legislative business in Washington prevents me from being with you this evening. But please know that I am here working to make sure that Bellefonte is given full and fair consideration for this project. We recently won a victory for Bellefonte when we managed to turn back a bill that would have left Bellefonte out of consideration. We succeeded in getting that bill dropped and keeping Bellefonte's standing alive and well. *1/07.03*

Thank you all for being here this evening and thank you for your concern about this important issue.

Sincerely,

Bud

Bud Cramer
Member of Congress

2416 RAYBURN BUILDING
WASHINGTON, D.C. 20515-0105
(202) 225-4801

403 FRANKLIN STREET
HUNTSVILLE, AL 35801
(205) 551-0190

1011-C JOHN R. STREET
MUSCLE SHOALS, AL 35661
(205) 381-3450

MORGAN CO. COURTHOUSE
BOX 668
DECATUR, AL 35602
(205) 355-9400

Commentor No. 58: John J. Federico Jr.

My name is John Federico and I live in Guntersville. I attended the last meeting held here at the college and spoke in opposition to the tritium project. After the meeting, my wife and I were approached by Nick Kazanas, the Bellefonte plant manager, who invited us to tour the plant so we could better understand how the plant would operate. Last month a small group of concerned citizens from Guntersville visited Bellefonte and I personally came away with the feeling that if the plant came on line tomorrow it would be operated safely. Mr. Kazansas and his people were extremely knowledgeable and professional and answered many tough questions. *1/07.03*

However, my concern focuses on the ominous partnership that would occur between TVA and DOE as a result of the tritium project. The environmental record of the DOE by its own admission is horrific when it comes to the way it has conducted its nuclear business over the span of the Cold War. It has created numerous superfund sites that will take years and millions of dollars to clean up. *2/08.02* Having said that, what I find objectionable in the draft environmental impact statement is reference to a Dec 95 Record of Decision that states DOE can initiate purchase of an existing commercial reactor (operating or partially complete - such as Bellefonte) or buy reactor irradiation services with an option to purchase the reactor for conversion to a defense facility. Mr. John Scalice, the chief nuclear officer for the TVA recently provided some interesting clarification and facts about TVA's nuclear program in a recent newspaper article. He stressed that one of the main reasons TVA's nuclear program is safe, reliable and productive is because it continues to meet external peer review, external regulatory review and external fiscal review. *3/05.27*

Commentor No. 58: John J. Federico Jr. (Cont'd)

If DOE should choose to purchase Bellefonte, all the checks and balances Mr. Scalice referred to will disappear because a DOE nuclear defense facility is not governed nor licensed by the Nuclear Regulatory Commission, nor is it obligated to adhere to the standards of excellence for the industry set forth by the Institute of Nuclear Power Operations. 3(cont'd) My final concern is the storage of spent fuel. If the Nuclear Waste Policy Act of 1982 mandates that spent fuel will be managed at a national repository, then DOE needs to expedite and assist in resolving the siting issues and not create additional on-site spent fuel storage facilities. 4/17.03

In closing, this is what I know. When you go to a race track to gamble, you bet the horse based on its track record. The track record of the TVA speaks for itself. 5/09.01 As tax and rate payers is it smart to let $4.5 billion spent to get Bellefonte where it is today just sit there and not realize a return on the investment? I don't think so! 3(cont'd) But do I bet on the horse named DOE who can turn Bellefonte into some of the other horses in their stable such as Hanford, Rocky Flats, Oak Ridge, and Savannah River? Definitely not! 2(cont'd) Idealistically, I say do nothing that puts citizens and the River at risk. One cancer death in 50 million years is one too much. But realistically I do believe that Bellefonte can safely do their part for the DOE which will help keep the nations nuclear stockpile credible while producing electricity. And we have to trust that everyone will be safe while we hold the outside eyes and ears of the industry accountable for doing their jobs. I also realize this is about jobs. 1(cont'd)

Commentor No. 58: John J. Federico Jr. (Cont'd)

When I reached out to the politicians for help in stopping this project, I was told I was naive to think that local citizens cared about what could happen in 20 years, when many were only focused on buying groceries this coming Friday.

But this must be where it starts and stops. If Bellefonte comes on line, it must never be allowed to become a government owned-contractor operated defense facility that will go unchecked by the mechanisms designed to assure it is managed with the safety of the citizens and environment as its primary concern. 3(cont'd)

Based on the above, I feel that paragraph S.1.6.1.1, page Summary 9 as it pertains to conversion to a defense facility should be deleted and the Dec 95 Record of Decision be amended accordingly. 6/06.05 Further, revise the last major planning assumption of para S.3.2.1 on page Summary 17 to state that spent fuel rods resulting from the tritium project will be stored at an existing spent fuel storage facility until the National Repository becomes operational IAW the Nuclear Waste policy Act of 1982. 4(cont'd)

John J. Federico, Jr.

John J. Federico, Jr.
2041 Buck Island Dr.
Guntersville, AL 35976-8579
(256) 582-4459
E-Mail: pjfed@juno.com
10-6-98

Commentor No. 59: Ronald L. Forster

CATARACT, INC.
An RCM Technologies Company
2500 McClellan Ave., Suite 350
Pennsauken, NJ 08109
609/ 317-0200 Tel
609/ 486-0802 Fax

Tuesday, October 06, 1998

Ronald L. Forster
14 Hillcrest Ct.
Ringgold, GA 30736
706.937.4304

To whom it may concern:

I am in full support of the completion of the Bellefonte Nuclear Plant for the production of tritium for the following reasons:

(1) Completion of the Bellefonte plant would be much sooner than that of the Proton Accelerator Plant. The production of tritium in an operating reactor is proven safe and efficient (not an experimental process).

(2) Funding for completion of the plant will come from taxes. Projected funding for completing the plant is approximately $2 billion. The alternative Proton Accelerator Plant would cost approximately $12 billion, a cost of $10 billion or more to taxpayers.

(3) Future operation of the Bellefonte plant will provide a clean source of electricity for the area and the nation's increasing demand. Also a portion of the revenues collected from the sale of this electricity will be returned to repay the taxes use to complete the plant; whereas the Proton Accelerator Plant will be non-incoming producing, and a lasting debt.

1/07.01

Cordially,

Ronald L. Forster
South Central Regional Manager
Cataract, Inc. (An RCM Technologies Company)

Commentor No. 60: Roger Graham

Tennessee Carpenters Regional Council
United Brotherhood of Carpenters and Joiners of America
Established August 12, 1881
1451 Elm Hill Pike, Suite 106
Nashville, TN 37210
(615) 366-3303 (615) 366-3149 fax

I am Roger Graham of Tennessee Regional Council, Carpenters Local 74. I am here tonight to speak in favor of tritium production in the U.S.A. I think when our young people are sent to put their lives on the line, to protect us and our country, WE owe it to them to have the most advanced weapons that can be had. I don't care if the tritium is produced in Alabama or South Carolina, but I do think OUR elected officials should be prudent in all decisions concerning OUR tax dollars. Now Bellefonte Nuclear Plant can be ready to produce tritium for less than 3 billion dollars in a proven safe technology, that will produce revenues by the sale of much needed electricity--versus the cost of building an accelerator plant at the cost of 16+ billions a year that we are not sure will work, but will cost 155 million a year to operate. It is our money, America, speak out.

1/07.03

Thank you,

Roger Graham

Commentor No. 61: James H. Green

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: Mr. Sohinki,

I've reviewed the EIS and would like to applaud the people who prepared the document. I know it represents a great deal of hard work and dedication on the part of those who wrote the EIS.

I would like to respond in kind by saying that both myself and many other people in the Northeast Alabama area are willing to give the same hard work and dedication in support of the production of tritium at Bellefonte Nuclear Plant.

I have 10 yrs. experience in TVA's nuclear program and am thoroughly convinced that nuclear is the way of the future. I have a highly technical background and personally know of many other people in this area with similar backgrounds who are avid supporters of the Bellefonte Tritium Production Project.

We are all eagerly awaiting the opportunity to assist in completing Bellefonte and helping operate the plant, in a safe, efficient manner. We just need the chance to prove it.

So let's go, DOE! Let's build Bellefonte and produce tritium!

Sincerely,
James H. Green

1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: James H. Green (optional)
Organization: TVA
Address: 865 Clemons Rd.
City: Scottsboro State: Ala. Zip Code: 35769
Work phone: (256) 437-4317 Home phone: (256) 574-1997
Fax:
E-Mail Address:

7/4/98

Commentor No. 62: Mayor Elizabeth Haas

TOWN OF HOLLYWOOD

P.O. Box 240
Hollywood, Alabama 35752
Phone 259-4845

10-6-98
DOE Public Meeting
Ladies and Gentlemen and Officials:

I am sorry I can not be at this meeting tonight to give my support to TVA in their endeavor to open the Bellefonte Plant for the production of tritium.

We have heard all the reasons not to produce tritium at Bellefonte and the danger this would be to our citizens and our environment. If all these dangers are true; then why is Aiken, South Carolina working hard to get DOE to choose that plant for the production of tritium?

I highly support TVA.

The reopening of Bellefonte will be a boost to our economy in Jackson County and the State of Alabama.

Thank You,
Elizabeth Haas
Mayor of Hollywood, Al.

1/07.03

Commentor No. 63: Randall L. Hartwig

DOE Public EIS Meeting
at Northeast Alabama Community College
on October 6, 1998

Comments of: Randall L. Hartwig

Union position: Valley-Wide Officer - Treasurer for the Engineering Association, Inc. (EA)

The Engineering Association is the union that represents 3500 TVA employees in positions involving professional engineering, architectural, chemical, economic, and computer systems functions, all employees in positions involving professional scientific and program planning and administration functions, and all employees in positions involving inspection, aide, or technical functions in engineering and scientific fields.

ENVIRONMENTAL IMPACTS OF OPERATION OF BELLEFONTE REACTORS

- EIS verifies that the incremental impacts of producing tritium in a commercial reactor are small with no measurable health effects.
- No air quality standards will be exceeded.
- No impacts to threatened or endangered species are expected.
- There will be a visual impact from the cooling tower vapor plume.
- Minimal impact on Guntersville Reservoir (0.2% of the flow).
- Minor impacts to aquatic resources from impingement in cooling water intake screens.
- Positive socioeconomic impacts
  - 800 Bellefonte workers
  - Up to 800 indirect jobs
  - Unemployment rate would stabilize approximately 2 % below current levels.

RADIATION EXPOSURE

SOURCES OF PUBLIC RADIATION EXPOSURE

- Natural Radon - 200 millirems per year
- Cosmic Radiation - 28 millirems per year
- Medical X-Ray - 39 millirems each time
- Nuclear Medicine - 14 millirems each use
- Drinking Well Water - 1 to 6 millirems per year
- 5 Hour Airplane Flight - 2.5 millirems
- Eating Food Grown with Phosphate Fertilizers - 1 to 2 millirems per year
- Wearing porcelain dental crowns or dentures - 0.7 millirems per year
- **Bellefonte Reactor Operation with Tritium Production - 0.58 millirems per year**
- Cooking with Natural Gas - 0.4 millirems per year
- **Bellefonte Reactor Operation - 0.26 millirems per year** Δ .32 millirem/year

PUBLIC RADIATION EXPOSURE COMPARISON

- Average U.S. resident (Background) - 363 millirems per year
- Resident of Denver, Colorado (Background) - 442 millirems per year
- Resident of Jackson County, AL (Background) - 355 millirems per year
- Resident of Jackson County, AL (Background plus **Bellefonte Reactor Operation**) - 355.26 millirems per year
- Resident of Jackson County, AL (Background plus **Bellefonte Reactor Operation with Tritium Production**) - 355.58 millirems per year

1/07.03

Commentor No. 63: Randall L. Hartwig (Cont'd)

Large scale production of tritium in a CLWR is currently being demonstrated at the Watts Bar Nuclear Plant.

There are eight TPBARs in four Lead Test Assemblies in TVA's Watts Bar Reactor for a single, normal operating cycle. When the demonstration is over (~~May~~ March 1999), they will be delivered to a DOE laboratory for subsequent examination.

The lead test assembly (LTA), currently producing tritium in the core of the Watts Bar Reactor, is ~~nearing~~ past the midpoint of its production and all indications and measurements of the reactor core and the LTA demonstrate that tritium production is proceeding as expected.

TVA has emphasized reactor safety over tritium production at Watts Bar. Reviews conducted to date have revealed no technical issues which would impact safe operation of the plant. Tritium is normally produced in the reactor coolant. Worst case tritium release assumptions are well below the Federal environmental limits. Therefore, the environmental impact from tritium production is minimal.

There are no major (and few minor) modifications that are needed for large scale production of tritium at either the Watts Bar or Bellefonte Nuclear Plants.

The large scale production of tritium in a CLWR involves relatively minor changes to the (nuclear) design of the reactor core.

The removal, packaging and shipment of the tritium production assemblies can be conducted during normal scheduled refueling outages with minor modification of established refueling procedures.

The TVA engineering workforce is technically robust and has consistently demonstrated its ability to solve the most difficult technical and regulatory challenges. This has been conclusively demonstrated by the recent INPO 1 Rating at Browns Ferry and Sequoyah Nuclear Plants and the outstanding ratings (SALP 1) received from the NRC for the Engineering support at our operating plants.

TVA engineering workforce is completely capable of providing the technical expertise necessary for the large scale production of tritium at TVA's Nuclear Power Plants. TVA responded in ***DOE RFP DE-RP02-97DP00414***, that there are 375 employees currently with Bellefonte experience and 3584 employees with nuclear experience within TVA. Also there are over 50,000 in the labor workforce with nuclear experience.

CONCLUSION: BELLEFONTE SHOULD BE THE PREFERRED ALTERNATIVE!

The draft CLWR EIS does not identify a preferred alternative for producing tritium. A no action alternative is for DOE to build an accelerator in South Carolina. After reviewing the draft EIS and comparing the potential impacts associated with the alternatives, including the no action alternative, The EA believe that the **preferred alternative should be identified as any alternative that includes Bellefonte**. This belief is based on the following:

- Negligible environmental impacts with no measurable health effects.
- Positive socioeconomic impacts supporting economic growth and development
- Flexible tritium production capacity to meet changing tritium needs
- Proven technology compared to the No Action alternative
- No proliferation issues that are not manageable under existing laws and controls associated with CLWRs
- Least Total Life Cycle Cost

Randy Hartwig, 10-06-98

1(cont'd)

Commentor No. 64: Mayor Glenda H. Hodges

Incorporated 1890

Town of Woodville
P.O. Box 94 • 26 Venson Street
Woodville, Alabama 35776
(205) 776-2860
Fax: (205) 776-2796

October 2, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
ATTN: Mr. Stephen Sohinki
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki:

In February 1998, the Woodville Town Council adopted a resolution in support of the production of tritium at the Bellfonte Nuclear Plant, and our position has not changed.

We believe that the production of tritium at Bellefonte poses no danger to the public and we feel confident that the plant can be operated in a completely safe manner.

Since the production of tritium by the Commercial Light Water Reactor method can be accomplished as a by-product of production of electricity, utilization of the Bellefonte Plant seems to be the most feasible and logical choice to produce the tritium needed for our national defense. North Alabama is proud of the contributions made and continue to be made to our nation's military programs. 1/07.03

Also, utilization of the Bellefonte Plant would provide an economic boost to an economic depressed area of our state. Therefore, for the above reasons, we continue to offer our support.

Sincerely,

Glenda H. Hodges,
Mayor

Commentor No. 65: Jyles Machen

Statement to DoE / EIS Meeting

It is seldom in a country as large as ours that an opportunity presents itself which will be a win for everyone involved.

The defense program must have a new source for tritium in order to preserve our core nuclear weapons stockpile as permitted under the START Treaty.

DoE is mandated to make a decision on where to produce tritium by December 1998. It should be an easy decision.

INSERT ¶

The TVA Bellefonte site meets the schedule requirements. Reactor 1 is more than 85% complete and the design requirements are firm. TVA has recent experience in getting through the NRC licensing maze, and tritium production can begin by the DoE target date.

The special-built tritium rods are functioning as expected with no problems at the Watts Bar demonstration site. And Watts Bar will is a backup production site until Bellefonte is ready. 1/07.03

Tritium produced at Bellefonte will be transported in its solid state to a new $400M extraction facility at the DoE Savannah River site, providing employment for 250-350 people.

If the Bellefonte Site is selected for Tritium production, TVA gets a completed reactor vitally needed for the region's power grid, the nation gets its vitally needed tritium for defense, and Savannah River gets the extraction/conversion facility in South Carolina. Even their Congressman Lindsey Graham, said in a 1995 detailed report to the Speaker of the House, that a commercial light water reactor [Bellefonte] is the way to produce tritium. So everybody wins.

So what's the problem? Some say the proposed Markey-Graham language in the Defense Authorization Bill, which excluded TVA, was nothing but parochial, preventing competition, costing billions more, while risking an untested accelerator. Fortunately, That language was removed in The Conference between The Senate and House.

Others are concerned about nuclear power plant safety. There are 110 nuclear power plants operating in the U.S. and not a single death by radiation exposure can be documented, ~~or is even suspected~~. While some scare stories are spread, no factual backup is provided.

Let's get on with the program. I encourage a fair evaluation and timely decision by DoE. TVA, I believe, is up to the job. The nation's largest power producer whose Browns Ferry and Sequoyah nuclear plants recently earned the highest performance evaluation rating possible, has new leadership and positive management and can again serve the nation and our region.

Insert ¶
The TVA Bellefonte site meets the budget requirements. Over the life of the program more than 7B will be saved in federal resources our tax dollars. Some calculations say even as much as $13B can be saved.

JYLES MACHEN
1515 LOCUST CIR SE
HUNTSVILLE, AL 35801
(205) 536-4459

Commentor No. 66: Bill Metchnik

October 6, 1998

Bill Metchnik - Resident of Paint Rock, Alabama, Jackson County, Union Represenitive for this area.

I rise as a citizen of Jackson County who resides in the town of Paint Rock, and who happens to be the Machinist Representative for all of North Alabama. As both a citizen and Union Representative, I do have a two-fold purpose to rise in support that the decision should be made that Tritium be manufactured at the Bellefonte TVA facility.

Understanding first of the economic boom where it would provide jobs, but jobs of a good paying nature for citizens not only for Paint Rock, Alabama, but for all the general area which can and will reach by such decision, and these jobs will be good union paying jobs.

As Union Representative, of course, the Union that I represent will be supplying people for jobs.

The studies that I have looked at clearly convinced me that the safety factor is so conclusive, and it should assure all, that ~~this~~ there is no danger to people who would work the jobs and again that environmental factor or impact to the area will not be compromised.

And last, when you look at the comparable cost to me as a tax payer, my taxes and yours would be better spent to have the work done at Bellefonte.

1/07.03

Commentor No. 67: Don Nelms

Plumbers & Steamfitters LOCAL UNION NO. 498

OCT-06-98 02:25 PM P&S L.U. 498 1 205 547 6330 P.02

Phone: (205) 546-6791

Fax: (205) 547-6330

October 6, 1998

FAX TO: DEPARTMENT OF ENERGY

FROM: DON NELMS, BUSINESS MANAGER

I am Don Nelms, Business Manager, Plumbers and Steamfitters Local Union 498, representing over 500 pipefitters and their families in Northeast Alabama. I am here on their behalf in support of Department of Energy Tritium Plant at Bellefonte. *1/07.03*

Don Nelms
Business Manager
Plumbers & Steamfitters Lcl. 498

AFFILIATED: American Federation of Labor and Building and Construction Trades Department.

Comment Documents

Commentor No. 68: David Nicholas

David L. Nicholas
President, Board of Directors
Rick Roden
Executive Director

SCOTTSBORO / JACKSON COUNTY
Chamber of Commerce

February 24, 1998

BELLEFONTE POSITION STATEMENT

Sirs:

I come before you today representing the Scottsboro-Jackson County Chamber of Commerce and four affiliated organizations: Leadership Jackson County, The 21st Century Council, Design Scottsboro and the Scottsboro Business Council. Over 500 of the most active and civic minded leaders of Jackson County are represented by the membership of these organizations.

The unanimous position of the leadership of these bodies is to strongly endorse the completion and operation of the Bellefonte Nuclear Project as a joint effort between the Tennessee Valley Authority and the Department of Energy. Furthermore, no opposition has been voiced by any of the general membership of these groups. 1/07.03

It is our position that the issue of whether or not a nuclear power plant should be located in Jackson County, Alabama was decided many years ago and that this is not an issue to be addressed during these proceedings. It is also our position that , given a choice, no one would choose to live in a world where nuclear arms exist, but again this is not the issue to be addressed during these proceedings. The Department of Energy has been given a mandate to provide a reliable source of tritium for the maintenance of our country's nuclear arsenal and that is simply a fact of life. We, the leadership of the Scottsboro-Jackson County Chamber of Commerce and its affiliated organizations

P.O. BOX 973 • 407 EAST WILLOW STREET • SCOTTSBORO, ALABAMA 35768 • 256 / 259-5500
email: sjcc@HiWaay.net

Commentor No. 68: David Nicholas (Cont'd)

David L. Nicholas
President, Board of Directors
Rick Roden
Executive Director

SCOTTSBORO / JACKSON COUNTY
Chamber of Commerce

believe that the Bellefonte facility is the single best choice to fill this need. Since the start of construction on the Bellefonte facility over 20 years ago, Jackson County has been subjected to the devastating economic effects of the on again-off again status of Bellefonte and TVA's inability to decide on a permanent course of action. The American taxpayers have seen a substantial amount of their tax dollars funneled into this project with absolutely no return from that investment. It is our belief that when this project began, TVA made a commitment to the taxpayers of Jackson County that they would build this plant and provide a substantial number of good paying, permanent jobs to this area. To the management of the Tennessee Valley Authority, we say it is time to make good on that commitment; it is time to honor your promise to those individuals who have borne the consequences of your indecision. 1(cont'd)

It is also time to act as good stewards of the resources of the taxpayers of this country. We believe that this proposed joint effort is the prudent course of action and we urge both the TVA and the Department of Energy to proceed with all due speed.

Signed:

David Nicholas
President
Scottsboro-Jackson County Chamber of Commerce

P.O. BOX 973 • 407 EAST WILLOW STREET • SCOTTSBORO, ALABAMA 35768 • 256 / 259-5500
email: sjcc@HiWaay.net

Commentor No. 69: Donald E. Olson

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments:

Worked with TVA over six years

TVA is a Quality / Safety Conscience organization

TVA Has superior ratings by INPO and the NRC at all three Nuclear Sites

Light Water Reactors Are SAFE and a prudent way to produce Electric Power

TVA is correctly ranked at the Top of the Nuclear Industry

We Need Tritium for the National Defense

I support the partnership between the DOE and TVA at the Bellefonte Nuclear site

1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Donald E. Olson (optional)
Organization:
Address: 1601 Sherwood Oaks
City: Decatur State: AL Zip Code: 35603
Work phone: 256. 729-4532 Home phone: 256- 306-0511
Fax:
E-Mail Address:

7/4/98

Commentor No. 70: Mayor Louis Price

CITY of SCOTTSBORO

MOUNTAINS • LAKES • INDUSTRY

SCOTTSBORO, ALABAMA

Gail Duffey, City Clerk
Louis Price, Mayor

U.S. Department of Energy
Commercial Light Water Reactor Project Office
ATTN: Mr. Stephen Sohinki
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki:

From the very beginning of the discussions of the Bellefonte Nuclear Plant as a source of tritium for our national defense, the City Government of the City of Scottsboro, Alabama has been very supportive of this plan. Our council and the mayor have expressed this support by resolution as well as by public statements as a group and individually.

We continue to maintain a strong desire to see Bellefonte completed for the production of tritium, as well as for the production of much needed electric power. For the benefit of our nation, cost, and schedule wise, it makes sense to use the Commercial Light Water Reactor for this task. The City of Scottsboro stands ready to do whatever can be done to bring this project to completion.

1/07.03

Sincerely,

Louis Price, Mayor
City of Scottsboro

Commentor No. 71: Michael D. Roberts

NAIDA

AmSouth Bank Building / P. O. Box 1668 / Decatur, Alabama 35602 / (256) 353-9450 / FAX (256) 353-5982

February 25, 1998

Mr. Stephen Sohinki
Director
U. S. Department of Energy, Commercial
Light Water Reactor Project Office
P. O. Box 44539
Washington, D. C. 20026-4539

Dear Mr. Sohinki:

I am the Executive Director of the North Alabama Industrial Development Association. Our primary mission is to assist communities in locating new industry for North Alabama.

I support the Jackson County leadership in their strong desire for DOE and TVA to partner and produce tritium at Bellefonte. This location offers proven technology, the quickest production and the lowest cost.

Jackson County and North Alabama will provide DOE and TVA with the necessary support required for this project.

1/07.03

Sincerely,

Mike Roberts

Michael D. Roberts
Executive Director

Commentor No. 72: R. Kent Ryan

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I AM EMPLOYED BY STONE & WEBSTER ENGINEERING CORPORATION AT THE TVA BROWNS FERRY NUCLEAR PLANT AS SITE MANAGER. THE TVA NUCLEAR PROGRAM HAS BEEN PROVEN TO BE ONE OF THE SAFEST, QUALITY FOCUSED AND COST EFFECTIVE PROGRAMS IN THE COUNTRY. I FULLY ENDORSE THE PRODUCTION OF TRITIUM AT THE BELLEFONTE NUCLEAR FACILITY. TVA, ALONG WITH ITS CONTRACTING PARTNERS, CAN PROVIDE THE REQUIRED TECHNICAL, CONSTRUCTION, AND OPERATIONAL EXPERTISE TO COMPLETE AND OPERATE THE BELLEFONTE NUCLEAR PLANT IN A SAFE AND EFFICIENT MANNER.

1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: R. KENT RYAN (optional)
Organization: STONE & WEBSTER ENGINEERING CORPORATION
Address: 10011 BLUFF DR
City: HUNTSVILLE AL State: AL Zip Code: 35803
Work phone: 256-729-2805 Home phone: 256 ~~729~~ 880-9936
Fax: 256-729-4968
E-Mail Address: rkryan5@tva.gov

7/4/98

Commentor No. 73: Steve C. Stutts

STEVE C. STUTTS
INTERNATIONAL REPRESENTATIVE
INTERNATIONAL UNION OF OPERATING ENGINEERS
AFL-CIO

#5 TWELVE OAK CIRCLE
SUITE D
JACKSON, MISS. 39209
PHONE 601 922 6844

INTRODUCTION

WHO ARE YOU.

WHO YOU REPRESENT.

Bellefonte should be selected as the primary tritium production source by the Department of Energy (DOE) to meet our national defense needs. We fully support the selection of Bellefonte based on the following reasons:

- IT IS A PROVEN TECHNOLOGY THAT IS SAFE AND ENVIRONMENTALLY FRIENDLY

  The accelerator, at best, is a science project since no accelerator of this size has been built and operated before. The proposed accelerator is two orders of magnitude greater than existing **research** accelerators. Bellefonte is proven technology that will be safely operated on a daily basis by the Tennessee Valley Authority (TVA). TVA currently safely operates five reactors in the Valley on a daily basis.

- MEETS DEPARTMENT OF DEFENSE (DOD) REQUIREMENTS FOR THE NATIONAL DEFENSE

  TVA could begin supplying tritium in 2005 as mandated by executive order. The accelerator would not be able to supply tritium until 2008 if everything went according to plan.

- ACCORDING TO CONGRESSIONAL BUDGET OFFICE REPORT, THE **BELLEFONTE OPTION COSTS $13 BILLION LESS THAN THE ACCELERATOR OPTION.**

1/07.01

Commentor No. 73: Steve C. Stutts (Cont'd)

In current dollars, the accelerator would cost $16 billion while the Bellefonte option would cost $3 billion.

In constant dollars, the accelerator option would cost the taxpayers anywhere from $9.5 to $16 billion, plus approximately $155 million each year to operate, while the Bellefonte option would cost the taxpayers a total of $2.5 billion.

The money spent by DOE to complete Bellefonte would be repaid to the federal government. Revenues from the sale of electricity will be paid to DOE over the 40-year life of the plant to pay off the investment with interest.

There would be no net loss of revenue to the government and taxpayers.

- CREATES 800 PERMANENT JOBS AND HUNDREDS MORE INDIRECT JOBS. THAT'S NOT INCLUDING THE ADDITIONAL CONSTRUCTION JOBS AT THE PLANT.

  This is a significant socio-economic impact on northeast Alabama that must be strongly considered.

1(cont'd)

In closing, I understand that an Interagency Report by the DOE, DOD, National Security Council, State Department, Arms Control and Disarmament Agency, White House Office of Science and Technology Policy, Office of the Vice President , and the Nuclear Regulatory Commission has concluded that no domestic law or international treaty would be violated by producing tritium at Bellefonte; that use of Bellefonte extends the past practice of using government-owned facilities simultaneously for civil and military purposes rather than setting a new precedent for proliferation; and that DOE should continue to pursue the CLWR option given the essential defense need for tritium and the flexibility, technical maturity, and cost-effectiveness of this operation. The Operating Engineers fully support the production of tritium at TVA's Bellefonte Nuclear Plant.

Commentor No. 74: Mayor Peaches Thompson

October 6, 1998

My name is Peaches Thompson, I am the Mayor of Gurley, Alabama. In 1985, which Bellefonte was at its peak, our low to moderate income of people was at 58 percent. In 1997, we ran another survey and the numbers jumped to 88 percent, and we feel like part of that was due to Bellefonte closing at that time.

Speaking on behalf of the 1500 residents of Gurley, we unanimously support a cooperative effort between DOE and TVA to complete the Bellefonte Nuclear Plant for the production of tritium.

The selection of Bellefonte offers:

1. an assured supply of tritium necessary to our national defense program,
2. at the least cost to the U.S. taxpayer,
3. and much needed employment to an economically depressed area of the United States.

We stand eager and ready to support DOE and TVA in the process of making a Bellefonte Tritium Production Facility a reality.

For the records, I would like to present to Mr. Moderator a written statement of our support.

THANK YOU.

1/07.03

Commentor No. 75: Richard Ward

GOOD EVENING, MY NAME IS RICHARD WARD, GENERAL ORGANIZER, REPRESENTING THE INTERNATIONAL ASSOCIATION OF BRIDGE STRUCTURAL, ORNAMENTAL AND REINFORCING IRON WORKERS AND AN ACTIVE MEMBER OF THE TENNESSEE VALLEY TRADES AND LABOR COUNCIL, WHICH IS COMPRISED OF 15 INTERNATIONAL TRADES AND LABOR ORGANIZATIONS.

SPEAKING ON BEHALF OF THE IRON WORKERS INTERNATIONAL ASSOCIATION, WE WHOLEHEARTEDLY PLEDGE OUR SUPPORT TO THE DEPARTMENT OF ENERGY AND THE TENNESSEE VALLEY AUTHORITY FOR THE COMPLETION OF THE BELLEFONTE PROJECT AS A TRITIUM PRODUCTION FACILITY IN SUPPORT OF OUR NATIONAL DEFENSE.

OUR MEMBERS AND FAMILIES, AS WELL AS THE COMMUNITIES IN THE SOUTHEASTERN UNITED STATES, ARE IN STRONG SUPPORT OF NATIONAL DEFENSE EFFORTS THAT KEEP THIS COUNTRY SAFE AND SECURE.

WE HAVE BEEN BRIEFED ON THE RESULTS OF THE RECENTLY RELEASED GOVERNMENT-PREPARED ENVIRONMENTAL IMPACT STATEMENT, AND WE FIND TRITIUM PRODUCTION WITH THE BELLEFONTE REACTOR TO BE ENVIRONMENTALLY SAFE AND ECONOMICALLY SOUND.

WE HAVE CAREFULLY ANALYZED THE CONGRESSIONAL BUDGET OFFICE COST COMPARISON OF THE TRITIUM PRODUCTION ALTERNATIVES AND IT MAKES NO SENSE WHATSOEVER TO CONSIDER ANY OTHER FACILITY OTHER THAN THE BELLEFONTE REACTOR TO PRODUCE TRITIUM.

I URGE THE DEPARTMENT OF ENERGY TO SELECT THE BELLEFONTE NUCLEAR PLANT AS THE PRIMARY SOURCE OF TRITIUM PRODUCTION.

THAT SELECTION WILL PROMOTE A COOPERATIVE EFFORT BETWEEN ORGANIZED LABOR, THE TENNESSEE VALLEY AUTHORITY AND THE DEPARTMENT OF ENERGY THAT WILL SAVE THE TAX PAYER BILLIONS OF DOLLARS.

MR MODERATOR, I WOULD LIKE TO PRESENT YOU WITH A COPY OF MY STATEMENT FOR THE RECORD.

THANK YOU.

1/07.03

Commentor No. 76: Dan Williams

North Alabama Mayor's Association

October 5, 1998

I am speaking on behalf of the North Alabama Mayors Association. The North Alabama Mayors Association represents the interest of one hundred eighty municipalities in the North Alabama area.

The North Alabama Mayors Association agrees with those who have reviewed the draft Environmental Impact Statement (EIS) for the production of tritium in a Commercial Light Water Reactor (CLWR) dated August, 1998. We find the proposed tritium production program to be environmentally safe and to produce no measurable health effects. In addition, we conclude that Bellefonte Nuclear Plant should be named in the EIS as the preferred alternative based on its least life cycle cost to the U. S. Taxpayer and the positive socioeconomic effects of the project. I am including a summary of the primary points from the Draft EIS used to reach this conclusion.

I appreciate the opportunity to tell you that the North Alabama Mayors Association supports wholeheartedly the production of tritium at the Bellefonte Nuclear Plant.

1/07.03

Dan Williams
President, North Alabama
Mayors Association

P.O. Box 308 Huntsville, Alabama 35804
(205) 532-7304 • Fax (205) 532-7525

Commentor No. 76: Dan Williams (Cont'd)

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

USES OF TRITIUM

Tritium is a radioactive isotope of hydrogen. If not properly controlled it can be dangerous, but when controlled properly is safe and can save lives. Tritium is:

- Used for life science and drug metabolism studies to ensure the safety of potential new drugs
- Used for self-luminous aircraft and commercial exit signs
- Used for luminous dials, gauges and wrist watches
- Used to produce luminous paint
- Used in Doppler Radar
- Used as a triggering component (i.e., boosts yield) in nuclear weapons

NONPROLIFERATION ISSUES
(Nonproliferation is defined as preventing the increase or spread of nuclear weapons)

Interagency Review of Nonproliferation Implications concerning tritium production was completed on July 14, 1998 and concluded the following:

- Nonproliferation policy issues associated with a Commercial Light Water Reactor (CLWR) are manageable and DOE should continue to pursue the CLWR option.
- No legal or treaty prohibitions against tritium production in a CLWR.
- Many exceptions have been made over the years to separation of civilian and military use of nuclear energy.
- Reactors producing tritium can remain on IAEA Safeguards List.
- No bilateral "peaceful uses" agreements will be violated. Reactors making tritium will use U.S. - origin uranium fuel.
- TVA's charter gives it a national security responsibility.

A House of Representatives Task Force (chaired by Lindsey Graham of South Carolina) issued a report to the Speaker of the House in 1995 concluding:

- Production of tritium in a commercial reactor is not a proliferation concern.
- Producing tritium in a reactor is no different than producing tritium in an accelerator.
- Raising nonproliferation concerns is simply an argument to sell the accelerator option.

Bellefonte would be operated as a electrical power generation facility with the ability to provide DOE with irradiation services for tritium production.

1

Commentor No. 76: Dan Williams (Cont'd)

ISSUES REVIEWED BY EIS

- Land use
- Visual Resources
- Air Quality
- Water Quality and Use
- Archeological and historic resources
- Biotic (living things) resources including threatened and endangered species
- Socioeconomics (interaction of social and economic factors)
- Public and Worker Health and Safety

ENVIRONMENTAL IMPACTS OF OPERATION OF BELLEFONTE REACTORS

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- No air quality standards will be exceeded.
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- 5 Hour Airplane Flight - 2.5 millirems
- Eating Food Grown with Phosphate Fertilizers - 1 to 2 millirems per year
- Wearing porcelain dental crowns or dentures - 0.7 millirems per year
- Bellefonte Reactor Operation with Tritium Production - 0.58 millirems per year
- Cooking with Natural Gas - 0.4 millirems per year
- Bellefonte Reactor Operation - 0.26 millirems per year

Commentor No. 76: Dan Williams (Cont'd)

PUBLIC RADIATION EXPOSURE COMPARISON
- Average U.S. resident (Background) - 363 millirems per year
- Resident of Denver, Colorado (Background) - 442 millirems per year
- Resident of Jackson County, AL (Background) - 355 millirems per year
- Resident of Jackson County, AL (Background plus Bellefonte Reactor Operation) - 355.26 millirems per year
- Resident of Jackson County, AL (Background plus Bellefonte Reactor Operation with Tritium Production) - 355.58 millirems per year

CONCLUSION: BELLEFONTE SHOULD BE THE PREFERRED ALTERNATIVE!

The draft CLWR EIS does not identify a preferred alternative for producing tritium. A no action alternative is for DOE to build an accelerator in South Carolina. After reviewing the draft EIS and comparing the potential impacts associated with the alternatives, including the no action alternative, we believe that the preferred alternative should be identified as any alternative that includes Bellefonte. This belief is based on the following:
- Negligible environmental impacts with no measurable health effects.
- Positive socioeconomic impacts supporting economic growth and development
- Flexible tritium production capacity to meet changing tritium needs
- Proven technology compared to the No Action alternative
- No proliferation issues that are not manageable under existing laws and controls associated with CLWRs
- Least Total Life Cycle Cost

Commentor No. 77: Danny L. Williams

October 6, 1998

My name is Danny L. Williams, Business Manager of the International Union of Operating Engineers, Local 320, Florence, Alabama.

Speaking on behalf of the 590 members, we unanimously support a cooperative effort between the Department of Energy and the Tennessee Valley Authority to complete the Bellefonte Nuclear Plant for the production of tritium.

The selection of Bellefonte offers:

1. an assured supply of tritium necessary to our national defense program,
2. at the least cost to the U.S. taxpayer,
3. and much needed employment to an economically depressed area of the United States.

We stand eager and ready to support DOE and TVA in the process of making a Bellefonte Tritium Production Facility a reality.

For the records, I would like to present to Mr. Moderator a written statement of our support.

1/07.03

THANK YOU.

Commentor No. 78: David Thornell

MOUNTAINS OF ADVANTAGE

Jackson County

A L A B A M A

Economic Development Authority

David Thornell, CED,
Executive Director

Shelia Bryant,
Assistant Director

Jackson County Economic Development Authority
Supports Tritium Production at Bellefonte

The lead economic/industrial development marketing and recruitment agency for Jackson County gives their enthusiastic endorsement for the production of tritium at the TVA-Bellefonte facility.

We feel that the selection of Bellefonte by the DOE to serve this nation's tritium needs represents a win-win situation for our county and this country. It is the clear winner and perhaps the best deal that the United States will ever have available from an investment standpoint. The shared power revenues as proposed will more than pay back all expenditures and the production of tritium in a light water reactor is the only proven method under consideration. We have learned a lot about this process through this selection phase. We have read the Environmental Impact Documents. We believe it is and will be safe. Without this knowledge we would be firm in opposing this project. However, based on the facts, Jackson County offers an operating environment that will be overwhelming in its support. This is true from our first-hand view and involvement and as indicated by these local public hearings. We want the jobs, we want the dollars and we want to support our nation's security interests by joining DOE and TVA in a partnership that will accomplish these common and vitally important objectives. Bellefonte is the wise choice and therefore the best choice.

1/07.03

817 South Broad Street • P.O. Box 609 • Scottsboro, AL 35768-0609
Ph: (256) 574-1331 • Fax: (256) 259-0873
E-Mail: JCEDA@HiWAAY.net

Commentor No. 79: Anonymous (3)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: We Are for Tritium Production At Bellefonte Plant | 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization:
Address:
City: State: Zip Code:
Work phone: Home phone:
Fax:
E-Mail Address:

7/4/98

Commentor No. 80: Anonymous (4)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: We are totally opposed to the proposal for environmental and other safety concerns (terrorism is a reality in our world today - this reactor most likely would be a prime target). | 1/14.04 | 2/22.01

Also... accidents do happen and even a small percentage of a chance of one occurring is far too risky considering the magnitude of a nuclear disaster. | 3/15.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Commentor No. 81: Melvin L. Brewer

IRON WORKERS LOCAL UNION NO. 704

INTERNATIONAL ASSOCIATION OF BRIDGE, STRUCTURAL, ORNAMENTAL AND REINFORCING IRON WORKERS

2715 BELLE ARBOR AVENUE CHATTANOOGA, TENNESSEE 37406

423 / 622-2111 FAX 423 / 622-2112

MELVIN L. BREWER
Business Manager

Good Evening,

I am Melvin Brewer, Business Manager of Local 704 of the International Association of Bridge, Structural, Ornamental and Reinforcing Ironworkers from Chattanooga, TN.

On behalf of our 600 plus members, I would like to voice our support for the proposed Commercial Light Water Reactor for the production of Tritium Gas at Bellefonte with Watts Bar and Sequoyah as a back-up.

The reasons for our support are numerous and are beneficial not only to the people of this area, but to the American people as a whole.

Some of the reasons are

Savannah River Site does not meet the 2005 production of tritium mandated by the President and Congress.

Accelerator Production of tritium requires a 500MW power source for operation. Bellefont will actual produce power. *1/07.01*

As for the safety of the plant, TVA has an excellent record. Accident risk for Bellefonte is one fatal cancel every 245 million years and transportation risk is less than one fatal cancer per 100,000 years. The risks factor for Watts Bar and Sequoyah are quite a bit less.

Additional low-level waste is about 1% of TVA current volume.

While the accelerator is an un-proven method, Commercial light water method has been proved at Watts Bar. With Watts Bar and Sequoyah has a back-up this plan will insure the country's supply of tritium for it's National Defense needs.

As Tritium production in a commercial reactor is not prohibited by International nor the United States law. We feel like the benefits out weight the risk.

Commentor No. 82: Danny M. Easter

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I AM IN SUPPORT OF THE CLWR PROJECT, BECAUSE OF OUR NATIONAL SECURITY & THE LEAST EXPENSE TO THE AVERAGE TAXPAYER. *1/07.03*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Danny M. Easter (optional)
Organization: Painter's LU 226 Chatt.
Address: P.O. Box 947
City: Rockwood State: Tenn Zip Code: 37854
Work phone: 423-365-3133 Home phone: 423-365-4151
Fax:
E-Mail Address:

7/4/98

Commentor No. 83: Ronald E. Easter

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I SUPPORT CLWR BECAUSE IT IS THE CHEAPEST WAY TO PRODUCE TRITIUM FOR OUR NATIONS DEFENSE. 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Ronald E. Easter (optional)
Organization: Printers LU226 Chatt.
Address: ~~[illegible]~~ P. O. Box 947
City: Rockwood State: Tn Zip Code: 37854
Work phone: 698-4163 Home phone: 354-1136
Fax:
E-Mail Address:

7/4/98

Commentor No. 84: Linda Ewald

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I ~~was~~ continue to be opposed to the production of tritium, because of the increased risk of environmental contamination, 1/10.03 increased hazard to human health, 2/14.04 increase production of nuclear waste (when we don't know what to do with current stores of waste), 3/16.04 the financial costs, 4/23.13 and the immorality of its use in nuclear weapons. 5/01.10

The United States does ~~[illegible]~~ not need tritium by the year 2005. By DOE's calculations the U.S. can maintain its current huge ~~[illegible]~~ arsenal without producing tritium until 2016. And if the arsenal is reduced, as experts claim it can and should be, no new tritium would be needed until 2036. Tritium decays at the rate of more than 5% per year - if production begins ~~by~~ the Public Health Security 2005 - half will be gone by the time it is actually used. 6/02.02

It will cost at least 2 billion dollars (and in reality probably much more) to begin production of tritium. That money is wasted - 2 billion Federal dollars could create 20,000 valuable jobs. 4(cont'd)

But most of all, the production of nuclear weapons materials in a civilian reactor is immoral 5(cont'd) and a violation of the nuclear non-proliferation treaty signed and ratified by the United States in 1970. It is → 7/01.04

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Linda Ewald (optional)
Organization: Foundation for Global Sustainability, Oak Ridge Environmental Peace Alliance
Address: 949 Pender Road
City: Knoxville State: TN Zip Code: 37923
Work phone: Home phone:
Fax:
E-Mail Address:

7/4/98

Commentor No. 84: Linda Ewald (Cont'd)

hipocracy for us to criticize other nations for their use of commercial reactors to produce nuclear weapons material, while we make plans to produce tritium in our civilian reactors.

As a taxpayer, grandmother and a human being, I do not want to support the production of tritium or any nuclear weapons material. Weapons of mass destruction threaten all of Creation. This plan sets a precedent that will destroy our international non-proliferation efforts. I urge the individuals with the power to make decisions to consider the long term consequences. Is short term gain worth the risk to our health, our home and our future?

Thank-you for the opportunity to comment.

7(cont'd)

Commentor No. 85: William Griffith

Stone & Webster FOUNDED 1889

STATEMENT FROM STONE & WEBSTER

My name is William (Bill) Griffith. I am a Vice President with Stone & Webster Engineering Corporation. We are now the Engineers of Record for the Bellefonte nuclear plant. We are one of the world's largest engineers and constructors of commercial nuclear facilities. We have reviewed the Draft Environmental Impact Statement and would like to compliment the Department of Energy on the thoroughness of that report. And we agree with the conclusions as stated both from a safety perspective and from the impact on the environment. We as the engineers, through our engineering and design responsibilities, will ensure that the Bellefonte nuclear power station is designed in compliance with all applicable laws and environmental regulations. *1/07.03*

###

10/8/98

Stone & Webster, Incorporated
P.O. Box 2325, Boston, Massachusetts 02107-2325
245 Summer Street, Boston, Massachusetts 02210
Tel: 617-589-5111 Fax: 617-589-2156

Commentor No. 86: Ann Harris

Ann Harris
305 Pickel Road
Ten Mile, TN 37880

phone # 423-376-4851
Fax # 423-376-8864
e-mail: apickel@aol.com

October 8, 1998

Comments to DRAFT EIS on TRITIUM production using the commercial light water reactors @ TVA:

1. Decommissioning of a TRITIUM production site has never been performed therefore who is going to clean up the mess left at Watts Bar when DOE and DOD leave? The cost will be much higher at a tritium production plant than at a plant not making tritium. Will the rate payers of TVA have that added to their stranded cost when deregulation hits? **1/20.01**

2. I could not find the definitions for such words as –
--"measurable health effects" **2/14.11**
--"associated impacts of transporting " **3/18.02**
--previous (TVA) impact statements—: "serve to a great extent as the basis for this EIS"
---Does it mean that DOE went back into history and found something they liked and used it -----that is what appears to have happened here. Watts Bar was licensed 3(three) years ago----Sequoyah over 15 and Bellefonte does not have one that is in this decade. So what is the basis for making that statement. **4/05.25** What is the NRC basing their decision of NO Significant Impact!
----What does No Significant Impact mean? Does that mean that the local people are of no significance, the country surrounding Watts Bar or the river is of no significance? Some where you must define how you use the word "significant" and how it applies to this EIS.
----TVA and the NRC both use the word **significant** until an action happens that makes people scream "Uncle". So I am asking what DOE's usage is in this format? **5/05.28**

3. You have used the national average of fuel rod burns to set the standard in this EIS. Why didn't you use TVA's average of burns. Is it because the average is much higher than 2 (two) per year. Using competent and safe nuclear programs around the nation does not reflect TVA's record. **6/19.06**

4. What is the basis for using INPO's reports to defend using TVA's CLWRs when the public does not have access to those reports and cannot get them? (The NRC and TVA both use INPO documents to make critical judgments that best suit them to write violations against TVA and TVA does not produce ALL of INPO's comments when talking to the public. Therefore the public is at a vast disadvantage responding to this EIS on that basis alone) **7/09.05**

Commentor No. 86: Ann Harris (Cont'd)

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ann harris
10-8-98 comments

5. You used the "affected environment area" terminology at the Bellefonte Meeting. Does that mean that you base that on the "current prevailing winds?" **8/14.12**

6. What is the current waste water program that the TVA nuclear programs use to clean up the reactor coolant waste water prior to release into the Tennessee river? Where is the procedure for that and how often is that program tested to support its reliability? What is the criteria that the NRC will use to monitor that program? Where is that criteria located now? **9/11.01**

7. At the Bellefonte it was stated that if TVA has an over run of the bid that TVA will pick up the overrun; i.e. the rate payers. Does the 1.9Billion dollars that using the CLWRs at TVA also include the cost of transportation to the SRS and does it include the cost of the extraction facility? If not why not?

8. You have made the point several times that TVA is a government agency. If that is a matter of fact shouldn't you notify the White House, congress, the media as well as the TVA Chairman and board in addition to the rate payers in the valley and notify them that TVA will be sharing the cost of mismanagement and illegal activities with all of the taxpayers across America. Also you state that TVA's reactors are government owned. When did the rate payers sell off the assets of the valley? What is the basis for these statements and why was this language used? TVA has never been known in the past as a government agency. Doe is taking the position that DOE only has to come in and confiscate TVA! **10/23.14**

9. In your draft you report very small numbers of abused employees that have been harmed as a result of raising safety issues. Are those numbers from the Department of Labor or is that from the thugs at Region II of the NRC or is that from the TVA Nuclear's Vice President that says that the NRC----DOE-----DOL----the media---- or the public does not know the law and that TVA has never abused any one over safety issues.

10. How will TVA------the NRC-------and DOE ensure a safety conscious work environment where employees feel free to raise safety issues with out damage to them, their families or their careers? When a TVA employee receives a death threat at his/her work desk since 1995 up and through out the past month then safety is not a top priority of these agencies. Where is my confidence that you are willing to protect workers from management abuse? **11/09.06**

Commentor No. 86: Ann Harris (Cont'd)

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ann harris
10-8-98 comments

11. Will DOE pay replacement cost for damage to private when the accident happens? (since the Price Anderson Act only requires that an insurance company to pay a set amount for damage to private property.) How will you reimburse me for your recklessness? 12/15.01

12. At the Bellefonte meeting you stated that you will be using Watts Bar, Sequoyah and in addition to Bellefonte to keep up the production on an annual rotation. What is the basis for this menage a trois with DOE? Also where in the EIS is that scenario addressed? 13/03.03

I have additional comments but will seek that they be addressed through further written comments.

Commentor No. 87: Jerry V. Mills

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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Comments: I support Tritium production at the TVA Nuclear facilities. I am an Engineer currently working at Sequoyah Nuclear Plant with 20 yrs experience in the nuclear industry. I worked 8 yrs on the Bellefonte design (Secondary side of plant - Power producing side). The design of the secondary side of the plant far exceeds the code requirements with respect to material certifications & quality. I was part of 2 major walkdowns of the secondary side of the plant in the early 1980's. All of the major equipment and piping is installed. Only small bore piping & misc drains & vents was not completed. Like Watts Bar, Browns Ferry & Sequoyah the Thermal efficiency of the plant (heat cycle efficiency) will be among the best in the country. With the growing concern over air quality, Finishing Bellefonte can help reduce greenhouse emissions from fossil fuels. 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Jerry V. Mills (optional)
Organization: Nuclear Engineering, Sequoyah Nuclear Plant
Address: 512 New Union Circle
City: Dayton State: TN Zip Code: 37321
Work phone: (423)843-8339 Home phone: (423) 775-6850
Fax:
E-Mail Address: JVMills@TVA.GOV

7/4/98

Commentor No. 88: Jesse L. Reed

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I am in support of the CLWR. We need the tritium for the protection of our nation, and the plants are already which is a huge savings for taxpayers. 1/07.01

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Jesse L. Reed (optional)
Organization: Ironworkers Local 704 Chatt. Tenn.
Address: 7437 Wasson Memorial Highway
City: Grandview State: Tenn. Zip Code: 37327
Work phone: Home phone: (423) 365-6669
Fax:
E-Mail Address:

7/4/98

Commentor No. 89: Steve Tanner

October 8, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
P. O. Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

I have the following comments on the Draft Environmental Impact Statement (DOE/EIS-0288D) for the Production of Tritium in a Commercial Light Water Reactor.

1. Summary - Section S.1.1 after last sentence add the same last sentence as Volume 1 section 1.1.1 which states: "DOE is considering only the purchase of irradiation services, not the purchase of a reactor." 1/24.12

2. Volume 1, Section 1.3.5 - Add reference to Speaker's Task Force on Nuclear Cleanup and Tritium Production, A Report titled: "Getting on with Tritium Production: A Report to Speaker Newt Gingrich" dated September 29, 1995. Reason for my comment is that this report also concluded there were no treaties, laws, or policies violated with CLWR tritium production. 2/01.04

3. Volume 1 Section 5.2.11 - Construction Impacts (regarding Accelerator) - I do not believe the most significant impact regarding dewatering has been captured.

   The current wording in the Draft CLWR EIS Section 5.2.11 currently states that impacts would be minimal, but there is no mention of the groundwater being contaminated. The APT Draft EIS, Section 3.3.2.2 identifies that radiological analysis of groundwater from the water table showed that radium and tritium are present in some locations beneath the preferred site and are slightly above the respective drinking water standards.

4. Under ERP No. D-DOE-A09828-00 Rating EC2, Surplus Plutonium Disposition (DOE/EIS-0283) for Siting, Construction and Operation of three facilities for Plutonium Disposition the EPA expressed concern as to the ***lack of assurance that proposed operations would not lead to further adverse impacts***. 3/04.05

   Draft CLWR EIS, Section 5.2.11, subsection on Operational Impacts states that the APT would produce neutrons which have the potential to penetrate the shielding and be absorbed by the soil and groundwater. This indicates that there **would be adverse impacts from operations** of the facility and that the EPA concerns under the plutonium disposition EIS are valid and should therefore also be addressed for the APT. I am not suggesting that all of the APT Impacts be addressed in the CLWR EIS. I do believe though that the most significant ones should be mentioned in the CLWR EIS since the APT is the no action alternative. If this area is not yet addressed in the

APT EIS, it would not be appropriate to address it in the CLWR EIS until the APT EIS has evaluated the issue. 3(cont'd)

Sincerely,

Steve

Steve Tanner
2475 Allegheny Dr.
Chattanooga, TN 37421

Commentor No. 89: Steve Tanner (Cont'd)

FR-ENVIRONMENTAL SCAN: 09/25/98

RA Web Page: http://insidenet.tva.gov/envmgt/regaff/ra.htm
For full text or "pdf" format: http://insidenet.tva.gov/envmgt/regaff/fedreg/em092598.htm

Index of Items: (09/25/98 Total 2)

1. **EPA**--Environmental Impact Statements and Regulations; Availability of EPA Comments
2. **EPA**--Common Sense Initiative Council, (CSIC)

-----No. 1 of 2---------
L-S ID No. : 645207 (72 lines)
PAGE: 63 FR 51349 NO. 186 09/25/98
CFR: -NONE-
CAPTION: Environmental Impact Statements and Regulations; Availability of EPA Comments
AGENCY: Office of Federal Activities
Office for Enforcement
Environmental Protection Agency
ACTION: Notice
CONTACT: Office of Federal Activities, 202-564-5076

SUMMARY: ERP No. D-DOE-A09828-00 Rating EC2, Surplus Plutonium Disposition (DOE/EIS-

Page 1

0283) for Siting, Construction and Operation of three facilities for Plutonium Disposition, Possible Sites Hanford, Idaho National Engineering and Environmental Laboratory, Pantex Plant and Savannah River, CA, ID, NM, SC, TX and WA.
Summary: EPA expressed environmental concern based on the effects on water and ecological resources and the presence of contamination in the existing environment and lack of assurance that the proposed operations would not lead to further adverse impacts.

Commentor No. 90: Steve Tanner

Good Evening, My name is Steve Tanner. I have over twenty six years experience in the nuclear and defense industries. I am an employee of TVA. I am here tonight though not as a TVA employee, but as an interested citizen and concerned taxpayer of the United States of America. The views and beliefs I express to you tonight are my own.

For over two years now, I have had the opportunity to gain a tremendous amount knowledge regarding DOE's efforts to obtain a new assured supply of tritium. I have researched information regarding what tritium is, the associated health effects, why the United States needs tritium, what has been occurring in congress and in DOE since 1989 pertaining to tritium production, what other nations are doing about tritium production, what the United States policies are regarding proliferation, arms reduction, science and technology, and how our political process is working just to name of few. I have also reviewed and compared data provided in the draft EIS's for both the CLWR and the APT options. I would be afraid to even try to estimate the volume of material I have seen and read regarding tritium.

Let me start by commending DOE and TVA for their thoroughness and depth in the draft Environmental Impact Statement for the CLWR production of tritium. I truly believe that all potential impacts have been identified and thoroughly evaluated.

~~Now,~~ Next I would like to share with you a few things that I have learned through my research and regarding the No Action Alternative:

The first thing I learned involves time and money:

> DOE has been attempting to provide an assured supply of tritium to meet defense needs for at least ten years now. In March 1989, a report was prepared identifying that an Accelerator for the production of tritium could be designed and built in Hanford, Washington at a cost of $2.3 Billion in 9 years.
>
> Today, over nine years later, 3 years into conceptual and detailed design activities, after numerous studies and some limited testing and who knows at what cost to date, the estimate is even higher. There is still $3.5 Billion to go to get an accelerator facility built and operating,

1/23.15

Commentor No. 90: Steve Tanner (Cont'd)

> 40 years of operations and maintenance cost, nine more years to go on the schedule, and not in Washington State but now in South Carolina.
>
> What this indicates to me is that we have people in this country that have found their answer to our ailing Social Security Program --- they have found a way to fund their own retirements through a pork barrel program called the Accelerator Production of Tritium—and it's being paid for through our tax dollars.

1(cont'd)

The second thing I learned deals with political interference:

> Congress has each year, I know since 1993, passed laws that required DOE to find a solution and make a decision regarding a source of tritium. In fact, in November 1993, congress passed the FY94 Defense Authorization Act which required DOE to evaluate the commercial production of tritium. Then a law was passed that specifically required any new tritium production facility to be built in South Carolina. Why South Carolina? Politics!
>
> In 1995, DOE's dual path strategy using an accelerator or a CLWR was published after the urging of congress for DOE to again consider commercial production. Congress recognized in public law the dual path strategy and mandated a decision date by DOE.
>
> Since then a political battle has been occurring. This battle has been Accelerator pork barrel benefactors against those that are serious about what is best for our country. Fortunately, we have some very strong and capable congressional members that have maintained DOE down a steady path of finding what is best for the United States and who support the decision being made by DOE based on merit not politics.
>
> I believe that DOE can and will make a decision based on what is best for the United States as long as the pork barrel politicians stay out of their way.

2/01.02

Commentor No. 90: Steve Tanner (Cont'd)

The third thing I learned also involves political interference but is more specific to so called proliferation implications:

> Who's to say what we as a country can achieve regarding arms reduction and control. I have seen some major shifts in our policy as a nation. Moving more and more towards being the leader in nuclear weapons reductions. The United States has been a leader in the development of the Comprehensive Test Ban Treaty, the Non-proliferation Treaty, and is currently leading the world towards adopting a Fissile Materials Cut-off Treaty.
>
> Yet while we move forward towards these goals, let us not forget that to lead we must take the right actions. I know that until we achieve total world nuclear disarmament the right action is for the United States to maintain a nuclear deterrent. I also know that to maintain that deterrent safe and reliable we need tritium.
>
> I believe to build an accelerator as a "New Nuclear Defense Production Facility" as part of the Nuclear Weapons Complex is not the right action. I state this because a new accelerator facility built with a mission of tritium production, a facility capable of producing fissile material such as plutonium and uranium, a new production facility controlled by the Nuclear Weapons Complex and probably not subject to IAEA accountability inspections, a facility that uses a technology that is not under current export controls --- that all of these things indicate high risk and they carry major proliferation implications. **3/01.04**
>
> On the contrary, DOE's purchase of irradiation services through a financial arrangement with TVA which allows for completion of Bellefonte, is consistent with the direction our country has been going regarding other military versus civilian technology uses.
>
> Let me share this with you: The United States National Security, Science and Technology Strategy states: "The Administration has launched initiatives that reflect new ways of doing business. Acquisition reform removes barriers that separate the defense industry from the commercial industry and thus ensures that the military acquires the highest quality equipment at the lowest cost. Our dual-use technology policy recognizes that our nation can no longer afford to

Commentor No. 90: Steve Tanner (Cont'd)

> maintain two distinct industrial bases and allows our armed forces to exploit the rapid rate of innovation of commercial industry to meet defense needs." **3(cont'd)**
>
> So I believe as we lead the world to disarmament and to minimize any potential proliferation implications, building the accelerator is not the right action. I also believe the right action is to use a CLWR. I state this because use of a CLWR:
>
> - supports our dual-use technology policy,
> - does not violate any laws, treaties, or policies,
> - Provides greater government control than the DOE Nuclear Weapons Complex which is managed by private sector Management and Operations companies under contract with DOE and in business for a profit while TVA reactors are managed and operated by government employees, and **4/07.01**
> - a CLWR would only be used to irradiate DOE components that produce tritium in a non-weapons usable form more like producing a raw material than the finished product in a TVA reactor.

In summary,

I recommend that DOE include as the preferred alternative to be identified in the Final CLWR EIS use of the Bellefonte facility with, when and if needed, a Watts Bar backup, and **5/06.05**

I request that DOE move expeditiously to eliminate any further funding of the "Accelerator Production of Tritium Project" or as a minimum rename the project to the "~~Pork Barrel~~ - Fund Our Retirement Production of Tritium Project". Then when someone says they are F.O.R APT, we'll know what they really mean. **6/04.01**

I thank you for listening and submit a copy of my comments for the record and your consideration.

Comments of Steve Tanner at Public Meeting on Tritium Production in Commercial Light Water Reactors, October 8, 1998, Evensville, TN

Commentor No. 91: Charles R. Watson

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: It is a good safe way to make tritium gas, and we need the job for people in the area 1/07.02

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Charles R. Watson (optional)
Organization: Paints L.U. 226
Address: 715 Fillmore Ln
City: Chatt, TN. State: TN Zip Code: 37343
Work phone:
Home phone: 842-5240
Fax:
E-Mail Address:

7/4/98

Commentor No. 92: Marie Weir

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I am in favor of CLWR because I believe it is in the best interest of our country to be able to defend ourselves and to do this, we must have the means of producing tritium.

I also believe CLWR is the most economical way to produce tritium. The plants are already there, which is a huge savings to tax payers in comparison to building a huge plant for that specific purpose. This is a two-fold savings as the plants also produce power at the same time.

It is safe according to all studies conducted. 1/07.02

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Marie Weir (optional)
Organization:
Address: 8507 Dayton Mtn Hwy.
City: Dayton State: TN Zip Code: 37321
Work phone: 698-4163
Home phone: 775-0356
Fax: 698-4932
E-Mail Address:

7/4/98

Commentor No. 93: Mitchell Weir

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I am in Favor of The CLWR process to produce Tritium For The Nations Stockpile. This option is The only one that makes any sense for the American taxpayer. The 9 Billion Dollar Savings along with the slight impact the CLWR will make on The Environment Makes The choice very easy. **1/07.02**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Mitchell Weir (optional)
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Address: 8507 Dayton Mt Hy
City: Dayton State: TN Zip Code: 37321
Work phone: 423-698-4163 Home phone: 423-775-0356
Fax: 423-698-4932
E-Mail Address:

7/4/98

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison

Comments on the
Draft Environmental Impact Statement
for Tritium Production
in a Commercial Light Water Reactor

by the
Oak Ridge Environmental Peace Alliance
October 8, 1998

CHAPTER 1

1.1.1 The document states that "the U.S. nuclear weapons complex does not have the capability to produce the amounts of tritium that will be required to support the Nation's current and future stockpile."

Comment: 1) The Nation is a magazine. The United States is a nation. 2) This statement is divorced from reality. The DEIS can reference the President's directive demanding more tritium, but as DOE well knows, its own numbers show we do not need tritium until 2016 (to maintain START 2 levels) and will by then likely need less tritium due to additional multilateral stockpile reductions. As NRDC has pointed out, a scenario of 1000 warheads—still more than enough to secure our national defense and serve as adequate a deterrent against hostile attack as any size arsenal—would not require additional tritium until 2032 (by that time, 3/4ths of any tritium produced in 2005 will have decayed away). **1/24.12** **2/02.02**

1.1.2 The DEIS envisions the life of the light water reactor being used to produce tritium to be 40 years.

Comment: In the case of Watts Bar and Sequoyah reactors, 40 years from 2005 would extend their life beyond current expectancy. In the case of Bellefonte, just a few years after the US would really "need" the tritium (2032 under the NRDC 1000 warhead scenario) the reactor would shut down. **3/21.03**

1.1.4 The DEIS proposes to define the reasonable alternatives as the four reactors "offered" by TVA (Watts Bar 1, Sequoyah 1&2, Bellefonte 1), added Bellefonte 2 as "reasonable" and proposed to examine the environmental impacts of using any combination of the five. TVA has withdrawn three of those reactors from its offer (Watts Bar and the Sequoyahs), leaving DOE with only Bellefonte 1 as "offered."

Comment: In considering reasonable alternatives, DOE must use some criteria and use it consistently. Either only the reactors offered in response to the procurement process can be considered (and then only those which continue to be offered), or all reactors, completed and uncompleted, which could be used must be considered as reasonable alternatives. (This would conceivably include the Fast Flux Test Facility in Richland, Washington and any number of commercial reactors operated by public utilities). Either the realm of reasonable is defined by those "offered" or it is not. In either case, DOE's current list is not sufficient to define "reasonable" alternatives. **4/06.03**

1.3.1 DOE describes the process by which the "required tritium requirements" (sic) are determined.

Comment: It is not clear from this description whether the date 2005 comes from the Presidential directive (where the President demonstrates the kind of clear thinking and good judgement that got him in his current mess, only this time on a subject far more serious) or from DOE's extrapolation from the Presidential directive. It should be made clear. **2(cont'd)**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

1.3.2. The DEIS: "In the absence of new weapons design and the total redesign of all warheads and delivery systems, the nation requires a reliable source of tritium to maintain a nuclear deterrent. Furthermore total redesign…would require nuclear testing which would be contrary to the President's pursuit of a Comprehensive Test Ban Treaty."

Comment: DOE demonstrates its selectivity in describing the context in which this "need" is being defined and this decision is being made. In imagining the possible future, it is more reasonable and just as accurate to say, "In the event of further arms reductions which would require accelerated dismantlement of the current nuclear arsenal, the nation's need for tritium to maintain its nuclear arsenal would decline along with the size of the arsenal, pushing the "need" date far into the future. This development would be in compliance with the nation's legal obligation to pursue complete disarmament under the Nuclear Nonproliferation Treaty, Article VI, which became the law of the United States upon its ratification in March, 1970. The DEIS should reflect reality—consideration of "reasonable alternatives" should not be bound by outdated policies, particularly those which have been denounced by no less eminent persons than General Lee Butler, retired head of the US Strategic Air Command and President Jimmy Carter. NEPA does not permit DOE to limit its "reasonable" alternatives to Presidential policy statements. **5/02.01**

1.3.3 The DEIS says tritium "must be available" by 2005 if a commercial light water reactor is the source and that tritium "must be available" by 2007 in a linear accelerator is the source.

Comment: This discrepancy is not based on any science or fact. It gives the lie to DOE's statement of "need." If the "need" for tritium is based on decay of tritium in the current arsenal and the fixed amount available in the reserve, then we will "need" tritium when we need it and the date will be the same whether the source is commercial reactors, linear accelerators, or purchase from Canada. **2(cont'd)**

1.3.5(2) The DEIS cites four instances of "exceptions to the practice of differentiating between US civilian and military facilities" in an effort to address proliferation concerns.

Comment: This attempt to skirt the significant concerns of the public (concerns shared by a large majority of the US House of Representatives) about the proliferation impacts of using a civilian nuclear reactor to produce bomb material is disingenuous, outrageous, and absurd.

Clearly the concern about nonproliferation which the US has used around the world has never been that a nation which possesses military nuclear facilities will surreptitiously use those facilities for peaceful purposes. It is disingenuous of the DEIS to pretend it misunderstood the public's concern. It is absurd to imagine we would threaten (or, as we ostensibly did in Iraq, attack) another nuclear power (Russia? Great Britain? China? France?) to prevent them from converting a military installation to a peaceful purpose, or to disable their efforts to use military technology for civilian purposes. **6/01.04**

Give us a break! The concern has always been that nations would be able to disguise weapons development as civilian activity or transfer commercial expertise toward the development of weapons of mass destruction. It is this activity we forbid in other nations (North Korea, Iran, Iraq, etc.) And it is precisely this activity we propose to undertake in this DEIS.

If, in fact, section 1.3.5 represents the best defense of the Interagency Review, then one of two things is true: either 1) the interagency review was bound by a predetermined outcome and had to perform these gymnastics of logic to attempt to perform its assignment satisfactorily or 2) the interagency review group was astonishingly inept.

1.3.5(3) The DEIS says any reactors used to produce tritium would "remain eligible for IAEA safeguards."

Comment: What are these safeguards? Is DOE saying the reactors would be placed under IAEA safeguard, or is DOE only being coy? Has IAEA agreed it would accept the responsibility of "safeguarding" these reactors? (This is not a silly question. In 1994, when DOE brought **7/01.06**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

highly"enriched uranium to the US from Kazakhstan, it announced loudly that the material would be placed under IAEA safeguards at Y-12 in Oak Ridge. This never happened because IAEA balked at the responsibility, apparently for two reasons: lack of resource to do the job, the fact that IAEA could not reasonably verify the contents of the cans and therefore declined to be responsible for them.) **7(cont'd)**

1.3.5(3) The DEIS says the fact that TVA reactors are technically owned by the government makes them "roughly comparable" to "past instances of government-owned dual-purpose nuclear facilities."

Comment: This statement not only insults the reader's intelligence, it is duplicitous. From a nonproliferation standpoint (the title of this section), crossing the line from civilian to military is in not remotely comparable to crossing the line the other way. **6(cont'd)**

1.3.6 The DEIS attempts to discuss DOE's current projections for future energy demand.

Comment: The DEIS does not make clear whether TVA's projections include conservation measures to reduce demand and/or development of renewable energy resources. **8/09.07**

1.4 DOE describes the NEPA strategy and the tiering (sic) of this decision from the Programmatic EIS.

Comment: DOE describes here a process which paves the way for an action that may prove unwise and untenable—that tritium will be produced in one of two ways even if the environmental impact statements for each demonstrate the impact to be drastic of prohibitive. DOE apparently leaves itself no room to back out, a position which runs counter to the intent of NEPA. **9/05.08**

1.4 DOE references the Record of Decision (60FR63878) compelling the two current EISes (linear accelerator and commercial light water reactor)

Comment: Does 60FR63878 stand regardless of the outcome of the EISes which tier (sic) from it?

1.5.1.2 The DEIS describes two Environmental Assessments on the Lead Test Assembly, one by DOE/TVA and an "independent" environmental assessment (small letters) by NRC.

Comment: It is distressing at this point to learn of the "independent" NRC environmental assessment. Apparently it was independent of any public participation. As such, it stands as a private government document and deserves the skepticism of a public shut out of its preparation process. **10/05.09**

1.5.2.4 The DEIS notes that TVA has been preparing a Bellefonte conversion EIS and that the EIS is on hold pending the outcome of this EIS.

Comment: It is unclear why the preparation of this EIS should impact the Bellefonte conversion EIS. It seems to make more sense to complete the conversion EIS so that the people living near the sites can make a decision about what they would like to see in their community—an operating fossil fuel electricity generating facility or a bomb plant. If this tritium CLWR EIS is going to influence the Bellefonte conversion, it should incorporate the conversion EIS in its entirety since they are connected actions. **11/05.05**

CHAPTER 2: Purpose and Need

The DEIS attempts to place the proposed action in a historic context. Any such effort much include the Nuclear Nonproliferation Treaty and its obligation to pursue complete nuclear disarmament. The United States ratified this treaty in 1970. In 1996, the International Court of Justice upheld the obligation of the US and other nuclear states to comply with the treaty obligation. **2(cont'd)**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

There is no reading of the Nuclear Nonproliferation Treaty which can countenance the construction of new facilities to create tritium.

This section also raises the question of "need." DOE claims, based on a Presidential finding, that the US "needs" tritium by 2005. Yet DOE's own charts—first printed in the PEIS on tritium production and repeated here make clear that there is no "need" for tritium until at the very earliest 2011 and, using material currently decaying "in the pipeline," until 2016. Realistic projections of further arms reductions (see our Comments at the scoping hearing for this EIS) based on maintaining a reasonable deterrent arsenal and using excess tritium from the pipeline, indicate no "need" for tritium until 3032 at the earliest.

Of course, it is the position of the Oak Ridge Environmental Peace Alliance that the US should abolish its nuclear weapons arsenal and lead other nations to do the same. Our position is shared, incidentally, by arms control experts and at least one former President of the United States. Yet the DEIS is dismissive of this scenario, suggesting at least that it is considered unreasonable.

In fact, DOE's position—that we "need" tritium by 2005—is unreasonable for at least two reasons:

First, it is based on a Presidential directive which, according to the international court of justice, violates our obligations under the Nuclear Nonproliferation Treaty which is the law of the land. The President does not have the right to violate laws, and even a "presidential directive" does not carry the force of law when it is counter to a law. **5(cont'd)**

Second, given the half-life of tritium, at least half of any tritium produced in 2005 (when DOE claims for the purposes of this document that we "need" it) will not be available when we truly will need it—in 2016. The nature of tritium is such that it only makes sense to produce the tritium as needed *when* it is needed; it simply has too short a shelf-life to be producing quantities of tritium a dozen years in advance of the time of need. DOE increases risks and the likelihood of environmental impacts by producing tritium in 2005—in order to have a predetermined amount of tritium available in 2016, DOE must produce twice as much tritium in 2005 as it would have to produce in 2015 to meet the same need.

DOE also notes in this section the presence of a five-year reserve of tritium which currently exists. The reserve tritium, being bound by the laws of physics, is not preservable. It is decaying. Tritium obeys the "use it or lose it" law. DOE should use this tritium before producing new tritium; the presence of a five year reserve simply adds five years to the time we "need" tritium.

CHAPTER 3: Commercial Light Water Reactor Program Alternatives

3.1. The DEIS says that tritium can be produced "during the normal operation of a CLWR."

Comment: On page 1-15, DOE says producing tritium in a commercial light water reactor on the scale proposed by DOE will generate additional spent fuel wastes. Removal and shipment of TPBARS is also not "normal." The DEIS must be forthright about the changes in normal operations required to accommodate DOE's proposal to produce tritium. **12/17.01**

3.1.2 The DEIS describes the Tritium Producing Burnable Absorber Rods, saying they are "long, thin tubes that contain lithium 6…"

Comment: Is all the lithium-6 necessary for these TPBARS already available or will lithium-6 need to be produced for this purpose? (The separation of lithium-6 from lithium-7, historically performed for nuclear weapons production at Oak Ridge's Y-12 plant, is responsible for the extensive mercury contamination for which Oak Ridge is so notoriously well known.) If lithium-6 will need to be produced, the environmental impacts of production must be thoroughly documented in the EIS. **13/19.07**

"3.1.2 The DEIS refers to a "maximum leakage rate of tritium for each TPBAR." **14/19.08**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

Comment: At the public meetings for the Environmental Assessment on the Lead Test Assembly (the first TPBARs to be inserted in Watts Bar) DOE repeatedly assured the public that leakage from TPBARs was virtually impossible. Explain fully, please.

3.1.3 The DEIS states that "some tritium is expected to permeate through the TPBARS during normal operation, which would increase the quantity of tritium in the reactor's coolant water system." **14(cont'd)**

Comment: At the public meetings for the Environmental Assessment on the Lead Test Assembly (the first TPBARs to be inserted in Watts Bar) DOE repeatedly assured the public that leakage from TPBARs was virtually impossible. Explain fully, please.

3.2.1 The DEIS states that DOE needs at least 4,000 TPBARs/year to produce its desired quantity of tritium.

Comment: Since TPBAR irradiation takes place during a normal fuel cycle, this means at any one time at least two and probably three reactors would be employed in the production of tritium. Currently, DOE has only one uncompleted reactor officially "offered" by TVA; this would appear to be inadequate to meet DOE's "need." **4(cont'd)**

3.2.1 The DEIS explains what impacts are considered for completed and uncompleted reactors.

Comment: The EIS should also provide a comparison between the two—between Watts Bar and Bellefonte, for instance, in order to allow the reader to understand the true choice from an environmental impact point of view. The purpose of NEPA is to compel the government to choose from among reasonable alternatives that which has least adverse impact on the environment. If the government owns all the TVA reactors, which this EIS claims for the purposes of making its nonproliferation argument, DOE can compel tritium production in whichever TVA reactors have the least environmental impact (in this case, saving the taxpayer several billions of dollars). **15/06.07**

3.2.1 The DEIS states that transportation impacts are based on an assumption that 4,000 irradiated TPBARs per year are transported.

Comment: The evaluation of transportation impacts should be straightforward, based on DOE's actual expected timing. If TPBARs are to be shipped on a regular basis, at the minimum rate, stretched throughout the year, the scheme for analyzing transportation risks presented here may be appropriate. If, on the other hand, TPBARs will be transported in bursts—3,400 over a relatively brief period every eighteen months, for instance—the analysis should address that scenario. **16/18.03**

3.2.1. The DEIS assumes completion of Bellefonte by 2005.

Comment: The DEIS should be subjected to a reality check and more reasonable projections should be used based on progress thus far on Bellefonte (begun twenty-three years ago) and the schedule of TVAs most recently completed reactor, Watts Bar I. **17/09.08**

3.2.1 The DEIS explains that it is essentially deferring questions about the management/storage of spent fuel.

Comment: Since Watts Bar does not have fuel storage capacity for the time period under consideration in this proposed action (40 years), issues of spent fuel storage and management can not be finessed but must be discussed in detail, specific to each reactor under consideration. **18/17.04**

3.2.3 The DEIS defines "reasonable alternatives." **4(cont'd)**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

Comment: Since some of the reactors under consideration as "reasonable alternatives" are not officially available to DOE (the TVA offer having been withdrawn) they are, essentially, like all the other commercial or government-owned reactors in the country unavailable to DOE. The criteria DOE is using to define "reasonable alternatives" must be explicitly stated. **4(cont'd)**

Table 3-5. page 3-16 Lists gaseous emissions of 282.5 Curies on an annual basis.

Comment: This does not appear to be an insignificant number. A clear accounting of the radionuclides should be included. **19/14.13**

3.2.5.2 Description of the facilities under consideration as reasonable alternatives.

Comment: The DEIS does not consider the possibility of an attack by hostile forces on these plants which would be making materials essential to the US arsenal of nuclear weapons of mass destruction. Given the fact that these facilities would be the least protected and least safeguarded of all US nuclear weapons facilities, this is a possibility which must be contemplated and included in the analysis. We note from the map and description here that the Sequoyah plant is located only 7.5 miles from Chattanooga, a major metropolitan area, making it a comparatively attractive target for terrorists. **20/22.01**

Table 3-9 lists annual releases of gases from Sequoyah plants.

Comment: The units of measure (presumably curies) for "other radionuclides" should be added; the "other radionuclides" should be identified. **19(cont'd)**

3.2.5.3 The DEIS describes Bellefonte Nuclear Plants 1 and 2

Comment: According to the DEIS, the chronology of Bellefonte construction is this:

- construction begins in 1975
- construction halted in 1988
- construction begins in 1992
- construction halted in 1994
- announcement of conversion to fossil fuel in 1996
- announcement of scheme to complete as nuclear in 1997

The EIS, in determining the reasonableness of completing Bellefonte for tritium production by 2005 should provide information on how complete Bellefonte currently is, how realistic the 2005 date is, and what size of spent nuclear fuel cooling pool is being (or has been) designed and constructed. **17(cont'd)**

3.2.6.1 The DEIS says, "Such conversion [of Bellefonte to fossil fuel] would be independent of this EIS and would not occur until after a decision were made regarding the role of Bellefonte 1 and 2 in tritium production.

Comment: This sentence tries to assert that the consideration of Bellefonte's conversion to fossil fuel is independent of this EIS at the same time that it states explicitly that it is dependent on the outcome of this EIS. The decision to convert Bellefonte to fossil fuel, taken in 1996 by TVA, is now being withheld pending the decision under consideration in this EIS—it is by definition dependent on this EIS and should be acknowledged and treated as such, despite the NEPA headaches which might be created by such acknowledgement of the facts. **11(cont'd)**

CHAPTER 4—Affected Environment

General Comment: The EIS fails to give adequate consideration to the analysis of environmental justice issues, dismissing them in one brief statement. **21/13.08**

Commentor No. 94: Oak Ridge Environmental Peace Alliance Presented by Ralph Hutchison (Cont'd)

Environmental justice asks this question: Are impacts being disproportionately visited on people of"color or low-income communities? The DEIS asserts the answer is no (5.2.3.10).

It is not enough to make this assertion, nor is it adequate to disguise adverse impacts on specific populations by describing a wide circle around the plant and drawing generalizations about the population living there. Environmental Justice doesn't ask in general about large areas; it asks specifically: are the people living closest, most likely to be impacted, low-income, people of color, or both?

For example: At Sequoyah, the DEIS draws a circle with a 50 mile radius around the plant and draws conclusions based on averages for the population within that huge area. Closer inspection, however, notes that the per capita income level for the closest community to the plant, Soddy Daisy, is less than half the income level for the entire county (Hamilton) which is circumscribed by the large circle. (4.2.2.8, p.4-47). **21(cont'd)**

This one instance where the DEIS provides information to make a comparison raises immediate environmental justice concerns. The EIS must include a thorough examination of environmental justice issues which answers the fundamental question: Are the people living nearest the plant—those most likely to be exposed to environmental insults—disproportionately low-income or people of color communities (or both)?

Table 4-35 The DEIS addresses economic impacts of the proposed decision.

Comment: The DEIS here addresses economic issues. (In response to Comments from the scoping hearing, the DEIS seems to pretend that economic questions are outside the scope of the EIS. NEPA, however, requires federal agencies to consider "the whole of the human environment," which obviously includes economic questions.) **11(cont'd)**

The DEIS fails to include in any of its analysis a comparison of the eventual decontamination and decommissioning costs between Bellefonte as a nuclear site and Bellefonte as a fossil fuel electricity generating plant. It should do so, since these are the possible futures for Bellefonte. Absent a role as a tritium producer, Bellefonte will not be completed as a nuclear plant.

4.2.3.11 The DEIS describes storage capacity at Bellefonte and says each unit has a storage pool which has the capacity to hold 1,058 spent fuel assemblies.

Comment: Does this mean it can or can not accommodate 3,400 TPBARs every eighteen months for forty years? **22/17.05**

CHAPTER 5: Environmental Consequences

Table 5-42 The environmental consequences of environmental impacts under different conditions for dry cask storage (required where pools are not adequate, such as Watts Bar) are considered using a generic matrix.

Comment: The information about earthquake and tornado damage is not sufficient to allow the reader to determine the adequacy of this method of estimating environmental impacts. **23/17.06**

5.2.7 The DEIS states that DOE will provide needed low-enriched uranium for additional fuel assemblies from its own supplies using uranium downblended from the US nuclear weapons program.

Comment: Despite the identification of the nonproliferation concerns associated with this scheme in earlier public meetings, the DEIS does not address this question. DOE currently has at its disposal **24/01.07** quantities of highly enriched uranium which has been determined to be excess to our national security needs. In recent years, DOE completed an EIS covering the downblending of this material for use in commercial nuclear reactors.

At the time DOE withdrew highly enriched uranium from the larger Programmatic Environmental Impact Statement of the Disposition of surplus fissile nuclear weapons materials, it did so for the explicit purpose of indicating to the world our determination to remove this material from the nuclear weapons arena. The decision was advertised to the public and other nations as one driven by nonproliferation concerns. It was critically important that we not only voice our resolve but that we take concrete steps to make that resolve manifest.

Does DOE not now care about the nonproliferation message sent to the public and the world by this proposed action? Are other nuclear or near-nuclear nations to be played as fools on the world stage, joined by the American people?

On the one hand, we removed the highly enriched uranium from our nuclear stockpile to show our determination to reduce our reliance on the nuclear arsenal in order that other nations would be encouraged to do the same. On the other hand, we now propose to take that very same material, downblended, and return it to the nuclear weapons production pipeline by using it to produce tritium to maintain our arsenal at levels which exceed the START 2 levels and violate the Nuclear Nonproliferation Treaty.

Surely this madness has direct, immediate, and profound proliferation concerns which must be addressed in this document. Additionally, it undermines any confidence the public might have had in DOE's determination to deal honestly and forthrightly regarding special nuclear materials—the solution to that, of course, is not for DOE to add another section to this document, but for it to abandon its current scheme. 24(cont'd)

Tables 5-50, 5-51 lay out the actual expected releases of tritium to the environment in a table which compares normal operation of Watts Bar and Sequoyah to operation with TPBARs in place.

Comment: DOE/TVA should highlight for the public these facts, not immediately apparent from the tables, especially in light of the fact that at previous hearings (cf. Spring City, TN) DOE assured the public the TPBARs were virtually leakproof.

- Each TPBAR is assumed to leak 1 curie of tritium per year (p. C-19)

- Total releases of tritium to the air during normal (no accident) operations will be 60 times higher at Watts Bar if tritium is being produced. (Table 5-50)

- Total releases of tritium to the water will be five times as much during normal (no accident) operations if tritium is being produced at Watts Bar. 25/14.05

- In accident conditions, releases of tritium to the air (failure of two TPBARs) at Watts Bar would increase nearly 300 times. Ninety-nine percent of the tritium released would be due to tritium production under this proposed activity.

- In accident conditions, releases of tritium to water will be nearly thirty times as high—an additional 17,010 curies—from tritium production.

- Under normal operations (Table 5-51) the annual dose for people living as far as fifty miles from the Sequoyah nuclear plant will triple (10.5 person-rem v. 3.2 person-rem).

Table 5-53 addresses cumulative impacts at Bellefonte comparing Bellefonte as a nuclear site with Bellefonte as a nuclear site making tritium for bombs.

Comment: Comparison should be between Bellefonte as a nuclear plant making tritium and Bellefonte as a fossil fuel plant, since absent DOE's billions of dollars for tritium, Bellefonte will not be completed as a nuclear plant. 11(cont'd)

OTHER COMMENTS

A-23 This appendix considers tritium production operations. Numbers on page A-23 indicate that Bellefonte would produce an additional 1,863 spent fuel assemblies if it were selected to produce tritium. This number exceeds the total capacity of Bellefonte's current spent fuel pools. 26/17.07

In the response to Comments section, the DEIS further muddies the water about the "need" for tritium, stating (F-6) that the Presidential requirements take into account "recent international arms control agreements." According to DOE's own figure, however (Figure 2-1, p. 2.2) the US currently has enough tritium to maintain the stockpile at START 2 levels until 2011 (2016 if the reserve is used). Both of these presentations can not be true at the same time.

The response to questions about why tritium is "needed" by 2005 if produced in a reactor but not "needed" until 2007 if produced in an accelerator is not adequate. It would appear that the same solution (using the reserve for a few years and replenishing it from new production) could apply as easily to reactors as to an accelerator. The fact, which DOE should come clean about, is that we do not "need" tritium by 2005. We just want it by then to feel more secure. And we are loudly going through the process of securing tritium production by then not because we "need" it (by any measure) but in order to try to pressure other nations to do what we want with their arsenals. This commenter notes that it is logic reminiscent of the old "Bizzaro World" skits on *Saturday Night Live* during the Reagan administration to try to compel others to do what you want by doing precisely the opposite. 2(cont'd)

The third Comment on page F-10, addressing Nuclear Weapons, asserts that tritium production is consistent with and fully supportive of the commitments of the US under a variety of treaties, including the Nonproliferation Treaty. This response is a lie—a statement intended to deceive. As the International Court of Justice ruled in 1996, the US is not upholding its treaty obligations under the nonproliferation treaty and the production of tritium for the sole purpose of maintaining a large arsenal into the next century directly contradicts our obligations under Article VI of the treaty. It is incomprehensible—beyond even the wildest gymnastics of language or logic—to state that maintaining our large arsenal is consistent with our obligation to pursue complete disarmament. 6(cont'd)

The response to the final Comment in the DEIS (p. F-12) asserts that "moral and ethical issues are beyond the scope of the EIS." But NEPA clearly states that an EIS must consider the whole of the human environment. In fact, the decision to seek to protect the natural environment and wildlife is a moral decision; the inclusion of environmental justice concerns is the result of nothing other than moral considerations; economic issues are heavily freighted with moral considerations. Abstract moral and ethical issues may present a greater challenge to the preparers of an EIS and may confront federal decision-makers with information they would choose to ignore, but it is possible to consider and even quantify the effects of many moral decisions. This commenter asserts, DOE denials notwithstanding, that moral and ethical issues are already present in abundance in this EIS, and the issues raised at the scoping meeting, while uncomfortable to contemplate and difficult to quantify, deserve full consideration throughout this decision-making process. 27/01.10

Commentor No. 95: Thomas J. Stone

SAVANNAH RIVER REGIONAL DIVERSIFICATION INITIATIVE

P.O. Box 696, Aiken, South Carolina 29802, (803) 593-9954 ext. 1409 FAX (803) 593-4296

RESOLUTION

WHEREAS, tritium is a critical ingredient in nuclear weapons and its ready availability is essential to the continued national security of the United States; and

WHEREAS, the U.S. currently has no domestic tritium production capability; and

WHEREAS, the United States Government is currently considering two technology alternatives, including use of existing commercial light water reactors, for meeting future tritium needs; and

WHEREAS, the merging of defense and peaceful uses of nuclear energy in a single facility as would occur in using a commercial power reactor for production of tritium has been counter to national policy since the commencement of the Atomic Age: and

WHEREAS, the existing commercial reactors proposed for tritium production would not be located on a secure Department of Energy defense production site and would not be under the Department's direct control and oversight; and

WHEREAS, the use of commercial power reactors for defense purposes violates the historical separation between peaceful and defense uses of nuclear energy and could be expected to erode public confidence and support for commercial nuclear power facilities;

NOW BE IT RESOLVED that the Savannah River Regional Diversification Initiative Board of Directors opposes the use of U.S. commercial light water reactors for production of tritium.

ADOPTED THIS 22nd DAY OF SEPTEMBER 1998 AT AIKEN, SOUTH CAROLINA.

1/01.09

Thomas J. Stone
Chairman

Robert M. Reich
Secretary

Commentor No. 96: Ralph E. Crafton

AddressID: 41

Date Updated: 10/8/98 3:12:27 PM

First Name: Ralph

MI: E

Last Name: Crafton

Title: Boilermaker

Organization:

Address: 413 Martin st.

City: Scottsboro

State or Province: AL

Postal Code: 35768-

Country: USA

Work Phone:

Fax Number:

Email Address: crafton@hiwaay.net

Home Phone: 256-259-4642

Notes: Istarted working at Bellefonte neclear plant in 1976 I saw this plant being built I I would like to see it finished by the DOE &TVA .This part of AL. TN.need theses kind of job I was laid off in 1985 from Belllfonte. I would like to work there again .I support the neclear industary & the DOE.

1/07.03

Commentor No. 97: James S. Arrington

AddressID:	42	Date Updated:	10/9/98 7:43:49 AM
First Name: James	MI: S	Last Name: Arrington	Title: Mechanical Engineer
Organization:	TVA, Watts Bar Nuclear Plant, Site Engineering		
Address:	EQB 2N-WBN		
City:	Spring City		
State or Province:	TN	Postal Code: 37381-	Country: USA
Work Phone:	423-365-1605	Fax Number:	423-365-1750
Email Address:	jsarrington@tva.gov	Home Phone:	423-693-4714

Notes:

This message is to Stephen Sohinki,
I was at the meeting last night at Rhea County HS and did not get to ask my question. I was wondering if DOE had pursued another option, other than CLWR & ATP. For instance, I believe it would be possible, as the bird sits in the silo the hydrogen decays into 50% helium & 50% hydrogen thereby significantly reducing the boosting effect. If at the time of launch, a squib valve blows allowing the helium/hydrogen to blowdown into a winding of silver-palladium tubing which is wrapped tightly around a pyrotechnic device which is ignited at the same time the squib valve blows, the tubing would become white-hot thereby passing the helium thru the walls of the tubing and separating the helium from the hydrogen. arming the warhead with pure hydrogen while the missile is in flight. This option would negate the high cost of tritium production. why hasn't a third option been pursued???? Thanks and keep up the good work. 1/01.03

Commentor No. 98: David & Willie Bellomy

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I ~~oppose~~ Am ~~[illegible]~~ ~~Opposed~~ Opposed TO This being PUT IN Belle FONTe because OF What IT Will do To The ENVironment, The Air-WATer, We Need TO THINK OF OUR Children & grandChildren. OUR TENN. River is AlReady dirty. you Can Check and See IF I Am Right About IT being ONE OF The 10 IN The NATION Also There are a LOT OF People IN This Area. 1/10.03

I Will NOT Support This UNLess IT is Natural GAS! 2/07.06

I was AT The DOE MeeTING Held AT NORTH East Comm College. MOST OF The People For The ProducTION OF Tritium AT BelleFONTe Was From OUT OF TOWN. I Have Lived IN Jackson County & SCOTTSboro ALL my Life & Know The majority OF People IN This Area. MOST OF The Cars We SAW IN Parking Areas were from Tennessee

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: DAVid & WiLLie Bellomy (optional)
Organization: Home OWNer
Address: P.O. Box 434 - 425 CAmpGround Circle
City: SCOTTSboro State: AL Zip Code: 35768
Work phone: Home phone: 574-5303
Fax:
E-Mail Address:

Also They made IT Clear we would Hear From Public OFFicals.
Thank you
Willie Bellomy

Mail to:
U.S. Department of Energy, Commercial Light Water Reactor Project Office,
ATTN: Stephen Sohinki
P.O. Box 44539,
Washington, D.C., 20026-4539

Commentor No. 99: Louise Gorenflo

Louise Gorenflo
185 Hood Drive
Crossville TN 38555

10/9/98

Dear USDOE

I oppose TVA making tritium for the Department of Energy.

* US insists that other nations do not use their civilian reactors to make weapons materials. The U.S. should act in a consistent manner. **1/01.09**

* The U.S. does not need tritium now. Half of the tritium made today will be decayed by the time it is needed **2/02.02**

* The tritium project is an expensive waste of tax dollars. If we want to strengthen our national defense, we need to put these dollars into educating our children. **3/23.13**

* Production of tritium will violate the Nuclear non-proliferation treaty that obligates all nations to nuclear disarmament. **4/01.04**

* Tritium production endangers the health of the local community. ~ Louise Gorenflo **5/14.04**

Commentor No. 100: Richard & Lucy Henighan

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments:

Tritium is highly radioactive and very dangerous. Its manufacture, despite planned safeguards, demands unequivocal need, which does not exist. The need for tritium depends on the number of nuclear weapons the US will maintain in the new century, and the environmental impact of tritium is tied up centrally with the environmental impact of nuclear weapons & the international arms race. Our treaty obligations (the nuclear nonproliferation treaty), and the growing risks due to international proliferation of nuclear weapons demand continuing restraint by the United States, as the leading nuclear power, and negotiated decreases in our nuclear stockpile. A 1000 bomb arsenal, more than adequate to deter attacks, would not require any additional tritium until nearly a third of the way thru the next century. Manufacturing tritium now will only impede the process of nuclear disarmament and nonproliferation, with all the heightened risk of regional or global catastrophe associated with any use of nuclear weapons. In addition the manufacture of tritium in commercial settings will greatly increase the risk of proliferation, since it breaches a fundamental principal of nuclear policy up to now: the separation of peaceful and military uses of nuclear power. The draft EIS does not deal with these issues adequately and the process of approval for this project should not go forward. **1/14.04** **2/02.02** **3/01.04** **4/01.09**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Richard Henighan / Lucy Henighan (optional)
Organization:
Address: 619 Mt. View DR.
City: Seymour State: TN Zip Code: 37865
Work phone: Home phone:
Fax:
E-Mail Address:

7/4/98

Commentor No. 101: Kenneth W. Holt

DEPARTMENT OF HEALTH & HUMAN SERVICES — Public Health Service

Centers for Disease Control and Prevention (CDC)
Atlanta GA 30341-3724

October 5, 1998

U.S. Department of Energy
Commercial light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
P.O. Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

We have completed our review of the Draft Environmental Impact Statement (DEIS) for the Production of Tritium in a Commercial Light Water Reactor [DOE/EIS-0288D]. We are responding on behalf of the U.S. Public Health Service, Department of Health and Human Services. Technical assistance for this review was provided by Dr. Felix Rogers, Radiation Studies Branch (RSB), National Center for Environmental Health, Centers for Disease Control and Prevention (CDC).

The DEIS Sections, Appendices C, D, and E dealing with potential adverse human health effects resulting from Environmental releases of radioactive or hazardous materials to the environment appear to be well developed and comprehensive. Radiological and hazardous waste exposures to the public from environmental releases resulting from normal operations, operational accidents, and transportation were estimated using information on source terms and potential at-risk years. Exposure modeling used to project the impacts on the health of the public due to radiological and chemical releases included meteorological data, hydro geologic data, and potential release scenarios that included both facility and transportation accidents. **1/14.06**

Risk estimate endpoints for the public included 1)excess cancers from radio nuclide and chemical exposures, 2)cancer fatalities from radio nuclide exposure, 3)adverse genetic effects from radio nuclide exposure, 4)hazard quotient from exposure to nonradioactive materials. Risk from radiological exposures were estimated using NCRP 1993 risk estimates. The uncertainties in the DEIS risk analysis procedure included model uncertainty, source term uncertainty, scenario uncertainty, and parameter uncertainty (sampling error, data sources)

Environmental pathway modeling done by the reviewer show little exposure to off site individuals from facility accidents or normal operations. The risk to public health from the operation, transportation and accident scenarios as expressed by the DEIS are low and reasonable expectations from operations of Commercial Light Water Reactors.

Commentor No. 101: Kenneth W. Holt (Cont'd)

Page 2 - Mr. Sohinki

Thank you for the opportunity to review and comment on this DEIS. Please send us a copy of the Final EIS, and any future environmental impact statements which may indicate potential public health impact and are developed under the National Environmental Policy Act (NEPA). **1(cont'd)**

Sincerely,

Kenneth W. Holt

Kenneth W. Holt, MSEH
Special Programs Group (F16)
National Center for Environmental Health

cc: Felix Rogers, Ph.D.

Commentor No. 102: Bre Nicole Reiber

PSRNYC
PHYSICIANS FOR SOCIAL RESPONSIBILITY/NYC
Disarmament • Environmental Protection • Violence Reduction

October 6, 1998

Stephen Sohinki
U.S. Department of Energy
P.O. Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

I am writing on behalf of the New York City chapter of Physicians fo Social Responsibility, a nonprofit public education organization representing 1,200 health professionals and concerned citizens in th New York metropolitan area. After reading the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor, I am deeply concerned with the DOE's inaccurate interpretation of national and international laws and its downplaying of the public health effects of low-level radiation.

The EIS asserts that "the use of CLWRs for tritium production (is) not prohibited by law." That is not accurate. Section 57e of the Atomic Energy Act prohibits the government from using commercial nuclear power plants to facilitate the development of nuclear weapons. It is noted in the EIS that "historically, there have been numerous exceptions to the practice of differentiating between U.S. civil and military facilities." It fails to mention, however, that these historical exceptions came with extreme financial and environmental costs, as there would be today. **1/01.09**

Next, the issue of nuclear nonproliferation is of paramount concern to PSR members. I would like to point out that tritium production for the purpose of maintaining a nuclear arsenal *does* violate a very important international treaty—contrary to what is stated in the EIS. As a signatory of the Nonproliferation Treaty (NPT), the U.S. has an obligation to work in good faith towards complete nuclear disarmament. Tritium production announces our intent to maintain a nuclear arsenal—and other nations can be expected to follow our lead. **2/01.04**

Last, the EIS avoids the most important issue with regard to

475 Riverside Drive • Room 551 • New York, NY 10115
Phone: 212-870-2980 • Fax: 212-870-2243 • Email:psrnyc@igc.apc.org

Commentor No. 102: Bre Nicole Reiber (Cont'd)

low-level radiation exposure: there is no safe low dose of low-level radiation. Radiation exposure can result in an array of adverse health effects, with cancer being the most lethal. **3/07.05** Additionally, the U.S. has yet to find a safe, permanent storage facility for radioactive waste; until it does so, creating more radioactive waste—no matter how small—is environmentally and socially irresponsible. **4/17.15** Countless studies have shown that man-made radiation is *not* a near-harmless, natural extension of background radiation, as DOE and EPA public relations claim. **3(cont'd)**

While I was disappointed that the Senate approved of CLWRs for tritium production, I was pleased that the DOE will receive no funding for it in FY 1999. In the interim, I hope the DOE will be more thorough in considering its impact on national and international obligations, on human health, and on the environment. **5/01.11**

Sincerely,

Bre Nicole Reiber

Bre Nicole Reiber
Executive Assistant

Commentor No. 103: William D. Scarbrough

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I have only had time to review the summary of the impact statement. I realise that it is prepared by advocates. Starting from this and my limited personal background the following opinion is hereby issued. I am sure more learned opinions will prevail. As I perceive this, any polution problem will not be any greater than that which already exist for the TVA area. 1/10.04

The actual Tritium extraction occurs in areas already over exposed to mismanagement. TVA areas would only expose special control rods and ship them to the extraction plant. It appears that this in no way adds significantly to any existing situation. 2/24.07

I am concerned that the ATOMIC ENERGY/BOMB PRODUCTION does NOT have a absolutely spotless history in environmental safety. 3/08.02

We do however already hve Energy production in the vally and it appears that control rod exposure would provide for great financial inhancement and efficiency for our area and AEC tritium production. Also it accomplishes this with a minimum of exposure to perceived dangers. 4/23.13

[illegible]

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Wm D Scarbrough (optional)
Organization: RETIRED
Address: 3503 Sparkman Dr NW
City: Huntsville State: AL Zip Code: 35810
Work phone: N/A Home phone: 256 852 9550
Fax:
E-Mail Address:

Commentor No. 104: Jennifer Stephens

Plumbers & Steamfitters Local 498 Gadsden, Alabama

Good Evening Ladies and Gentlemen,

It is apparent to me that those of you who object to the use of Bellefonte as the site for the extraction of tritium have many valid reasons for your opposition, not the least of which include your deep concern for the health and well-being of yourselves and your families. We, the proponents of tritium production at Bellefonte, are concerned about our families as well. I must assume that those of you in opposition have occupations which allow you to see you families each and every day. You wake up in your own bed every morning. You go to your job every day. And you return to your home every evening. However, many of us in this room are denied this aspect of daily life which you take for granted. We, or our spouses, have occupations which require us to travel hundreds of miles away from our homes because there is no where in northern Alabama for us to make a living. We must wake up in strange beds, work in strange towns, and live in strange motels while we are away. We keep in touch with our families by telephone. We do not get the luxury of watching our children grow up. We miss birthdays, school functions, our kid's baseball games, anniversaries. We miss being able to come home each night. 1/07.03

Now, it may be easy for those of you to whom I am speaking to just say, "Get a different job." Well, that's not the answer. The economy of northern Alabama was booming when we began our careers. Unfortunately, industry moved north, and therefore, so did our jobs. Its time to bring the jobs back home.

The thought of 4,500 temporary and 700-800 permanent jobs becoming available in northern Alabama is almost too great a prospect for us to even think about. These jobs do not only mean that we will be able to work at home, they mean that the local economy will undeniably increase. We will be here to purchase our gasoline, our food, and our work-related items. We will be here, in northern Alabama, putting our money back into our own economy. Everyone will benefit.

Why should we continue living in the dark ages? Nuclear technology is here and it is not going to go away. Our direct risks from that technology are minuscule compared to the risks we will all take when we leave here tonight and drive home. If tritium is not produced at Bellefonte, it will be produced somewhere else. This means that all of the benefits I just spoke of, will continue to be benefits to some other area of the country. We do not want this to happen anymore. We need the jobs here. We need to boost our own economy for a change. We need to be at home, so we too, can be with our families.

Commentor No. 105: Mary Ellen Bowen

Comments Received via "800" Number

Date:	Oct 16, 1998
Name:	Mary Ellen Bowen
Organization:	
Address:	Lewis County, TN
Phone #: **Fax #:**	(931) 964-2534
Comment #:	

Comment:

I just want to state that I do not want you to proceed with the use of tritium or any other thing to keep the nuclear power industry alive. I think that it is wrong and that it is hurtful to the people and the planet and please put a stop to it. Thank you. *1/14.04*

Commentor No. 106: Dot Houser

Comments Received via "800" Number

Date:	Oct. 19, 1998
Name:	Dot Houser
Organization:	
Address:	46 Sherry Drive Ringo, GA 30736
Phone #: **Fax #:**	(706) 866-7239
Comment #:	

Comment:

I am voicing a very strong opinion of not putting tritium at the Bellefonte plant near Scottsboro, Alabama in Jackson County. There are enough people down there dying with cancer as it is with much radiation, contaminated air, and everything as it is, but there are a lot of older folks there. *1/14.04* They do not need this. The people that live in that area are not educated enough to run plants like that, they would have to bring in employees to run the plant and it is not a good idea. *2/13.01* Absolutely, I just resent this being pushed down the throat of us North Alabama people. We have a second home there. We live in North Georgia, but we are in North Alabama since we opted to have a second home there and this just hurts me to the bone when I think about something like that coming to that area, it really does, but I trust that somebody else will take it somewhere else. Thank you for your time

Commentor No. 107: Robert H. Page

AddressID: 43

Date Updated: 10/16/98 9:14:59 AM

First Name: Robert

MI: H

Last Name: Page

Title:

Organization:

Address: 2 Stacey Circle

City: Signal Mountain

State or Province: Tn

Postal Code: 37377-

Country: USA

Work Phone: 860-447-1791

Fax Number: 860-440-0404

Email Address: pagerh@gwsmtp.nu.com

Home Phone: 423-886-6856

Notes:

From what I've read, The US will need to continue with Tritium too maintain our weapons.
I support the production of Tritiun in a comercial reator What we do in the USA does change our concerns or position for countries trying to develope weapons capabilities, or our lessen our influence in detering proliferation.
I do not support the spending of an estimated $5 billion on an unqualified,dedicated,defense technology at the Savannah River Site.
The Bellefonte proposal,to finish a viable commercial reator, should cost the taxpayers less.
provide needed electicity in a more safely regulated industry. and spread the gov't spending to more than one state
The regional support for TVA is justifiably very high, while the National concencus is that the Savannah River Site is an environmental liability.
Please think green (dollars and environment)and go with Bellefonte.
Thank you for your support,
Robert and Antoinette Page

1/07.03

Commentor No. 108: Dr. Chris Gunn

13 oct 98

At 6,643 feet, Clingmans Dome is the highest peak in the Great Smoky Mountains National Park. The platform is provided to present an unparalleled view of the national park.

Photo by Adam Jones

Dear DOE -

Please visit these mountains and our people. Get away from DC and your paperwork and realize just how how we do not need or want tritium in our TVA reactors. The danger, the waste of $ the short-sighted planning are all threats to US—all of US.

Sincerely,

Dr. Chris Gunn
PO Box 1104
Cullowhee, NC 28723

US Dept of Energy
Commercial Light Water Reactor Project
PO Box 44539
Washington
DC 20026-4539

1/14.04

2/23.13

3/02.01

USA 20

SPACE RESERVED FOR U.S. POSTAL SERVICE

Commentor No. 109: Dorothy J. Mock

Dorothy J. Mock
46 Skyland Drive
Pisgah Forest
N.C. 28768

United States Department of Energy

Commercial Light Water Reactor Project

Post Office Box 44539

Washington, DC 20026-4539

To Whom It May Concern (To Whom I Address My Concern):

I urge you, I entreat you, I implore you: do not permit tritium to be made--not in any reactor anywhere in the United States! 1/07.02

Tritium is extremely dangerous. 2/02.01 Tritium is not needed; we should not be making nuclear bombs! 3/14.04

Most important, as we move into the twenty-first century, making tritium violates the Nuclear Nonproliferation Treaty the US signed and ratified over 25 years ago. For us/US to violate this treaty weakens our hand in efforts to limit and control the spread of nuclear weapons among the nations of the world. 4/01.04

Shouldn't the United States be leading the world toward disarmament instead of demoralizing such efforts by producing tritium?

I urge you, I entreat you, I implore you: do not make tritium!

Sincerely yours,

Dorothy J. Mock

Commentor No. 110: Earl Budin, M.D.

Submitted by EARL BUDIN, M.D. Earl Budin
Co-chair, Physicians for Social Responsibility
SANTA BARBARA
Assoc. Clinical Professor of Radiology, UCLA
Medical Center

LIGHT WATER REACTOR PROJECT

COMMENT FORM

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- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail. 1-800-332-0801

Comments: The proposal to use a civilian nuclear power reactor to produce Tritium for use in nuclear bombs would be a terrible mistake and I strongly object to that proposal for the following reasons.

1. The most important reason is that this would be a violation of the Nuclear Non-proliferation Treaty which declares that every government must work toward a world-wide agreement on a treaty to abolish all nuclear weapons as an urgent goal to be achieved in the shortest time period. If we produce more Tritium this would send a message to other countries that we intend to keep nuclear bombs and make it very difficult to reach agreement on their abolition. 1/01.04

2. World-wide abolition of nuclear weapons has been the stated goal of our president and of recent chief of staff of our armed forces Gen. Colin Powell, as well as of a large number of high ranking generals and admirals of U.S. and other countries who in a recent statement called for the abolition of all nuclear weapons, recognizing the fact that nuclear bombs are of no military value. 2/01.01

3. As noted on page 13 of the DEIS, we have on hand enough Tritium to maintain our nuclear weapons until the year 2010. Certainly we must by then have established a world-wide verifiable agreement on the elimination of nuclear weapons. 3/02.02

4. If "enhance the yield of a nuclear weapon" is the key function of Tritium (page 5, DEIS), we could maintain our present nuclear weapons without Tritium, since the explosive power of our present nuclear bombs already makes them infeasable for military use. 4/01.03

5. The proposal to use commercial nuclear power reactors to produce Tritium for nuclear bombs would violate the long-standing U.S. policy to keep military and civilian nuclear reactors separate. 5/01.09 6. To establish a new use for civilian nuclear power reactors is counter to the growing world-wide consensus that nuclear power should be eliminated as a source of energy since it is inherently unsafe, uneconomic and most importantly unnecessary. 6/24.08

Submitted by Earl Budin, M.D. Earl Budin MD
co-chair, Physicians for Social Responsibility, Santa Barbara chapter
Associate Clinical Professor of Radiology, UCLA Medical Center
Address: 2415 Stanwood Drive,
Santa Barbara, CA 93103

Commentor No. 111: Virginia Thrasher

Comments Received via "800" Number

Date:	Oct 26, 1998
Name:	Mrs. Virginia Thrasher
Organization:	
Address:	2716 Hanover Circle Birmingham, AL 35213
Phone #: **Fax #:**	
Comment #:	

Comment:

I am calling for a copy of your Environmental Impact Statement. What you all are planning to do up in Scottsboro, Alabama, the Commercial Light Water Reactor, is what I want the EIS on. If it includes any information as to why there's any reason to continue with this project in view of the fact that nuclear reactors are being demolished throughout other parts of the United States, I just want some justification for it other than that you need to create jobs, which I realize are very necessary. *1/02.01*

Commentor No. 112: R. D. Liska

AddressID:	45	Date Updated:	10/25/98 5:00:31 PM
First Name:	R.	MI:	D
Last Name:	Liska	Title:	concerned citizen
Organization:			
Address:	115 S. Oakwood		
City:	Republic		
State or Province:	MO	Postal Code:	65738-
Country:	USA		
Work Phone:		Fax Number:	
Email Address:	auggie8@juno.com	Home Phone:	

Notes:

Hello DOE,
Why must Tritium be produced for nuclear weapons? Is not there enough death and insanity in the world as is? *1/01.01* Put your time,money. and energy into building safe and clean nuclear power plants. *2/23.13* Put your time,energy, and money into cleaning up the nuclear waste you are now and have produced. How many people will this project end up killing? *3/14.04*
I thought we were getting rid of our nuclear stockpile. *4/02.01*

Commentor No. 113: Richard J. Sturtridge

AddressID: 47 | Date Updated: 10/26/98 8:25:17 PM

First Name: Richard | MI: J | Last Name: Sturtridge | Title: Owner

Organization: Jalan-Jalan

Address: Box 128122

City: Nashville

State or Province: TN | Postal Code: 37212- | Country: USA

Work Phone: ( ) 385-2321 | Fax Number: ( ) 385-7288

Email Address: artworkdesign@home.com | Home Phone:

Notes:

I am appalled and frightened to hear that you are planning hearings for the production of Tritium in a commercial light water reactor in my home state of Tennessee. I am appalled at the thought of using a civilian facility for the production of weapons of nuclear destruction and frightened by the thought of the creation of yet another cancer 1/01.09
producing facility in a State alreadt suffering from a dangerously poor environmental record. Do us all a favor and stop it now. 2/14.04

Commentor No. 114: Ronald Allen

Comments Received via "800" Number

Date:	Oct 26, 1998
Name:	Ronald Allen
Organization:	
Address:	10324 West Blue Springs Court Homosassa, FL 34448
Phone #: **Fax #:**	(352) 628-0994
Comment #:	

Comment:

As a taxpayer, I am very concerned that the Government do this tritium in the Bellefonte and the other TVA plants versus the Savannah River plant because of the cost -- talking a great deal of money more for Savannah River to do it versus TVA. I would very much like some more information. If you would mail this to me on this issue and I would appreciate it that you make my comments known. Thank you. 1/23.15

Commentor No. 115: Patricia Pelot Sanders

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments:

NO TRITIUM

It's a waste of money. 1/23.13

It's dangerous. 2/14.04

It violates US treaty obligations. 3/01.04

It's absurd to make it before you need it. 4/02.02

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Patricia Pelot Sanders (optional)
Organization: U.S. citizen
Address: P.O. Box 1275
City: M'boro. State: TN. Zip Code: 37133
Work phone: (615) 896-0255 Home phone (615) 896-0255
Fax (615) 893-2688
E-Mail Address: —

7/4/98

Commentor No. 116: Leigh Haynie for Wild Alabama

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Cielo Sand, TN
Advisory Board:
Dave Foreman
Dr. Reed Noss
James Redfield

October 26, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
P.O. Box 44539
Washington, DC 20026-4539

RE: Comments on Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor

Dear Director Sohinki:

On behalf of Wild Alabama, a non-profit outdoor recreation and environmental organization, I am filing the following comments on the Draft EIS for the proposed conversion of a commercial light water reactor into a tritium producing facility.

Wild Alabama's initial and greatest concern is the Department of Energy and TVA's blithe assertions that while tritium is radioactive, it must be produced. No options; no alternatives. The purpose of an EIS is to present all possible, viable alternatives. Instead, the documents provided interested parties contain nothing more than bureaucratic filler for foregone conclusions. The fact that you provide a chart with 18 reactor combinations does not give the vulnerable public the "alternatives" required by NEPA; nor does the consideration of producing tritium in an accelerator provide an alternative. 1/06.01

The EIS is woefully inadequate and incomplete. Assertions by the DOE that waste will be produced and that storage of that waste may be stored on-site or may be stored in a federal storage 2/05.11 3/16.02

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

facility does not satisfy the requirements of NEPA. Comments cannot be made with such indecision and inconsistency. Complete information cannot be provided by DOE until after March of 1999 when the post-irradiation tests will be studied from Watts Bar. A lack of mitigation measures and a lack of concise and complete discussions of impacts by the proposed production also inhibit adequate comments. The DOE spends an admirable amount of time with drawings and explanations of what will happen during the process of production, but the DOE becomes vague and noncommital when discussing the impacts this will have on the environment. Another inadequate section is found in §5.2.10 where the DOE states that accidents as a result of sabotage will not be addressed because of their speculative nature. In the next Draft EIS, the DOE needs to further explain why this is a speculative argument with the growth of extremist terrorist organizations. The United States is no longer impervious to terrorist attacks as the World Trade Center bombing illustrates. The environment and safety issues require just as in-depth and clear scientific explanation as tritium production.

3(cont'd)
4/05.10
5/24.14
6/05.12
7/22.01

The alternatives in the EA did not consider a broad enough range. Each alternative (excluding the no action alternative) provides for the same amount of tritium production. The EIS fails to provide adequate justification and discussion of how the DOE arrived at the due date of 2005 to start production of tritium (other than the fact that the 1996 Nuclear Weapons Stockpile Plan is accompanied by a Presidential Decision Directive that mandates new tritium be available by approximately 2005 IF a CLWR is the selected option for tritium production). The EIS also fails to provide adequate support for the production of 3 kilograms of tritium per year. Finally the EIS fails to provide the data and figures as to why DOE needs forty years of tritium production at 3 kilograms a year.

8/06.02
9/02.02
10/03.03

One reasonable alternative would be to moderate the amounts of tritium produced to fewer number of years of production and/or smaller yearly levels. According to the chart on page 12 of the summary, the DOE will not reach 1996 NWSM stockpile levels until 2010, which could be a delayed start-up date. (The DOE can borrow expertise from modern accounting procedures where inventory is not delivered until it is needed thereby increasing efficiency in relation to time, money, and storage space.) This is another alternative not considered by the DOE. All of the DOE's alternatives result in the same amount of tritium in the same amount of time, and with the cursory consideration of the no action alternative, all of the alternatives will result in production dependent on TVA. This is legally insufficient.

8(cont'd)

A particularly instructive case is *Friends of the Bitterroot, Inc. v. U.S. Forest Serv.*, No. CV-90-76-BU, 25 E.L.R. 21186 (D. Mt. 1994). There, even though the Forest Service identified and considered seven alternatives, the Court held that the Forest Service failed to comply with NEPA because the agency failed to consider just one additional reasonable alternative, namely an alternative to protect roadless areas. The agency claimed that such an alternative would not further the purposes of the proposed action, but the Court disagreed. The Court held:

"In Count II of their complaint, as amended, plaintiffs contend the Trail Creek

2(cont'd)

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

EIS fails to adequately analyze all reasonable alternatives, including a less environmentally damaging alternative that would exclude logging and road building activity in existing roadless areas within the Beaverhead National Forest. Plaintiffs maintain the EIS should have addressed an alternative exempting the Beaver Lakes roadless area from the timber sale in order to preserve that area's value as secure wildlife habitat. In response, defendants assert the alternative would not have met the management goals, standards, and objectives of the Beaverhead National Forest Plan. Defendants further maintain the development of such an alternative would not have added any new information to the EIS.

"NEPA requires an EIS provide information in detail and consider every reasonable alternative to a proposed action. *Citizens for a Better Henderson*, *supra*, 768 F.2d at 1057; see 42 U.S.C. § 4332(2)(c)(iii). An agency's range of alternatives is reviewed under a 'rule of reason' standard that 'requires an agency to set forth only those alternatives necessary to permit a reasoned choice.' *California v. Block*, 690 F.2d 753, 767 (9th Cir. 1982) ('The touchstone for [a court's] inquiry is whether an EIS' selection and discussion of alternatives fosters informed decisionmaking and informed public participation.'). Additionally, NEPA does not require a separate analysis of alternatives which are not significantly distinguishable from alternatives actually considered or which have substantially similar consequences. *Northern Plains Resource Council v. Lujan*, 874 F.2d 661, 666 (9th Cir. 1989). As a result, an agency's consideration of alternatives is sufficient if it examines an appropriate range of alternatives, even if it does not consider every available alternative. *Headwaters, Inc. v. Bureau of Land Management*, 914 F.2d 1174, 1181 (9th Cir. 1990).

"In the case sub judice, the Forest Service examined seven alternate courses of action with respect to the Trail Creek project: six 'action' alternatives (Alternatives B, C, D, E, F, and G) and one 'no action' alternative (Alternative A). The 'action' alternatives proposed timber harvesting in varying locations, amounts, and methods in the Trail Creek area. Moreover, the action alternatives all called for varying degrees of timber harvesting in the Beaver Lakes roadless area.

2(cont'd)

"Defendants maintain the plaintiffs' preferred alternative 'would not have met the management goals, standards, and objectives defined in the Beaverhead National Forest by the Beaverhead Forest Plan.' Specifically, defendants maintain that 'because the management decisions to harvest timber in those areas have already been made at the Forest Plan level it did not need to be revisited.'

"The fact the Beaverhead Forest Plan designates certain land as suitable for timber management does not, however, obligate the Forest Service to proceed with the timber harvesting, nor does it preclude the Forest Service from exercising its discretion to consider other courses of action. Accordingly, to the extent defendants maintain an alternative aimed at preserving the Beaver Lakes roadless area would be 'pointless,' based upon the goals of the Beaverhead Forest Plan, the court concludes defendants' summary judgment motion is not well taken. Defendants' position is contrary to NEPA's underlying tenet, i.e., that agencies consider all reasonable alternatives so as to ensure an EIS fosters informed decision making. See *Idaho Conservation League v. Mumma, supra*, 956 F.2d at 1519-20.

"The Forest Service cannot deny there is some benefit to be derived from considering an alternative that preserves the Beaver Lakes roadless area. Plaintiffs, as well as the Montana Department of Fish, Wildlife & Parks, whose considerable expertise in the area of wildlife management is undisputed, expressed concerns that preservation of the Beaver Lakes roadless area warranted full consideration in the Trail Creek NEPA process given the area's high security value for wildlife. Moreover, plaintiffs have alleged the roadless areas provide wildlife corridors essential for maintaining the biological diversity in the Northern Rocky Mountains.

"Given the contentious and long-standing debate in the State of Montana regarding the preservation of roadless lands and wilderness designation, the court concurs with plaintiffs' assertion that the NEPA process would have been properly serviced by development of an action alternative that preserved roadless lands in the Trail Creek area. Such an alternative would have afforded the opportunity for scientific and public participation and debate regarding the delicate balance between preserving natural resources and timber management.

"Accordingly, the EIS' failure to address an alternative preserving existing roadless lands in the Trail Creek area renders compels this court to REMAND this matter for further administrative proceedings."

The Council on Environmental Quality (CEQ) administers and interprets NEPA. See *Abenaki Nation of Mississquoi v. Hughes*, 805 F. Supp. 234, 241 (D. Vt. 1992), aff'd, 990 F.2d 729 (2d Cir. 1993). 40 C.F.R. § 1502.14 makes abundantly clear that the DOE has failed to adhere to the regulations and therefore the EIS should be revised again to address each of the following requirements. This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (Section 1502.15) and the Environmental Consequences (Section 1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public. In this section agencies shall:

(a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

2(cont'd)

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Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

(b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

(c) Include reasonable alternatives not within the jurisdiction of the lead agency.

(d) Include the alternative of no action.

(e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Include appropriate mitigation measures not already included in the proposed action or alternatives.

Only a brief survey of the preceding requirements is needed to demonstrate that the DOE has failed to address all but one item, item D. While the DOE provides the public with a tome of bureaucratic jargon, the DOE fails to identify alternatives that were dropped from consideration and why they were dropped from consideration. This is a violation of NEPA. In the eyes of the DOE, each alternative will result in approximately the same impact even though one set of the reactors, Bellefonte, is not in production and sits idle. The fact that the DOE glosses over the cataclysmic change that will occur in northeast Alabama due to the start-up and production of radioactive materials emphasizes the glaring weaknesses of this EIS. This is a violation of NEPA. What is the DOE's preferred alternative? Where, if at all, is there a discussion of the mitigation measures that will be in place once production is started? Mitigation measures will be needed at all three CLWRs with the construction of the ISFI and the impacts on endangered species. 40 C.F.R. § 1508.20 defines mitigation to include (a) Avoiding the impact altogether by not taking a certain action or parts of an action. . . (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment ,(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and (e) Compensating for the impact by replacing or providing substitute resources or environments. The DOE must address the issue of mitigation measures and adequately examine those in the Final EIS.

Within this Comment letter, we point out two alternatives that the EIS did not, and it is apparent that the DOE fails to adhere to the rules and regulations of NEPA. As we have outlined at least two viable but unexamined alternatives that could be used to address the tritium problem, the EIS is inadequate and must be reissued.

2(cont'd)

The EIS spends sufficient time examining the technical aspects of tritium production, but fails to thoroughly examine issues outside of its expertise, such as ecosystem and economical considerations. With all of the activity affecting the viability of the aquatic wildlife such as the mussels and native fish and with all the unnatural diversions of water, at least four dams between the three proposed Commercial Light Water Reactors, what is to be gained environmentally, and

11/12.03

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Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

in the long run economically, by choosing a Commercial Light Water Reactor? Since TVA has been planning on converting Bellefonte to a fossil fuel plant, how will the destruction of that plan affect the economics of the surrounding area? Where is the comparison of economic gain to be won with tritium production over another fossil fuel plant? 11(cont'd) 12/13.02

The presence of Indiana and gray bats along with the endangered mussels and the endangered green pitcher plant prohibit the furtherance of any proposed actions at Bellefonte. No documentation is given as to WHO determined the green pitcher plant is not found in the vicinity of the plant or that it is not supposed to be found in this area. As to the Indiana bat, the DOE should be aware of its tenuous hold on existence and the federal court's measures to protect said species. As one federal district court has determined,

> The Indiana bat was listed as an endangered species on March 11, 1967. Between 1960 and 1975, the bat's population decreased by 28%. In 1983, subsequent in time to the passage of the ESA, the U.S. Fish and Wildlife Service ("Fish & Wildlife") issued a recovery plan for the Indiana bat. Fish & Wildlife then designated seven (7) "Priority 1 hibernacula" where 85% of the Indiana bats currently hibernate. Despite the recovery plan's goal of halting the decline of the Indiana bat, the bat's population has continued to fall. Between 1960 and 1987 there was a 55% population decline at Priority 1 hibernacula, and a generally similar decline at Priority 2 hibernacula. [AR, Tab 38 GG 008]. According to the defendants' Indiana Bat Summer Habitat Management Strategy, "if the present rate of decline continues, the Indiana Bat Recovery Team projects that the species will be extirpated from Priority 1 caves, and perhaps become extinct, by the year 2040." 13/12.04

House v. United States Forest Service, 974 F.Supp. 1022, n.1, (8th Cir., 1997). In that particular case, the U.S. Forest Service was ordered to cease and desist all activities in an area inhabited by the Indiana bat. The DOE will have to provide much more information before it can proceed at Bellefonte, which includes site-specific information as to all species listed under endangered status and mitigation and habitat management plans for each species.

Agency decisions are subject to the "arbitrary and capricious" standard which applies in APA actions. *State of North Carolina v. Federal Aviation Administration,* 957 F. 2d 1125, 1128 (4th Cir.1992). In order to apply this standard, a court must determine whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment. *Id.* (quoting *Citizens to Preserve Overton Park, Inc. v. Volpe,* 401 U.S. 402, 416, 91 S. Ct. 814, 823-824, 28 L. Ed.2d 136 (1971)). It is the DOE's responsibility to determine the suitability of Bellefonte for tritium production. While the DOE has notified the United States Fish and Wildlife Service of the existence of the Indiana Bat, the Endangered Species Act requires all federal agencies to consult in such a situation:

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

> Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.

16 U.S.C. §1536(b). 13(cont'd)

To state, as the DOE does in Appendix B, that " . . .no additional impacts to biological resources would be expected from tritium production" fails to take the "hard look" as required by NEPA. In an EA the agency must take a "hard look" at the project and its impacts, "as opposed to bald conclusions, unaided by preliminary investigation," and must "identify the relevant areas of environmental concern." *Maryland-National Capital Park and Planning Commission v. U. S. Postal Service*, 487 F.2d 1029, 1040 (D.C. Cir. 1973). General, vague comments, such as "For partially completed CLWRs, the baseline and associated impacts would depend on the level of modification necessary to complete construction and the effluents resulting from the reactors' operation activities (EIS B-6), do not suffice as a "hard look." Furthermore, more explanation needs to be provided the public as to Table 5-24. Footnote b assures the reader that the radioactive release will significantly less than the limit of 20,000pCi/L for tritium, but what does that limit mean. Did the government set the limit where only one in a 100 will die from cancer or suffer the effects? What does that limit mean? The next EIS the DOE does must examine these limits in more detail and provide adequate explanation for the lay reader. 14/14.14

NEPA sets forth a "national policy which will encourage productive and enjoyable harmony between man and his environment [and] promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man." 42 U.S.C. § 4321.

The Eleventh Circuit has recently explained the genesis and overall approach of the Act:

> "Prior to the passage of [NEPA], environmental considerations were systematically underrepresented in the federal agency decision making process. Consistent with traditional notions of natural resource allocation, the benefits of development were overstressed and less environmentally damaging alternatives for meeting program objectives were often given limited consideration. NEPA declares a broad national commitment to protecting and promoting environmental quality. This commitment is implemented by focusing government and public attention on the environmental effects of proposed agency action; The Act ensures that important environmental 15/05.13

consequences will not be 'overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast.' In short, NEPA requires that the evaluation of a project's environmental consequences take place early in the project's planning process."

North Buckhead, 903 F. 2d at 1539-40 (citation omitted).

NEPA does not set out substantive environmental standards, nor prescribe any regulatory program. Rather, the congressional mandate of § 4321 is realized through a set of "action forcing" procedures that require an agency to take a "hard look" at environmental consequences. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 109 S.Ct. 1835, 1846, 104 L.Ed.2d 351 (1989); *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council*, 435 U.S. 519, 558, 98 S.Ct. 1197, 1219, 55 L.Ed.2d 460 (1978). The procedural requirements derive from 42 U.S.C. § 4332(2)(C)(I-iv), which directs all agencies of the federal government to prepare for "major Federal actions" a detailed statement on (i) the environmental impact of the proposed action; (ii) any unavoidable adverse environmental effects if a project is implemented; (iii) alternatives to the proposed action; (iv) the relationship between short-term uses of the environment and maintenance of long-term productivity; and (v) any irreversible and irretrievable commitments of resources involved in the project's implementation. **15(cont'd)**

An EIS is [supposed to be] an exhaustive analysis of the impacts, proposed mitigation, and alternatives to the federal project, which has been circulated to other involved agencies, see § 1502.19, subject to public comment and agency response, see § 1503, reviewed by the CEQ in case of interagency disagreement, see § 1504, and ultimately submitted to the President. The EIS, therefore, is the primary vehicle for compliance with NEPA where a project will have a significant impact on the environment. The EIS is the "action forcing" device envisioned by Congress to insure that NEPA's policies and goals are infused into federal decision making. 40 C.F.R. § 1502.1.

There is a failure to identify how Bellefonte, an untested site, is a viable alternative when of each proposed plant Bellefonte is the one that will receive the most significant impact. Whereas the other CLWRs already operate, therefore already experience increased levels of radiation, Bellefonte currently experiences no radiation. (EIS p. 5-67). Producing tritium at Bellefonte will increase radiation exposure exponentially. Your own EIS confirms this conclusion:

> At Bellefonte, there would be a potenital for secondary impacts arising from the proposed action. This is because Bellefonte reactors are currently not operating. While it is noted that any secondary impacts would be caused by the radionuclides other than tritium, these impacts would represent a change from no action. (EIS p.5-111).

16/05.14 There is absolutely no cumulative impacts analysis in this EA. The EA very briefly looked at some things called "cumulative impacts" but these were actually indirect impacts and nothing but "cookbook" analysis at that. There is nothing site-specific at all about cumulative impacts, and there is nothing at all about other actions (public or private) in the area and how they will interact with this proposal. Reliance upon 1974 or older data from TVA does not suffice NEPA's "hard look" requirement. "Cumulative impacts" are not the things that happen later or some distance from this proposal, such as downstream sedimentation five years from now. Those are called "indirect impacts," which NEPA also requires the agency to consider. However, the DOE cannot forego its legally mandated consideration of cumulative impacts by mislabeling indirect impacts as "cumulative." Where is the cumulative analysis on Bellefonte's impact in conjunction with the Widows Creek Fossil Plant? Data from 1974 is too distant and not accurate enough to satisfy NEPA's requirements. Further analysis and measurements need to be initiated before a complete Draft EIS can be submitted.

Isolated references to impacts this proposed construction and operation at Bellefonte will have on the citizens and wildlife in this area are ineffective until the DOE analyzes those impacts cumulatively. For example, in Chapter 5 of the EIS, the DOE lists consequences that will occur from tritium production such as increased operational noise levels. After identifying the amount of noise increase and finding that wildlife will experience "startled responses," the DOE dismisses these responses as "causing little or no disturbance of wildlife on the site and thus should affect no changes in local wildlife populations." (EIS p. 5-50). This "little" disturbance combined with the "insignificant reduction in the aquatic macroflora and plankton" in the river (EIS p. 5-51) and the "small impact of radiological releases on aquatic species" (EIS 5-52) may combine to be a significant impact on the ecosystem as a whole. However, neither the writer or the reader knows since that kind of analysis is never produced by the DOE. **16(cont'd)**

The EA is required to identify and consider cumulative effects:

> "For each alternative, estimate the direct, indirect, and cumulative environmental effects, including the effectiveness of the mitigation measures, that would result from implementing each of the alternatives, including the no action alternative. Also, identify any additional mitigation measures that may be required, such as measures common to all alternatives."

1909.15 FSH § 15.

The CEQ Regulations are clear that cumulative effects involve impacts from other projects, but this EIS neither mentions nor identifies the impacts from a number of similar projects being proposed in this area or from past projects in the area.

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

The CEQ Regulations define "Cumulative impact" as:

"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

40 C.F.R. § 1508.7 (Emphasis added.)

The CEQ Regulations also state:

"'Effects' include: . . . (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

40 C.F.R. § 1508.8.

The EA labels a few charts as cumulative effects. Those charts, however, disclose only direct or indirect effects of the project. An example is that the EA discusses "cumulative" impacts on ecological from this proposal and this proposal alone. The EA assumes that general impacts from this proposal several years from now, such as the increase of water temperature, are "cumulative" impacts. (EIS at 5-115). That is a direct impact. While mentioning other TVA activities in or nearby the Tennessee River, nowhere does the EIS discuss the impacts of this proposal in addition to other similar actions in the area, whether on TVA projects or private activities. All the EIS discusses is the increase in radioactivity from tritium productions. While such discussion is appropriate, to limit cumulative impacts analysis to that one item is grossly inadequate. Another example of DOE's failure to present the facts in a proper way is the chart on page 5-43. According to the chart, only .0004 percent of the Tennessee River's water flow will be diverted to accommodate the needs of a plant producing tritium, yet the EIS fails to present how this diversion of water in conjunction with municipalities and industries and dams will affect the river. **16(cont'd)**

Another failure of the DOE when discussing the impact on surface water and groundwater is the failure to convey in clear, accurate and simple terms what the effects to the human environment will be if a leak of tritium occurs. In Appendix B the EIS attempts to discuss the methods by which water resources and water quality will be monitored. Again, the EIS is replete with general surmises, especially concerning the partially completed facilities. The DOE concedes **17/11.10**

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

there will be an impact when an idled plant is engaged, but apparently expects residents to appreciate the fact the DOE will monitor the change in water quality. Like normal hydrogen, tritium can bond with oxygen to form water. When this happens, the resulting water (called tritium oxide or tritiated water) is also radioactive. Because tritium oxide is chemically identical to normal water, it cannot be filtered out of the water. Once Bellefonte tritium hits the water supply there will be no way to retrieve it. **17(cont'd)** To spend over 400 pages explaining the benefits of tritium and the wonders it will do for the economy and socioeconomic levels of the area, it is remiss and violative of NEPA to minimize and trivialize the negative effects that will occur. To dismiss concerns about the potentially significant and harmful effects of tritium production with some vague assurances the water will be monitored does not suffice. NEPA requires the government to analyze both positive and negative significant impacts. This EIS fails to follow those regulations.

NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail. 40 C.F.R. §1500.1(b).

"An EIS serves two purposes: (1) to provide decision makers with enough information to aid the substantive decision whether to proceed with the project in light of its environmental consequence; and (2) to provide the public with information and an opportunity to participate in gathering information." *Big Hole Ranchers Association*, 686 F. Supp. at 260. **18/05.15**

In relevant part, CEQ regulations define "significantly" as follows:

"Significantly as used in NEPA requires considerations of both context and intensity:

"(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action . . . .

"(b) Intensity. This refers to the severity of impact. . . . The following should be considered in evaluation of intensity:

"(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial

"....

"(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

"(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

"(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future considerations.

"....

"(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

"(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for protection of the environment."

40 C.F.R. § 1508.27. The DOE must take adhere to these regulations and provide the public with an EIS that adequately identifies how this proposed project will impact their environment as a whole. 18(cont'd)

There is a very limited discussion of other projects in the area, including some private lands. However, that section only gives cursory review to those actions, and nowhere does the EA ever identify and discuss the IMPACTS from those other actions. Cumulative effects analysis requires more than ticking off a list of other things in the area; it requires identification and analysis of the impacts from those actions and the proposed action together. 16(cont'd)

The lack of site-specific analysis is a clear violation of NEPA. All of the analysis in the EIS could be cut and pasted into another project anywhere else in the country. Site-specific analysis 19/12.05

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

cannot be cut and paste because it deals with the specifics of the project. The Department must address the impacts to the specific streams, plants, animals, etc. in the project area. All wildlife discussion in the EIS is based entirely upon generic statements with absolutely no site-specific supporting data or information. None of the information has been field-checked or verified in any way. There is no site-specific data on wildlife in this compartment, and there is no survey data showing what numbers of sensitive species occur in these areas such that the agency can adequately determine that the proposal will not adversely impact the viability of these species. Without actual site-specific data showing the number of individuals of a species and how many will be killed or displaced by this proposal, the agency cannot logically conclude that the viability of these species is assured in this area. The bottom line is the DOE must provide numbers and populations statistics. Even this EIS acknowledges that TVA activities on the Tennessee River have resulted in declining numbers of mussels and other aquatic life. Only with site-specific data and hard numbers will the DOE accurately convey the true impacts of this proposed action. 19(cont'd)

At no point in the EIS does the DOE consider possible attack on the transport of TPBARs from the production site to either Savannah River Site or the Richland, Washington site.

A blanket statement such as "No environmental impacts are expected as a result of compliance with both NRC and DOE safeguard and security provisions based on the adequacy of the existing TVA security provisions illustrates the cursory analysis given to such considerations as security. (EIS p. 5-106). 7(cont'd)

From a document well over 400 pages, the DOE sees fit to devote only two paragraphs to the important discussion of soils. (EIS p. 4-66). Soils can be what conduct the waste from this proposed activity; soils can be what protects the waste from entering the water table. Soil identification is necessary to evaluate storage options and stability for the future. 20/10.02 Adverse impacts to water quality have not been analyzed properly. There is a lack of data on impacts from previous diversions. Tables 5-22 and 5-23 are antiquated charts from 1967 without any recent data to confirm what is in the water now, nor any qualified data as to what will be in the water once the proposed actions begin. The following statements do nothing to ease one's mind: "Water required from the Guntersville Rervoir would be a small fraction of the river flow, and most of it would be returned to the reservoir after use." (EIS p. 5-42). 21/11.07

The EA avoids any discussion of the economic impacts to recreation. This is a blatant failure to comply with the agency's NEPA duties. The EA fails to consider how the presence of an active radioactive production plant will affect the economics of recreation at the Guntersville State Park 22/13.03

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

and Reservoir. At no point in the EIS is there any discussion of the economics of fishing, hunting, hiking, wildflower viewing, bird watching, horse back riding or other recreational uses of these areas.

There are countless legal requirements to consider the economic impacts of this proposed plant to other uses. Some of these include:

> "(B) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations ...."

NEPA Section 102, 42 U.S.C. § 4332.

The analysis pretends that creating an active tritium plant where there is no activity now has no adverse effects on recreation. The DOE has an obligation to disclose these effects. It is not legal to pretend they do not exist or to ignore them merely because considering them would be "difficult."

> "Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative."

40 C.F.R. § 1508.8.

The ID Team must contain the expertise necessary to evaluate the economic impacts of the project. Even if the economic impacts of recreation were truly "intangible" and difficult to address, the EA still cannot refuse to address the issue. Thus, the EA has not provided a legally adequate economic analysis.

22(cont'd)

In closing, my client, Wild Alabama, is opposed to the proposed tritium production at Bellefonte, in particular. Wild Alabama is particularly concerned that DOE will focus too heavily on the potential economic benefits from the Bellefonte site and will not weigh these benefits with the significant decreases in land resources, air quality, water quality, ecosystem quality and quality of life issues. In addition too much emphasis is placed on the fact that TVA announced in 1994 that Bellefonte would not be completed as a nuclear plant without a partner. However, in a general sense, my client finds the EIS is woefully inadequate for all proposed sites. The DOE sloughs off the

23/05.26

24/05.16

Commentor No. 116: Leigh Haynie for Wild Alabama (Cont'd)

difficult issues raised by tritium production at Bellefonte. To ask the citizens of Jackson County and north Alabama to trust the DOE that tritium is needed, but that the figures to support that are classified does not satisfy the open process of NEPA. It is also irresponsible to state that an explosion of the Bellefonte facility is outside of the scope of this EIS. Chernobyl is a mere decade behind us; residents around such facilities need to be informed of the results of such an explosion. While moral and ethical considerations may be beyond the scope of the DOE's analysis, issues such as life and death, healthy and unhealthy lives, and safe and unsafe water are not beyond the scope. The facts as DOE presents them are that there will be increase in the quantity of radionuclides to be released if and/or when an accident occurred; the tritium content in the liquid effluent will likely increase; there will be a likely increase in the generation of low-level radioactive waste, which must be stored somewhere with plans to store on-site; and there is a significant change in potential risks from proposed tritium production. The EIS completely fails to list and examine mitigation measures for these increased risks to the surrounding citizenry.

24(cont'd)

25/15.08

26/14.04

27/16.01

26(cont'd)

5(cont'd)

Besides learning how to make tritium and enjoying the excellent models and drawings, the EIS glosses over the environmental issues and dismisses the significant impacts this proposed project will have on the surrounding ecosystem, humans and all. At a minimum, DOE must be required to do the EIS over again after the testing is completed in the spring of 1999. This EIS is too early. Until the post-irradiation examination and studies are completed by DOE, no solid and specific information can be provided. After March of 1997, the DOE will be able to provide specific information, instead of general surmises. This proposed action will have a significant impact on the environment around the Bellefonte facility. To posit there will be no significant adverse impact when 3 kilograms of tritium is run through a facility that is idled and zapping no radioactivity waves in addition to the creation of low-level radioactive waste on site is the height of ludicrousness. Wild Alabama requests the DOE to delay reissuing another Draft EIS until such time as complete tests have been run on the TPBARs currently at Watts Bar 1.

18(cont'd)

4(cont'd)

18(cont'd)

4(cont'd)

Please make these comments part of the record. Thank you for your consideration.

Sincerely,

Leigh Haynie

Attorney for Wild Alabama

Commentor No. 117: Joanne MacNulty

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Joanne MacNulty
Organization:	
Address:	PO Box 266 Paonia, CO 81428
Phone #: **Fax #:**	(970) 527-6620
Comment #:	

Comment:

I am responding to the notion of creating tritium for war in a commercial reactor or 2 or 3, Watts Bar, Sequoyah, and Bellefonte. In the south, where I used to live, I can't tell you strongly enough what a crazy idea many of us out here think that is, not to mention illegal and counterproductive to life on earth. You have my written comment from a couple of months back, but I understand that the comment period is about up so I wanted to go on record of asking you, please don't do this thing. Thank you. *1/01.09*

Commentor No. 118: Monica Blanton

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Monica Blanton
Organization:	
Address:	1629 Berkley Circle Chattanooga, TN 37405
Phone #: **Fax #:**	(423) 756-8237
Comment #:	

Comment:

I'm calling in opposition to the production of tritium at Bellefonte Nuclear Plant. *1/07.03*

Commentor No. 119: Marita M. Hardesty

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Marita M. Hardesty
Organization:	
Address:	1235 Lonesome Pine Road Kingston Springs, TN 37082
Phone #: **Fax #:**	(615) 952-5865
Comment #:	

Comment:

I'm calling in regards to the proposal that more tritium be produced in civilian reactors. I am against the making of more tritium. I understand that the United States is in violation of treaties that have already been signed about nuclear proliferation and that tritium also has a shelf life and it decays at about 5% per year. **1/01.04** Right now we have in our stockpile enough tritium until the early years of 2000, the 21st century. It is not needed. **2/02.01** I am hoping that the majority of voices in our democracy will tell you that they don't want it and that the money spent on this unnecessary situation should be spent towards better causes. Thank you for your time. **3/23.13**

Commentor No. 120: Eskel Lind

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Eskel Lind
Organization:	
Address:	515 3rd Street Santa Cruz, CA 95062
Phone #: **Fax #:**	460-0338
Comment #:	

Comment:

I am also calling on behalf of Ms. Roberts. She is also a Santa Cruz resident living on Paul Minnie Avenue. Her phone number is 475-8910. We are both opposing the development of tritium, the production of tritium, in the commercial light water reactor in Tennessee. We are against that component which is for the use of nuclear weapons and also for the impact upon the environment and for the safety of people. **1/07.02** I don't like the idea of using civilian facilities for the production of that material and I don't like the use of that at all. **2/01.09** To begin with…it causes cancer and it is not really that concerned about the…people and I think it is insane to be doing that to begin with, so I'm making my comment that I am against this. I'm against the production of tritium in a commercial light water reactor. O.K. Goodbye. **1(cont'd)**

Commentor No. 121: Joyce Rolce

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Joyce Rolce
Organization:	
Address:	Nashville, TN
Phone #: **Fax #:**	(615) 370-4032
Comment #:	

Comment:

This comment is from Richard and Joyce Rolce of Brentwood, Tennessee. We are very much opposed to the manufacture of tritium at TVA facilities or within Tennessee, the light water reactor program, and wanted to express our opposition to it. Thank you. Please contact me if you have any questions. Bye. *1/07.02*

Commentor No. 122: Beverly Charles

Comments Received via "800" Number

Date:	Oct. 27, 1998
Name:	Beverly Charles
Organization:	
Address:	46 Radcliff Road Springfield, IL 62703
Phone #: **Fax #:**	(217) 585-1329
Comment #:	

Comment:

I am calling to make a comment on the production of tritium in a commercial light water reactor. I do not see a need for this--it is a component for nuclear weapons--we are not at war and we, for sure, don't need to be selling it to anyone else. *1/02.01* Although many people may not truly believe it, I believe a lot of these factors are a part of what is increasing the cancer rates--having been a victim of breast cancer myself, I am thoroughly against this type of production. Thank you. *2/14.04*

Commentor No. 123: Maggie Colgan

AddressID: 48

Date Updated: 10/26/98 7:32:30 PM

First Name: Maggie

MI:

Last Name: Colgan

Title:

Organization:

Address:

City:

State or Province:

Postal Code:

Country: USA

Work Phone:

Fax Number:

Email Address: MACOLGAN7@aol.com

Home Phone:

Notes: Stop this insanity!! No CLWR in Tennessee 1/07.02

Commentor No. 124: Alex A. Pulsipher

AddressID: 50

Date Updated: 10/27/98 12:04:38 PM

First Name: alex

MI: a

Last Name: pulsipher

Title:

Organization:

Address: 816 maplehurst park apt #1

City: KNOXVILLE

State or Province: TN

Postal Code: 37902-

Country: USA

Work Phone:

Fax Number:

Email Address: APULSIPH@ICX.NET

Home Phone:

Notes: NO TRITIUM PRODUCTION IN CIVILIAN FACILITIES! 1/01.09 END ALL PRODUCTION OF NUCLEAR WEAPONS NOW! 2/01.01

Commentor No. 125: William W. Howell

AddressID: 51

Date Updated: 10/27/98 10:43:33 PM

First Name: William

MI: W

Last Name: Howell

Title:

Organization:

Address: 1007 Stonewall Drive

City: Nashville

State or Province: TN

Postal Code: 37220-

Country: USA

Work Phone: 615-297-2269

Fax Number: 615-385-2503

Email Address: wwhowell@earthlink.net

Home Phone: 615-269-4532

Notes: Having read the summary of the Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management, I am amazed that the proposal was not abandoned a long time ago. With the Cold War over and nuclear stokpiles being reduced, where is the justification for maintaining a stockpile? Why don't we just dismantle the weapons as the components age and deteriorate? I don't want my tax dollars squandered on this boondoggle. 1/02.01 2/23.13

Commentor No. 126: Justin P. Wilson

STATE OF TENNESSEE

DON SUNDQUIST
GOVERNOR

October 27, 1998

Mr. Stephen M. Sohinki, Director
CLWR Project Office
U.S. Department of Energy
P.O. Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

As the Governor's Lead Contact for State of Tennessee National Environmental Policy Act (NEPA) reviews, I am providing comments in response to the **U.S. Department of Energy - Draft Environmental Impact Statement for the Production of Tritium in Commercial Light Water Reactor, DOE/EIS – 0288D dated August 1998**. The attached comments from state agencies represent the complete and official response of the State of Tennessee. These comments are limited to the scope of study appropriate for the aforementioned document. Please give these comments your full consideration as well as all comments presented by concerned citizens at your public meetings

The State firmly supports the maintenance of our national security. The proposed actions appear to further that goal without compromising the health and safety of Tennessee citizens or the protection of State resources. 1/14.06

The State makes the following comments:

1) The Department of Energy (DOE) should consider a specification that commercial reactors producing tritium be operated at a level appropriate for efficient power production, not a level that maximizes tritium production. Since risk of exposure is greatest during fuel rod replacement or transportation of spent nuclear fuel, this would minimize risks of accidental exposure. Operating the reactor at an inefficient level for power production increases the rate of fuel consumption, thereby increasing both the rate at which fuel rods are changed and the amount of spent nuclear fuel that must be transported and disposed. In addition, the EIS did not evaluated the operation of Bellefonte for maximum power efficiency as it did for Watts Bar and Sequoyah. The DOE should provide this analysis if it intends to produce tritium at Bellefonte. 2/14.15

2) The document should explain whether operational limits for a plant would be changed to produce tritium and whether those changes might affect National Pollution Discharge Elimination System (NPDES) permits under which that plant now operates. 3/11.02

State Capitol, Nashville, Tennessee 37243-0001
Telephone No. (615) 741-2001

Commentor No. 126: Justin P. Wilson (Cont'd)

Mr. Stephen M. Sohinki
Page 2
October 27, 1998

3) The DOE should consider background and downstream monitoring of these facilities. 4/11.03

We appreciate the opportunity to comment and will respond to additional opportunities in the future. If you have any questions, please contact our staff policy analyst at 615/532-4968 (fax 615/532-0740).

Sincerely,

Justin P. Wilson
Deputy Governor for Policy

JPW/emw

cc: Mr. Milton H. Hamilton, Jr., Commissioner
NEPA coordination file/Mr. Dodd Galbreath
State NEPA Contacts
Mr. James Chardos, Tennessee Valley Authority

Commentor No. 127: Earl C. Leming

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DOE OVERSIGHT DIVISION
761 EMORY VALLEY ROAD
OAK RIDGE, TENNESSEE 37830-7072

October 5, 1998

US Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
PO Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki

U.S. Department of Energy - *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*, DOE/EIS-0288D dated August 1998

The Tennessee Department of Environment and Conservation, DOE Oversight Division (TDEC DOE-O) has reviewed the above Draft Environmental Impact Statement (EIS). The subject EIS was reviewed in accordance with the requirements of the National Environmental Policy Act (NEPA) and associated implementing regulations 40 CFR 1500, 1508, and 10 CFR 1021 as implemented.

The production of tritium at Sequoyah and/or Watts Bar and/or Bellefonte nuclear plants as described in the subject EIS does not appear to create a significant risk to the environment or human health, provided tritium production is at a level that allows efficient power production. Less efficient power production would result in additional spent nuclear fuel (SNF) with associated environmental and transportation risks. After review of the subject document, the Division offers the following comments for your consideration: 1/14.15

- The option of simultaneously burning mixed oxide (MOX) fuel and producing tritium in the same reactor was not discussed in the EIS. The EIS should explain why this option was not included. 2/04.04
- The National Environmental Policy Act (NEPA) does not specifically require cost analyses, however, due to extremely important and complex socioeconomic factors associated with the tritium production project, the EIS should include a complete cost analyses. 3/23.16
- If tritium is produced at levels that increase reactor fuel consumption, the EIS should clarify who owns the additional SNF and who will pay for its eventual treatment, storage, and disposal. 4/17.08

Commentor No. 127: Earl C. Leming (Cont'd)

The following request was made in the State's comments on the Notice of Intent (letter from J.P. Wilson to S.M. Sohinki dated March 6, 1998, with attached letter from E.C. Leming to S.M. Sohinki dated March 6, 1998). We again request that following data be provided to this office for review.

"**Environmental Impacts and Safety**
Provide to the State and interested stakeholders the TVA sampling data from the primary coolant at the Watts Bar Pilot Project (both before) and during actual production of tritium. Send the data as it becomes available. Measurements of H-3 in particular should be provided. Since the tritium-producing burnable absorber rods (TPBARs) contain different materials than standard BARs, other relevant neutron activation products should be included in the data. Supply enough reference data to facilitate evaluation. Supply detection limits and bounding statistics." *5/19.13*

Sincerely

Earl C. Leming
Director

Commentor No. 128: Joelle Key

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Radiological Health
3rd Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1532
615-532-0399
INTERNET: jkey@mail.state.tn.us

October 26, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki:

Thank you for the opportunity to review the Draft Environmental Impact Statement for the Production for Tritium in a Commercial Light Water Reactor. We have the following comments about this document.

1) The TPBARs being tested at Watts Bar will not be removed until 1999, and yet the decision of which technology is going to be used is going to be made by the end of 1998. Is it reasonable to make this decision before concluding the test at Watts Bar? If this decision can be made without this information, then there was no reason for the test to be run. *1/05.10*

2) The production of tritium in a reactor will cause a significant increase in the amount of tritium in the coolant. The presentation of material in this report implies that the increase in the quantity of tritium is not significant. Section 5 compares the amount of tritium released annually under normal operations and the amount predicted with tritium being produced. On page 5-5 the comparison is made for gaseous emissions. In this example, it is stated that under normal conditions 5.6 Ci of tritium is released annually. With 1,000 TPBARs in the reactor, a release of 1,655.6 Ci of tritium is predicted. The footnote states that 1,550 Ci of this comes from the unlikely condition that 2 of the TPBARs fail. Even if none of the TPBARs fail, 1,550 Ci from 1,656.6 Ci leaves 100 more Ci released when tritium is being produced. This is almost 20 times as much tritium than is currently released from the commercial reactor. The same comparisons can be made for liquid effluents on page 5-6, with the increase being threefold. The dose assessment for these releases does show that they are well within federal guidelines, but the increase in the amount of tritium being release is significant should not be treated as if it is insignificant. *2/14.16*

Sincerely,

Joelle Key
Health Physicist

Commentor No. 129: Robert L. Foster, Jr.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
WATER SUPPLY
6th Floor, 401 Church Street
Nashville, Tennessee 37243-1549

October 26, 1998

U. S. Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
P. O. Box 44539
Washington, D. C. 20026-4539

Re: **U. S. Department of Energy - Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor, DOC/EIS-0288D dated August 1998**

Dear Mr. Sohinki:

The Tennessee Department of Environment and Conservation, Division of Water Supply has reviewed the draft environmental impact statement (EIS). The Division of Water Supply offers the following comments for your consideration:

- The proposed impact statement could be strengthened by requiring TVA, DOE and DOD to fund background and downstream tritium monitoring at public water system intakes that could potentially be impacted by the production of tritium. Sample containers should also be prepositioned for use in case of an accidental release of tritium by nuclear plants. The data generated by the monitoring should routinely be made available to the state and to the water systems for inclusion in consumer confidence reports along with a simple explanation anticipated health effects of the ingestion of tritium at the concentrations found in water at the intake. *1/11.03*

Thank you for the opportunity to comment.

Sincerely,

Robert L. Foster, Jr.

Robert L. Foster, Jr.
Deputy Director

RLF/rlf

Commentor No. 130: Christopher F. Turner

AddressID:	53			Date Updated:	10/28/98 5:19:48 PM
First Name:	Christoper	MI:	F	Last Name:	Turner
Title:					
Organization:					
Address:	3056 Bowling Green Dr.				
City:	Walnut Creek				
State or Province:	CA	Postal Code:	94598-	Country:	USA
Work Phone:		Fax Number:			
Email Address:	caped8@aol.com			Home Phone:	(925)937-6586

Notes: I just wished to express my thanks to all the members of the CLWR project for doing such important work in the development of tritium production.many more feel the same way I do. Thanks *1/07.02*

Commentor No. 131: Judi Kazanas

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: I fully support the production of tritium ~~pro~~ at the Bellefonte nuclear plant in Hollywood, Alabama. Secretary of Energy Richardson has many positive considerations at Bellefonte. From an aspect of cost, Bellefonte is by far the best choice to produce tritium. Environmental impact studies have been conducted in the region and have been favorable. Technical risk aspects have been thoroughly studied with a favorable report. Compatibility, with respect to quantity & schedule, has been reviewed. The partnership of DOE & TVA represents a wonderful opportunity for Alabama & Tennessee to once again contribute to the military defense of our great country. 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Judi Kazanas (optional)
Organization:
Address: 5720 Laurel Ridge Rd
City: Chattanooga State: TN Zip Code: 37416
Work phone: Home phone: 423 344-1137
Fax:
E-Mail Address: jkazanas@aol.com

7/4/98

Commentor No. 132: Madeline Duckles

Women's International League for Peace and Freedom
United States Section
1213 Race Street, Philadelphia, PA 19107-1691
(215) 563-7110 • (215) 563-5527 (FAX)

Berkeley-East Bay Branch
P.O. Box 5576, Berkeley 94705
510-845-3737

October 26, 1998

DRAFT ENVIRONMENTAL IMPACT STATEMENT
for the
PRODUCTION OF TRITIUM IN A COMMERCIAL LIGHT WATER REACTOR

Using commercial reactors to produce tritium has serious environmental and public health impacts. Tritium is extraordinarily difficult to contain. Elevated tritium levels have already been found in the air and water around reactor sites. Far from harmless, tritium contamination has been associated with a variety of public health problems including birth defects and cancers. 1/14.04

In December 1991 coolant contaminated with tritium leaked into the Savannah River from a D.O.E. reactor. As a result, industrial and residential water plants in Georgia and South Carolina were closed for an undetermined period. 2/08.02

We do not believe these concerns have been adequately addressed in the subject E.I.S.

Women's International League for Peace and Freedom is very concerned that plans to produce nuclear weapons materials such as tritium in commercial reactors will do irreparable damage to non-proliferation goals. Until now the U.S. has maintained a clear distinction between weapons work and commercial programs, and it has tried to persuade other nations to do the same. Violating this long-standing policy would set a dangerous precedent worldwide. 3/01.04

Since no country poses a credible military threat to the U.S. and the Start II Treaty has been ratified by the U.S. Senate, there is no urgent requirement for more tritium than can be obtained from the scheduled dismantling of our nuclear weapons arsenal. 4/02.02

India and Pakistan have burst into the international scene with their recent nuclear tests and have thus joined the acknowledged nuclear powers (U.S., Great Britain, France, Russia and China). Israel is known to possess nuclear weapons, and Iran is approaching nuclear capability. 3(cont'd)

Other countries possess nuclear power plants. It would be irresponsible, to say the least, for the U.S. to lead the way to using commercial reactors for weapons purposes. 5/01.09

WOMEN'S INTERNATIONAL LEAGUE FOR PEACE AND FREEDOM.
Berkeley-East Bay Branch

Madeline Duckles

Madeline Duckles, Chair

Commentor No. 133: Mayor Glenda H. Hodges

Incorporated 1890

Town of Woodville

P.O. Box 94 • 26 Venson Street
Woodville, Alabama 35776
(205) 776-2860
Fax: (205) 776-2796

October 2, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
ATTN: Mr. Stephen Sohinki
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki:

In February 1998, the Woodville Town Council adopted a resolution in support of the production of tritium at the Bellfonte Nuclear Plant, and our position has not changed.

We believe that the production of tritium at Bellefonte poses no danger to the public and we feel confident that the plant can be operated in a completely safe manner.

Since the production of tritium by the Commercial Light Water Reactor method can be accomplished as a by-product of production of electricity, utilization of the Bellefonte Plant seems to be the most feasible and logical choice to produce the tritium needed for our national defense. North Alabama is proud of the contributions made and continue to be made to our nation's military programs. *1/07.03*

Also, utilization of the Bellefonte Plant would provide an economic boost to an economic depressed area of our state. Therefore, for the above reasons, we continue to offer our support.

Sincerely,

Glenda H. Hodges,
Mayor

Commentor No. 134: Randy Horton

Comments Received via "800" Number

Date:	Oct. 30, 1998
Name:	Randy Horton
Organization:	
Address:	145 Fairhill Drive Wilmington, DE
Phone #: **Fax #:**	302-234-7874
Comment #:	

Comment:

I'm calling in support of the DOE proposal to open the Bellefonte Nuclear Plant. Thank you for your support. *1/07.03*

Commentor No. 135: Colleen Lancaster

COMMENT FORM

The Department of Energy is interested in your comments on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.*

There are several ways to provide comments on this document and these include:

- attending public meetings and giving your comments directly to DOE officials
- returning this comment form to the registration desk at the meeting
- returning this comment form or other written comments to the address on the back
- faxing your comments to 1-800-631-0612
- commenting via the World Wide Web site: http://www.dp.doe.gov/dp-62
- calling toll-free and leaving your comments via voice mail, 1-800-332-0801

Comments: My study of history tells me that, after World War II, a new "peaceful" role for nuclear energy would begin—not to be confused or intertwined with the defense role. There was to be a wall between the two roles. Section 4.1.5.4 of this draft EIS attempts to muddy the water and imply "dualness" has been commonplace. However, we are engaged in a discussion about making a bomb component in a civilian reactor. There is a difference! I am highly troubled by the breaching of the wall.

Admittedly, though, some breaching has already occurred because the civilian role has always been tainted by the defense role. Now, the defense role comes begging at the door of its poor relative, the civilian role; and the civilian role must take up the slack in a period when the world doesn't seem to respect nuclear weapons and superpowers much. 1/01.09

My choice:

The No Action Alternative for the CLWR EIS – accelerator production of tritium at the Savannah River site. 2/04.01

We cannot have "dual-use" facilities in this country and then be picky about dual-use technology we sell to other countries or protest sale of it by others to rogue nations. 1(cont'd)

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: Colleen Lancaster (optional)
Organization:
Address: 801 Davis DR
City: Brentwood State: TN Zip Code: 37027
Work phone: 615-741-0783 Home phone: 615-370-1572
Fax:
E-Mail Address: Plumbob246@AOL.COM

Commentor No. 136: Judith Cumbee

11076 CR 267
Lanett AL 36863
Sept 27, 1998

Mr. Stephen Sohinki, Director,
CLWR Project Office, US DOE
PO Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

I write in total opposition to the Alabama Bellefonte plant being completed to produce nuclear energy and tritium for nuclear weapons and in general opposition to any dual production.

I am concerned about security for my state, our country and the world.

Bellefonte, a commercial plant making nuclear bomb material, could become a target for terrorist action or a bomb attack by hostile forces. Also Bellefonte would be the least protected of all U.S. nuclear weapons facilities and having them in my state certainly does not enhance my security. 1/22.01

On site leakage of radioactive and other toxic wastes (as happened at the Savannah River Plant and which could also happen in transporting the irradiated TPBARS as well as the used fuel rods or the wastes) is another risk not to be taken in "Alabama the Beautiful." 2/16.03 3/08.02 4/18.04 5/18.10

But furthermore it is great hypocrisy for America the Beautiful to live up to her promises as a leader for a new world. What moral authority do we have to deny Saddam Hussein for building weapons of mass destruction while we, a signer of the Nuclear Non-proliferation Treaty, instead of pursuing complete nuclear disarmament as called for in Article VI, plan to produce tritium for the continued production of nuclear weapons? 6/01.04

Commentor No. 136: Judith Cumbee (Cont'd)

The argument that there is no qualitative difference between TVA producing electricity for nuclear weapons and producing tritium, that it is just "in effect extending the past practice of using government-owned facilities simultaneously for civil and military purposes" is absolute contradiction to the intent of the International Atomic Energy Act. Using a commercial plant to produce weapons material would set a precedent for Iraq, China, and any other country to disguise weapons development as civilian activity. 7/01.09

Security from accidents that will be generated both by nuclear energy and nuclear weapons is best by developing a reverence for life. For security, environmental, and moral reasons, I urge neither the Bellefonte plant - or any other - be used to produce tritium. 8/01.10

Sincerely,

Judith Cumbee

PS - A note for those who believe we need a nuclear deterrent: the Natural Resources Defense Council points out that 1000 warheads - more than enough to serve as a deterrent - "would not require additional tritium until 2032... by that time 3/4ths of any tritium produced in 2005 will have decayed away." A tritium facility producing by 2000 would be defunct by 2040 - 9/02.02

Commentor No. 136: Judith Cumbee (Cont'd)

A Resolution Opposing Production of Tritium at the Alabama Bellefonte Plant
By the Peace-Justice Human Rights Committe of Alabama New South Coalition
October 2, 1998

Whereas, the Department of Energy has prepared a Draft Environmental Impact Statement on the production of tritium in the TVA reactor at the Alabama Bellefonte plant;

Whereas, tritium, produced from uranium fission, is used for the trigger of nuclear weapons and the United States has more than enough tritium to last until 2015 if there are no more arms control treaties (and if there are, less will be needed); 9(cont'd)

Whereas, making bomb material in a commercial reactor violates the Atomic Energy Act which has always kept commercial and nuclear power separate for reasons of safety, security, and nonproliferation;

Whereas, the current course of developing additional radioactive materials for weapons use is in violation of the Nuclear Nonproliferation Treaty; 6(cont'd)

Whereas, serious safety flaws shut down reactors at the Savannah River Plant which produced plutonium and tritium,

Whereas, the Savannah River Site is heavily contaminated; carbon steel tanks holding 34 million gallons of radioactive liquid wastes developed leaks; "arsenic, mercury, tritium and other poisons contaminate site's ground and surface water (Atlanta Journal/Constitution 4/18/91); 3(cont'd)

Whereas, leakage of radioactive tritium and other poisons would cause severe environmental contamination in Alabama, endangering human and other life systems, even beyond the immediate site (in 1983 carcinogenic solvents were discovered under the Savannah River Site in the deep Tuscaloosa aquifer, which flows into Alabama); 10/14.04

Therefore be it resolved that the Peace-Justice-Human Rights Committee of the Alabama New South Coalition, which was founded on a platform that included support for a Nuclear Weapons Freeze, generally opposes further production of tritium 11/01.01
and specifically opposes using the Bellefonte plant for such production, and 12/07.03

Be it further resolved that this notice of opposition will be forwarded to Stephen Sohinki, Director, CLWR Project Office, US Dept. of Energy, PO Box 44539, Washington DC 20026-4539 [or faxed to 800 631 0612 or sent to http://www.dp.doe.gov/dp-62, all to be marked: "CLWR EIS Comments} and to newspapers in the Scottsboro, Fort Payne, Huntsville, Anniston, and Birmingham areas.

Alliance for Nuclear Accountability

A national alliance of organizations working to address issues of nuclear weapons production and waste clean-up

Member Groups

American Friends Service Committee
Denver, CO

Citizen Alert
Las Vegas, NV

Coalition for Health Concern
Benton, KY

Concerned Citizens for Nuclear Safety
Santa Fe, NM

Environmental Defense Institute
Troy, ID

Fernald Residents for Environmental Safety and Health, Inc.
Ross, OH

Global Resource Action Center for the Environment
New York, NY

Government Accountability Project
Seattle, WA
Washington, DC

Hanford Education Action League
Spokane, WA

Heart of America Northwest
Seattle, WA

Los Alamos Study Group
Santa Fe, NM

Miamisburg Environmental Safety & Health
Miamisburg, OH

National Environmental Coalition of Native Americans
Prague, OK

Native Americans for a Clean Environment
Tahlequah, OK

Neighbors in Need
Engewood, OH

Oak Ridge Environmental Peace Alliance
Oak Ridge, TN

Panhandle Area Neighbors & Landowners (PANAL)
Panhandle, TX

Peace Action Education Fund
Washington, DC
Nashville, TN

Peace Farm
Panhandle, TX

Physicians for Social Responsibility
Washington, DC

Portsmouth/Piketon Residents for Environmental Safety & Security
McDermott, OH

Rocky Mountain Peace and Justice Center
Boulder, CO

Snake River Alliance
Boise, ID

Southwest Research and Information Center
Albuquerque, NM

STAND of Amarillo
Amarillo, TX

Tri-Valley CAREs
Livermore, CA

Western States Legal Foundation
Oakland, CA

Women's Action for New Directions
Arlington, MA

October 27, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
Attn: Mr. Stephen Sohinki
PO Box 44539
Washington, DC 20026-4539

RE: Comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (Draft CLWR EIS)

Dear Mr. Sohinki:

These comments are submitted by the Alliance for Nuclear Accountability (ANA). ANA is a national network of more than 30 organizations working to address issues of nuclear weapons production and waste cleanup. ANA groups have been directly affected by contamination problems caused by past tritium production as well as effects of nuclear weapons production. **1/08.02**

ANA has two major concerns about the DEIS. First, ANA opposes any renewed tritium production for nuclear weapons. Thus, we oppose all of the alternatives included in the DEIS -- both producing tritium in civilian reactors, which are the five "reasonable alternatives" discussed, and the "no action" alternative of producing tritium in an accelerator. **2/01.01** Second, ANA believes that the DEIS is substantially deficient as a NEPA document in its analysis of the environmental impacts, in addition to not discussing all reasonable alternatives. **3/05.16**

ANA requests that the DEIS be withdrawn and that no decision be made to select a new tritium production source for nuclear weapons. **2(cont'd)**

Regarding the "need" for tritium production, the DEIS does not demonstrate that any tritium production source is actually needed, and there has not been a valid and public debate about the size and existence of the U.S. nuclear arsenal. **4/02.01** The DEIS's own chart (Figure S-3) shows that to maintain the START-II Stockpile tritium is not needed until 2016. Under any START-III treaty, the need for tritium would be further delayed. The DEIS itself is contradictory as to the "need." Section 1.3.3 states that tritium "must be available" by 2005 if a commercial light water reactor is **5/02.02**

Seattle Office: 1914 North 34th St., #407, Seattle, WA 98103, 206/547-3175, Fax: 206/547-7158
Washington, DC Office: 1801 18th St. NW, #9-2, Washington, DC 20009, 202/833-4668, Fax: 202/234-9536

the source and that tritium "must be available" by 2007 if a linear accelerator is the source. **5(cont'd)**

Any valid DEIS must discuss real alternatives -- such as not having a new tritium production source and maintaining a smaller nuclear arsenal, and complying with the treaty obligations under Article VI of the Nuclear Nonproliferation Treaty to step up the U.S. commitment to progress on nuclear arms reduction. **6/01.04**

Regarding environmental impacts, the DEIS does not discuss the history of environmental and health problems around DOE tritium production facilities. Environmental problems, leaks, and accidents that have occurred at other tritium production sites are reasons that there are currently no U.S. tritium production plants for nuclear weapons. **1(cont'd)** The DEIS does not discuss how spending billions of dollars on tritium production will divert funding from much-needed cleanup of the nuclear weapons complex. **7/23.13**

The discussion of environmental impacts in the DEIS is also flawed. The DEIS does not fully describe that tritium-producing burnable absorber rods (TPBARs) is a new technology, so there are great uncertainties in their use, including the actual leakage rate (which could be much larger than the 1 curie per year estimate used on page C-19) and the environmental effects of handling, storing, and transporting them. **8/19.09** The DEIS does not discuss the fact that there is no disposal site for spent fuel, so that the environmental effects of tritium production could include centuries of on-site spent fuel storage at commercial reactor site(s). **9/17.09**

The DEIS also does not adequately discuss environmental justice issues. For example, the DEIS does not fully describe and discuss the impacts on low-income and minority populations living in close proximity (less than 15 miles) from some of the commercial reactor sites. Environmental impacts are diluted by the DEIS's usage of a 50-mile radius, when water and air contamination problems could be concentrated in areas in proximity to reactor sites. **10/13.08**

Thank you for your careful consideration of these comments.

Yours truly,

Susan R Gordon

Susan Gordon
Director

Commentor No. 138: Linda King

161 Calienta Dr.
Hoover, AL 35226
Oct. 24, 1998

Commercial Light Water Reactor Project Office
P.O. Box 44539
Washington, DC 20026-4539

Dear Mr. Sohinki:

I have been reading material concerning the proposed tritium plant in the state of Alabama.

I am quite concerned. As careful as anyone would try to be working with this product, accidents, no doubt, would still occur. I do not want my beautiful state to be ruined. 1/15.03

I feel sure you are aware of the negative possibilities, such as it being a radioactive form of water. That's a scary thought! Also, air emissions, cancer, discharge into rivers, transportation of the substance – all of these outweigh the formation of new jobs. 2/14.04

Commentor No. 138: Linda King (Cont'd)

Jobs are great, but at what price! 2(cont'd)

Visit our beautiful state. We want to keep it that way – safe, too. 1(cont'd)

I'm not usually a letter writer, but I may become more of one.

Please give consideration to my thoughts on the matter.

Thank you,
Linda King

Commentor No. 139: Joseph A. Imhof

OCT 26, 1998

U.S. DEPT. OF ENERGY
CLWR PROJECT OFC.
ATTN: STEPHEN SOHINKI
WASHINGTON, D.C.

DEAR STEPHEN,

JOSEPH IMHOF, HERE. I MET YOU AT THE RAINSVILLE, AL. PUBLIC HEARING ON OCT. 6 OF THIS YEAR.

AS A NATIVE ALABAMIAN, I WANT WHAT IS BEST FOR ALABAMA. I FEEL THAT THE BELLEFONTE PROJECT WOULD BE HARMFUL TO OUR ENVIRONMENT IN MANY WAYS. THEREFORE, **1/10.03**

Commentor No. 139: Joseph A. Imhof (Cont'd)

(2)

SPEAKING FOR MYSELF ONLY, I CANNOT SUPPORT THIS PROJECT. I RECOMMEND THE "NO ACTION" OPTION. **1(cont'd)**

IF I COULD SPEAK FOR THE PEOPLE OF ALABAMA, (AND THESE PEOPLE FULLY UNDERSTOOD THE CONSEQUENCES OF THIS PROPOSED BELLEFONTE PROJECT) I WOULD UNEQUIVOCALLY SAY THAT THE PEOPLE OF ALABAMA DON'T WANT THIS PROJECT. **2/04.01**

PLEASE CONSIDER THE "NO

Commentor No. 139: Joseph A. Imhof (Cont'd)

(3)

ACTION" OPTION AND PRESERVE THE SCENIC BEAUTY AND PASTORAL SETTING OF THIS BEAUTIFUL AREA. 2(cont'd)

THANK YOU VERY MUCH FOR YOUR ATTENTION TO THIS REQUEST.

SINCERELY,

JOSEPH A. IMHOF

Joseph A. Imhof

256-880-1019

E-MAIL debhof@juno.com

Commentor No. 140: Robert E. Eigelsbach

IRON WORKERS LOCAL UNION NO. 704

INTERNATIONAL ASSOCIATION OF BRIDGE, STRUCTURAL, ORNAMENTAL AND REINFORCING IRON WORKERS

2715 BELLE ARBOR AVENUE CHATTANOOGA, TENNESSEE 37406

MELVIN L. BREWER
Business Manager

423 / 622-2111 FAX 423 / 622-2112

October 28, 1998

Mr. Bill Richardson
U.S. Department of Energy
Commercial Light Water Reactor Project Office
PO Box 44539
Washington, DC 20026-4539

Dear Mr. Richardson:

I would like to take this opportunity to thank you on behalf of our entire membership for your visit and reception at Bellefonte Nuclear Plant regarding the Tritium Project under consideration at the site.

Our membership believes that tritium production is essential for the defense of this great nation we live in. But as I mentioned in our brief conversation, that as builders by profession, this plant still remains as "unfinished business" to a large percentage of our membership who has worked there at one time or another. I myself started a career as an Iron Worker over 20 years ago at Bellefonte Nuclear Plant, as we all have grown and progressed over the years this plant continues to remain idle. 1/07.03

Again on behalf of our membership, we urge you to select this site so our blood, sweat and tears that we as builders put in this project will not be for nothing.

Yours truly,

Robert E. Eigelsbach
Assistant Business Manager
Iron Workers Local Union 704

REE:cjc

Commentor No. 141: Mike Woloszyn

Comments Received via "800" Number

Date:	Nov. 3, 1998
Name:	Mike Woloszyn
Organization:	
Address:	
Phone #: **Fax #:**	302-832-3344
Comment #:	

Comment:

My wife and my mother-in-law both live in the Scottsboro area and I just wanted to tell you that I support the Bellefonte unit and everybody there that I've talked to believes that it is a safe use for the area. 1/07.04 It would be a good plus for the economy and it makes economic sense to use that facility instead of building one from scratch. The benefits for the average American taxpayer are enormous and once again, I fully support the use of this facility. Thank you. 2/23.13

Commentor No. 142: James H. Lee

United States Department of the Interior

OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

September 29, 1998

ER-98/546

U.S. Department of Energy
Commercial Light Water Reactor Project Office
Attention: Mr. Stephen Sohinki
P.O. Box 44539
Washington, D.C. 20026

RE: DEIS for the Production of Tritium in a Commercial Light Water Reactor

Dear Mr. Sohinki:

The Department of the Interior has reviewed the referenced Draft Environmental Impact Statement (DEIS) and offers the following comments.

The DEIS discusses the impacts associated with the production of tritium in existing Commercial Light Water Rectors owned by the Tennessee Valley Authority (TVA). The installations being considered are the Watts Bar Unit 1, in Rhea County, TN; Sequoyah Units I and 2, Hamilton County, TN; and Bellefonte Units I and 2, Jackson County, AL. The proposed tritium production will not involve new construction or significant increases in tritium discharges beyond those already permitted in the Tennessee River. The Fish and Wildlife Service previously provided a current list of federally threatened and endangered species which occur in the area. The DEIS incorporated consideration of impacts to those species and concluded the operation would not adversely impact those species. The Fish and Wildlife Service does not anticipate adverse effects to listed species from the proposal. TVA is committed to an extensive environmental monitoring program which would be conducted during operations. Should the monitoring indicate an adverse impact on listed species, TVA would immediately initiate consultation with the Fish and Wildlife Service regarding those impacts. 1/14.06

Please contact me at 404-331-4524 if you should have any questions.

Sincerely,

James H. Lee
Regional Environmental Officer

Commentor No. 143: Heinz J. Mueller

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

October 27, 1998

4EAD/rkm

Mr. Stephen Sohinki
U.S. Department of Energy
Commercial Light Water Reactor Project Office
P.O. Box 44539
Washington, D.C. 2006-4539

SUBJECT: Draft Environmental Impact Statement (DOE/EIS-0288D) for the *Production of Tritium in a Commercial Light Water Reactor*

Dear Mr. Sohinki:

We reviewed the subject Draft Environmental Impact Statement (DEIS) in accordance with Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. The proposed action is to obtain irradiation services from one or more Commercial Light Water Reactors (CLWRs) to provide tritium in sufficient quantities to support the nation's nuclear weapons stockpile requirements.

The proposed action includes fabricating tritium-producing burnable absorber rods (TPBARs) at a commercial facility; irradiation of the TPBARs at one or more of five operating or partially constructed TVA nuclear reactors; the possible completion of TVA's nuclear reactors; transportation of non-irradiated TPBARs from the fabrication facility to the reactor sites, irradiating TPBARs in the reactors and transporting irradiated materials from the reactors to a tritium extraction facility that DOE would establish at the Savannah River Site in South Carolina; and management of spent nuclear fuel and low-level radioactive waste. Overall, the DEIS is comprehensive and detailed. The Summary document provides a concise synopsis. Our comments on the DEIS are attached.

EPA has environmental concerns about the project; in particular, the Final EIS should provide more detailed information about the comparative costs of the tritium production alternatives, processes, and potential environmental impacts. **1/23.16**

Commentor No. 143: Heinz J. Mueller (Cont'd)

Thank you for the opportunity to review this DEIS. Based on our review, we rate the DEIS "EC-2", that is, we have environmental concerns about the project, and more information is needed to fully assess the impacts. If you have questions, please contact Ramona McConney of my staff at (404) 562-9615.

Sincerely,

Heinz Mueller

Heinz J. Mueller, Chief
Office of Environmental Assessment

Attachment

Commentor No. 143: Heinz J. Mueller (Cont'd)

Comments for
Draft Environmental Impact Statement (DEIS) for the
Production of Tritium in a Commercial Light Water Reactor

GENERAL COMMENTS:

1 DOE should be explicit concerning the costs associated with tritium production at each TVA plant considered. Please provide a comparison of engineering requirements and costs associated with using existing reactors vs. use of a new reactor. **1(cont'd)**

2. The completion of Bellefonte Nuclear Plant(s) should be a separate EIS. Unless solely used for tritium production, this EIS should not suffice as a dual one for the completion and commercial operation of the Bellefonte plant(s). **2/05.06**

3. Data from the final report from the test phase currently ongoing at Watts Bar should be reviewed and analyzed before a final EIS is completed for this CLWR project. Uncertainties related to burnup, reactor physics, and other factors should be more adequately assessed by DOE at that time. **3/05.10**

4. Will the emissions from the tritium produced be covered under the Clean Air Act - NESHAP-Radionuclides [10 CFR 61, subpart H]? Although a minor contributor to the air emissions from a Nuclear Plant, nevertheless the tritium is owned by DOE. **4/11.05**

SPECIFIC COMMENTS:

P.1-12, Sec.1.5.1.2: Please provide the report that discusses the findings or lessons learned from the Lead Test Assembly demonstration. When will the post-irradiation exam be conducted? **3(cont'd)**

P.3-2, Sec.3.1.2: States the tritium produced would be chemically bound to the "getter" and extracted only after heating to a high temperature. Is there no release potential of any form of tritium, such as elemental or tritium oxide, that contributes to the 0.2 mrem/yr for 1000 TPBARs, for example? Is the only tritium added to waste and releases related to the nuclear process itself? **5/19.10**

P.3-9, 4th bullet: States that the tritium production "would not be expected to affect the radiological condition of the reactor..." Will the results of the trial test at Watts Bar provide the adequate evidence required to better predict what will happen in the core, the reactor life, etc.? **3(cont'd)** What will be the effect on the reactor physics itself? How different from using the regular burnable absorber rods? **6/24.15**

P.5-99, Sec.5.2.7: What is the current U-235 enrichment, 4.0%? Why would DOE supply the higher enriched uranium, and not the U.S. Enrichment Plants? Is it because of the uranium surplus at DOE? **7/24.04**

Also, the text states that the environmental impacts "would be minimal" from increasing the enriched uranium use in the reactor. How does this compare with the H-3, in liquid/air releases? DOE should quantify this statement. **8/14.17**

Commentor No. 143: Heinz J. Mueller (Cont'd)

P.A-12, 1st Paragraph: The text does not go into any detail about the differences between using TPBARs instead of burnable poison rods. Is this discussed elsewhere? If so, it should be referenced here. If not, please provide more detail. **9/19.11**

Commentor No. 144: Anonymous (5)

Comments Received via "800" Number

Date:	Nov 13, 1998
Name:	Unknown
Organization:	
Address:	"North Alabama"
Phone #: **Fax #:**	
Comment #:	

Comment:

I am a citizen of North Alabama. I do not want the publicity. I am not in favor of a tritium plant in Jackson County. Thank you. 1/07.03

Commentor No. 145: Herbert L. Harper

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

September 1, 1998

Mr. Stephen M. Sohinki
Office of Reconfiguration
Department of Energy
Washington, DC 20585

RE: DOE, TRITIUM/COMMERCIAL LIGHT WATER, UNINCORPORATED, MULTI COUNTY

Dear Mr. Sohinki:

The Tennessee State Historic Preservation Office has reviewed the above-referenced undertaking received on Tuesday, August 25, 1998 for compliance by the participating federal agency or applicant for federal assistance with Section 106 of the National Historic Preservation Act. The Advisory Council on Historic Preservation has codified procedures for implementing Section 106 of the Act at 36 CFR 800 (51 FR 31115, September 2, 1986).

After considering the documentation submitted, it is our opinion that the undertaking will have no effect upon National Register of Historic Places listed or eligible properties. This determination is made either because of the location, scope and/or nature of the undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, this office has no objections to your proceeding with the project. 1/14.06

If you are applying for federal funds, license or permit, you should submit this letter as evidence of compliance with Section 106 to the appropriate federal agency, which, in turn, should contact this office as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination to this office for comment. You may direct questions or comments to Joe Garrison (615)532-1559. This office appreciates your cooperation.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

Commentor No. 146: Mary Lou Blazek

Oregon

John A. Kitzhaber, M.D., Governor

Department of Consumer and Business Services
Office of Energy
625 Marion St. NE, Suite 1
Salem, OR 97301-3742
Phone: (503) 378-4040
Toll Free: 1-800-221-8035
FAX: (503) 373-7806
Web site: www.cbs.state.or.us/external/ooe/

October 5, 1998

Mr. Jay Rose
Office of Defense Programs
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Re: Oregon Office of Energy's comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor.

Dear Mr. Rose,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (CLWR EIS). Tritium production is a subject Oregonians have strong feelings about. Our most urgent concerns are:

The CLWR EIS mentions numerous times that production of tritium in a commercial light water reactor may result in more spent fuel. As also detailed in the CLWR EIS, this fuel will have higher enrichments and lower burnup than fuel currently discharged to the spent fuel pools and thus will have higher reactivity. The CLWR EIS discusses in detail the use of Independent Spent Fuel Storage Installations (ISFSI), but it is presumed that some of this more reactive fuel will be discharged to the facility spent fuel pool. The CLWR EIS contains no discussion of the effects of this high reactivity fuel on spent fuel pool design parameters or spent fuel pool or fuel handling accidents. We recommend that a detailed analysis of the effects of this high reactivity fuel on the various plants' spent fuel pools, and on fuel pool and fuel handling accident analyses be done and a discussion of the results included in the CLWR EIS. **1/17.10**

There is no discussion of the effect of this high reactivity fuel on the postulated geologic repository. For example: Since there will be much more spent fuel generated by this process, will this affect the capability of the geologic repository to accept fuel from other CLWR? Will its high reactivity make it ineligible for geologic storage or require special handling? These issues should be evaluated and discussed in the CLWR EIS. **2/17.11**

Commentor No. 146: Mary Lou Blazek (Cont'd)

Attached are additional specific comments. Should you have any questions, please contact Doug Huston of my staff at (503)378-4456.

Sincerely,

Mary Lou Blazek

Mary Lou Blazek
Administrator
Nuclear Safety Division
Oregon Office of Energy

cc: Ms. Donna Powaukee - Nez Perce Tribe
Mr. J. R. Wilkerson- CTUIR
Mr. Michael Wilson - Washington Ecology
Mr. Douglas Sherwood - EPA
Mr. Russell Jim - Yakama Nation

Commentor No. 146: Mary Lou Blazek (Cont'd)

Oregon Office of Energy's comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor Page 1 of 4.

Section 4.2.1.9 discusses "conservative assumptions" used for both individual and population exposure times. We recommend that these conservative assumptions be expressly discussed in the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (CLWR EIS). **3/14.18**

Table 4-10 refers to a footnote "c." Footnote "c" does not exist. It appears that footnote "d" is correct. This table needs to be corrected. **4/24.12**

Table 4-11 does not contain any reference to the source of the data in the table. We recommend that a citation as to the source of the data, for example, exposure records, be included with Table 4-11. **5/24.16**

The Low Level Radioactive Waste section on page 4-28 implies a difference between the primary coolant system and the reactor coolant system. In reality these are one and the same system. We recommend that consistent terminology be used in this section.

Section 4.2.2.1 refers to Chickamauga Lake, Figure 4-7 refers to Chickamauga Reservoir. These references need to be consistent. **4(cont'd)**

The Aquatic Resources Section on page 4-42 discusses a decline in the native mussel population but does not discuss a suspected cause. We recommend that this suspected cause be included in this section. **6/12.06**

The discussions of socioeconomic impact are very inconsistent between sites. These discussions need to be to the same level of detail for each site. **7/13.04**

The first assumption listed in Section 5.1.2 is not an assumption; it's a statement concerning the conservatism of the model used. Move this statement from the list of assumptions up into the paragraph, which precedes the list of assumptions. **8/24.17**

The statement in the fourth assumption of Section 5.1.2 that experience with boron burnable absorber rods bounds what would be expected from Tritium Production Burnable Absorber Rods (TPBAR) needs more amplification. There are several types of boron burnable absorber rods with different materials of construction. The number of boron burnable poison rods installed in a core is much less than the possible number of TPBARs that would be installed for tritium production. **9/19.01**

Section 5.2.1.1 under Land Use states no additional land would be disturbed at Watt's Bar to prepare for tritium production but then goes on to discuss construction of a dry cask spent nuclear fuel storage facility at the site. We recommend that the first sentence be modified to acknowledge the possible construction of a dry cask spent nuclear fuel storage facility. **4(cont'd)**

Commentor No. 146: Mary Lou Blazek (Cont'd)

Oregon Office of Energy's comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor Page 2 of 4.

Section 5.2.1.9.1 makes the statement no new facilities would be constructed to support tritium production at Watt's Bar. Construction of a dry cask spent nuclear fuel storage facility constitutes new facilities. We recommend that this possibility be acknowledged in any discussion of construction impacts in the CLWR EIS. **4(cont'd)**

Section 5.2.1.9.2 under Radiological Impacts states assessment of dose and associated cancer risk to the non-involved worker is not applicable for beyond-design-basis accidents. The rationales given following this statement are of dubious validity. The assumption of a slow moving accident is not a general case; many scenarios of fast moving beyond basis accidents exist. Further, the statement is made that the public within 10 miles would have been evacuated. This evacuation would not occur immediately and would most likely take hours to accomplish. We recommend that dose and associated cancer risk be evaluated for the non-involved worker. **10/15.09**

Table 5-6 presents risk increments associated with various accidents, and the paragraph following this table describes these numbers as the actual risk. Terminology should be consistent between narratives and tables. **11/15.10**

The statement on page 5-39 that studies of natural draft cooling towers in England approximate the performance of natural draft cooling towers in the southern US needs amplification. There are significant climate differences between these two areas. **12/11.06**

Footnote "e" to Table 5-22 appears redundant.

The footnotes associated with Table 5-29 are out of synch with the table. **4(cont'd)**

Table 5-30 does not include health risks to workers. The assumption that administrative controls will completely protect workers is unrealistic. The Oregon Office of Energy recommends that as a minimum, historical exposures for workers in similar processes, with administrative controls in place, be reviewed and the risks then extrapolated. **13/14.01**

Table 5-32 assumes mean (50%) meteorological conditions to the maximally exposed offsite individual. We recommend that worst case credible meteorological conditions be used to bound the risks. **14/15.11**

Table 5-32 does not give units for the data presented. We recommend these units be provided in the table. **15/24.20**

Table 5-38, Uranium Fuel Cycle and Waste Management entry discusses only transportation. Issues associated with additional on-site storage capacity for spent fuel should also be discussed. **16/17.12**

Commentor No. 146: Mary Lou Blazek (Cont'd)

Oregon Office of Energy's comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor Page 3 of 4.

Section 5.2.6, page 5-92 discusses the exposure to a "real" individual. Information should be included on what is meant by placing the word real in quotes. **17/24.23**

Include the assumptions behind the conservatively estimated dose to a worker from the Independent Spent Fuel Storage Installation (ISFSI). (page 5-94, top of the page.) **18/17.13**

Page 5-94, second paragraph states no chemical, biocide or sanitary wastes would be generated in the operation of the ISFSI. This disagrees with Table 5-41, which implies that small amounts of these would be generated. These two references should be consistent. **19/17.14**

Table 5-42, page 5-96, the bottom of the table is cut off.

The table on the top of page 5-97 has no title, is not referred to anywhere in the text, and generally contains no useful information. We recommend this table be deleted. **4(cont'd)**

The transportation segments discussed in section 5.2.8 (page 5-100) do not include transportation of raw materials to the TPBAR fabrication facility. This phase of transportation should also be discussed. **20/18.12**

The Table 5-46 assumption of a one month refueling outage is optimistic. We recommend that the TVA average refueling outage duration be used in this column. **21/14.19**

Section 5.2.9 refers to a "baseline tritium production CLWR configuration" which it says is described in Sections 5.2.1 to 5.2.3. These sections consider two conditions: 1000 TPBARS and 3400 TPBARS. Table 5-46 identifies the baseline as 3400 TPBARS, but it is not apparent that this is the baseline assumed in Table 5-47 since some of the "change from baseline" columns for this case are non-zero. The baseline assumed in this section needs to be stated explicitly, and all the tables in this section should be checked for consistency with this baseline. **22/24.18**

Tables 5-51 and 5-53 do not consider two reactors operating in the tritium production mode even though these options are possible as discussed in Table 3-2. The two reactors in tritium production configuration should be added to these tables. **23/24.13**

The following typographical or grammatical errors were discovered:

Summary, page 6 top of page, second sentence contains a split infinitive – "to not be.." should be "not to be…"
Page 3-10, second bullet, fourth sentence, replace "of" with "at" just prior to "a national repository."
Page 3-29, Low Level Radioactive Waste Generation, first sentence. Add the word "at" prior to Bellefonte 1. **4(cont'd)**

Commentor No. 146: Mary Lou Blazek (Cont'd)

Oregon Office of Energy's comments on the Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor Page 4 of 4.

Typographical and grammatical errors (cont.)

Page 4-12, 4-13, the last two full sentences on page 4-12 are repeated on the top of page 4-13.
Page 5-1, Section 5.1, first sentence. Add the word "to" following the abbreviation CEQ.
Page 5-31, Section 5.2.3.2, second paragraph, first sentence. Add the word "by" following the phrase "compensated for…"
Page 5-98, last sentence on the page. Insert the word "no" prior to the word "additional."
Page 5-105, TBAR should be TPBAR
Page 5-105, Section 5.2.10, second sentence. The word "characterizes" should be "comprises."
Page 5-120, first full paragraph at the top of the page, second sentence. This sentence should be re-written. A suggestion is "Due to the limited amount of land disturbance, there would be small impacts….."
Page C-8, the paragraph following Table C-2. The radiation unit Grey is improperly abbreviated Cy. **4(cont'd)**

The following commentors (200 through 255) submitted comments concerning the December 14, 1998, public meeting and TVA's latest proposals to DOE for use of Watts Bar, Sequoyah, and Bellefonte.

Commentor No. 200: Mrs. Ed Houser

Comments Received via "800" Number

Date:	Dec 10, 1998
Name:	Ms. Ed Houser
Organization:	
Address:	46 Sherry Drive Ringo, GA 30736
Phone #: **Fax #:**	(706) 866-7239
Comment #:	

Comment:

I am totally against opening a plant in Hollywood, Alabama at the Bellefonte plant. Those people down there have enough trouble as it is. There's not enough educated people to run that--they would have to be bringing people in to run it. There's not enough housing for people to be brought in. It is mostly a farm community. Lots of older folks and younger folks, not a whole lot in between. But this plant does not need to be in Bellefonte because it will create nothing but trouble. *1/13.01*

Commentor No. 201: W. D. Scarbrough

Comments Received via "800" Number

Date:	December 10, 1998
Name:	W.D. Scarbrough
Organization:	
Address:	3503 Sparkman Drive, NW Huntsville, AL 35810
Phone #: **Fax #:**	(256) 852-9350
Comment #:	

Comment:

Comment on tritium production at Tennessee Valley. I feel it would be highly desirable. I do feel like part of your message is not getting out because I have not seen one reference in any public publication, newspaper or television report, radio report, otherwise of the fact that all you will be doing in the Tennessee Valley is exposing control rods to radiation and you will transport the control rods somewhere else to extract tritium. I feel like it will be highly desirable to have that situation here because we already are producing atomic electricity--we might as well get some other benefit from it as tax benefits. *1/07.07*

Commentor No. 202: Robert Van Wyck

Comments Received via "800" Number

Date:	Dec. 15, 1998
Name:	Robert Van Wyck
Organization:	
Address:	709 Helmsdale Place North Brentwood, TN 37027
Phone #: **Fax #:**	(615) 373-9176
Comment #:	

Comment:

I don't want any of the options. My problem is you notified me on Friday of a meeting that's being held at the Rhea County High School in Evansville today. There's no way I can make that on such a short schedule. I tried to fax a letter in to Sohinki asking in the future at least 2 weeks notice but your fax machine is not working. I don't know why. I tried for the last 24 hours so please check your fax machine and try to schedule these meetings so people have time to get there to make discussion. *1/07.02* *2/05.31*

(Mr. Van Wyck's comments were received, see Commentor No. 247)

Commentor No. 203: Angela Heckler

Comments Received via "800" Number

Date:	Dec. 17, 1998
Name:	Angela Heckler
Organization:	
Address:	983 County Road 213 Hollywood, AL 35752
Phone #: **Fax #:**	(334) 499-2380
Comment #:	

Comment:

I am calling in reference to the Bellefonte Nuclear Plant producing tritium--we are against it. We feel like this is being pushed upon us. The polls that have been taken have not been taken fairly. It will affect us and we do not want it here. I don't know where the people are getting their information that says that Jackson County does want this because everyone I talk to say they do not want it and we would like to make that clear. Just wanted to make the comment and let someone know that we are not for this. We are against it and we do not want it in our community. *1/07.03*

Commentor No. 204: Carol L. Womacks

AddressID: 56 Date Updated: 12/16/98 1:22:03 AM

First Name: carol MI: l Last Name: womacks Title:

Organization: Bellefonte Alliance

Address: 204 County Rd. 402

City: Scottsboro

State or Province: Al Postal Code: 35768- Country: Jackson

Work Phone: Fax Number:

Email Address: womacks@HIWAAY.net Home Phone: 256)574-2808

Notes: I would like to say that the majority of citizens of Jackson County do not want the Bellefonte plant put onto operation. That of course not what the elected officials, business owners, and union people from Tennessee want you to think. People in Jackson county are concerned if they will loose jobs. business owners will loose business . I know that the man who ran against our Mayor lost his job working for the city of Scottsboro and this was after many good job reviews prior to his running for Mayor. And you wonder what I am telling you is true? I only wish you would take time to remember that all who came to the meetings were people who would profit from the Bellefonte option and not one average citizen was for the Bellefonte option. Please take this into consideration and do the right thing for the people of Jackson County by not selecting our Bellefone plant as the place to produce tritium. Thank you

1/07.03

Commentor No. 205: William L. Stiles

AddressID: 57 Date Updated: 12/18/98 2:34:08 PM

First Name: William MI: L Last Name: Stiles Title: Elect. Maint. Foreman

Organization: TVA SEQUOYAH

Address: 3216 SCENIC DR.

City: SCOTTSBORO

State or Province: AL. Postal Code: 35769- Country: U.S.

Work Phone: 423-843-8574 Fax Number:

Email Address: wlstiles@tva.gov Home Phone: 256-259-0554

Notes: I'VE BEEN IN TVA POWER PLANT MAINTENANCE FOR THE LAST 24 YR'S. 20 YR'S OF THIS TIME OF THIS TIME HAS BEEN AT BELLEFONTE FOR 10 YR'S AND THE LAST 10 YR'S AT SEQUOYAH NUCLEAR PLANT.
TVA HAS GOOD NUCLEAR PLANTS BUT BELLEFONTE IS THE BEST BUILT,DESIGNED AND WILL HAVE AN OPERATING LIFE OF 40 YR'S.
ECONOMICALLY BELLEFONTE IS THE BEST DEAL AND THE PEOPLE OF JACKSON COUNTY WANT DOE!!!

1/07.03

Commentor No. 206: Silas M. Booker

AddressID: 58

Date Updated: 12/19/98 7:51:25 AM

First Name: Silas MI: M Last Name: Booker Title:

Organization:

Address: 1325 Torbett Road

City: Spring City

State or Province: Tn Postal Code: 37381- Country: USA

Work Phone: Fax Number:

Email Address: Suedoname1@AOL.COM Home Phone:

Notes: Tritium production should be confined to DOE owned reactors. To do otherwise would confuse the distinction of Commerical uses and weapon uses of nuclear power. It would weaken the US stand that countries should not use their utility reactors for weapons production. 1/01.09

Commentor No. 207: Judith Cumbee

Comments Received via "800" Number

Date:	Dec. 14, 1998
Name:	Judith Cumbee
Organization:	
Address:	11076 County Road Lanett, AL 36963
Phone #: **Fax #:**	(334) 499-2380
Comment #:	

Comment:

I am the Chair of the Peace-Justice Human Rights Committee of Alabama New South Coalition. I have been out of town. I got a message Thursday afternoon about this "Public Hearing" Monday night, the 14th. I am leaving for Atlanta tomorrow. I have a sick daughter. There's no way I can be in Tennessee, but number one, I am chagrined that we would get information at such a last minute about a matter that has to do with producing tritium in either Tennessee or in Alabama--that is outrageous. We need to have a good long advance notice. How would one of the Secretaries of Energy or anybody else be able to plan something at the last minute? 1/05.31 I have sent in my comments before about my opposition to tritium production. We need to be doing away with our nuclear weapons. We are accusing Iraq of weapons of mass destruction and here we are proceeding with tritium. Absolutely outrageous. I totally oppose it and I won't go on, as 2/01.01 I said, you have my written comments but I think having this meeting at the last minute is totally wrong and if you want to try to get a full accurate kind of response from the public, you need to set another meeting in January. 1(cont'd) So, in spite of our differences over this, whoever might hear this message, or maybe you even agree with me, I wish you, …what, Season's Greetings which means that I hope the people of the world can come together and create a world where we can live together and set a plan to try not to annihilate us all and we can find ways of peace and it's not through building up these kinds of weapons. 2(cont'd)

Commentor No. 208: Jim Snell

AddressID: 55

Date Updated: 12/11/98 5:24:43 PM

First Name: Jim

MI:

Last Name: Snell

Title:

Organization:

Address: 301 Scott Ave.

City: Nashville

State or Province: TN

Postal Code: 37206-

Country: USA

Work Phone: 615-322-4848

Fax Number: 615-343-0325

Email Address: james.e.snell@vanderbilt.edu

Home Phone: 615-226-1365

Notes:

As a concerned citizen of Middle Tennessee, I believe that tritium production in commercial light water reactors (CLWR) would be a tremendous mistake on several fronts. First of all, I have safety concerns for the workers and community members around the proposed sites. I understand that DOE believes that this technology is safe, but it is still a relatively untried procedure. | 1/14.04

Second, I believe that resuming tritium production sets a conflicting goal to those of strategic arms reduction. The need assesments set forth by the DOE seem to ignore current reductions activities as well as those required by strategic arms reduction treaties the the United States has signed into law. | 2/02.01

Third, and most importantly, I believe that the use of a commercial reactor for military purposes sets an extremely bad example and precedent. The United States can only expect other nations to follow our example and use their civilian facilities for military purposes. The hypocrisy is clear, and we can not reasonably expect other countries to keep civilian and military seperate while we happily churn out bomb material in a CLWR. | 3/01.09

It appears that the DOE and TVA have already struck a deal to produce tritium regardless of the concerns of community members such as myself. | 4/05.33

I hope, however, that this is not the case and that the DOE will reconsider its desire to resurrect the Cold War era bomb machine. It simply is not needed and will waste untold billions of taxpayer money. | 2(cont'd)

Please do not proceed with the Commercial Light Water Reacter project. | 5/23.13

Yours Truly,
Jim Snell

Commentor No. 209: Mike Crane

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I AM IN FAVOR OF THE BELLEFONTE PROPOSAL. | 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) MIKE CRANE
Organization:
Address: 315 LENORE LANE
City: SPRING CITY State: TN Zip Code: 37381
Work phone: 423 2653633 Home phone:
Fax:
E-Mail Address: MLCRANE1@JUNO.COM

12/10/98

Commentor No. 210: Robert L. Davis

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I support any of the Bellefonte options, it is the best for the country and by far the best utilization for the American Taxpayer. Any other option threatens the load base of TVA Electricity production, makes no social economic benefit for the local area or utilities. Federal assets DOE has an opportunity to make a wise self paying choice and any other option is a short term bandaid. 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Robert L. Davis
Organization: TVA
Address: 1100 Bessemer Rd. NW
City: Huntsville State: AL Zip Code: 35811
Work phone: (256) 574-8410 Home phone: (256) 534-2724
Fax: (256) 574-8791
E-Mail Address: RLDavis@tva.gov, RLDCARD@aol.com

12/10/98

Commentor No. 211: Cheryll A. Dyer

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: The East Tennessee area is overflowing with toxic materials from hazardous waste operations both in local industry and DOE Operations. East Tennessee cannot handle any more toxic wastes, emmissions or accidents. 1/10.04

The people of the Bellefonte area are willing to host this new facility. Consideration should be given first to this site. 2/07.03

There are many illnesses believed to have been caused by the DOE Nuclear Operations across the country. 3/08.02 East Tennessee has three nuclear facilities that have contaminated the air, soil and water. We do not need another nuclear facility to add more burden on an already sick environment and population.

Even if an "accident" did not occur over the next 25 years at Watts Bar/Sequoha, the contamination issues are of grave concern and require serious consideration.

Tritium poses a nuclear danger and the contamination issues possible should not be placed in this area. There are just too many environmental and population concerns with adding yet another nuclear facility to the East Tennessee area. 1(cont'd)

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Cheryll A Dyer – Disabled Worker from DOE Oak Ridge K-25 Site
Organization: Coalition for a Healthy Environment
Address: 1180 Melton Hill Cir
City: Clinton State: TN Zip Code: 37716
Work phone: Home phone: 423/457-8322
Fax: 423-457-8150 (Call home # first
E-Mail Address: CherylDyer@yahoo.com

12/10/98

Commentor No. 212: Linda Ewald

Dec. 14, 1998

COMMENT FORM

COMMERCIAL LIGHT WATER REACTOR PROJECT

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I would like to protest the short notice of this meeting - many interested persons did not hear about the meeting or were not able to attend because of other commitments. 1/05.31
Also, the deadline for the decision needing to be made before the end of the year (2-3 weeks) is of concern. Such an important decision should not be rushed and there [is] short time for all who wish to comment by phone, letter and other ways. Also due to short notice. 2/01.12
I have commented at previous meetings and my statements have not changed. I am opposed to the production of tritium or any nuclear weapons material. 3/01.01
I am opposed to the production of tritium for nuclear weapons in Watts Bar or any commercial nuclear reactor. This violates U.S. nonproliferation policy and the Nuclear Nonproliferation Treaty. The United States would protest this action in any other country - we must abide by the same rules made for the whole world. 4/01.04
I question the statement that Tritium is not a special nuclear material 5/01.13
(exactly what is a special nuclear material?)
Tritium is highly radioactive and harmful to human 6/14.04
health and the environment and should not be produced 7/10.03
on purpose. I also as a electric rate payer and a tax payer, I protest being forced to pay for production of weapons materials with electric bill and taxes. 8/23.13
And finally the choice between tritium production in a commercial reactor or linear accelerator is an arbitrary decision and should not be forced. The reasonable and most 3(cont'd)

Thank you for your input. Please use additional sheets if necessary and attach them to this form.
cost effective course is the reduction of nuclear weapons stockpile along with Russia. 3(cont'd)

Name: (optional) Linda Ewald
Organization: Oak Ridge Environmental Peace Alliance / Thunder Mountain Global [illegible]
Address: 949 Pender Road
City: Knoxville State: TN Zip Code: 37923
Work phone: Home phone:
Fax:
E-Mail Address:

12/10/98

Commentor No. 213: Patty Fagan

COMMENT FORM

COMMERCIAL LIGHT WATER REACTOR PROJECT

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: Where has TRITIUM been Produced? & what has the Studies Shown to the environment? 1/08.03
We The People (Mothers esp.) worry about the environment - our water / fish is unsafe here, we do not boat, fish, swim in the water. We do not want the same type thing to happen to the air. 2/14.04

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Patty Fagan
Organization: Mother, Res. Homeowner
Address: 4995 Blythe Ferry Rd
City: Dayton State: TN Zip Code: 37321
Work phone: 423 2095812 Home phone:
Fax:
E-Mail Address:

12/10/98

Commentor No. 214: Ronald L. Forster

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments

12/14/98

PRIOR

to Leaving the Meeting

Comments: I am opposed to the Sole Production of tritium @ WBN and SQN for the following reasons:

1. Operating the Units as high leakage cores for tritium production which would possibly reduce the operating life of these units by a number of years; thus removing these highly needed sources of electricity production. No R.O.I.

2. The Startup and operation of Bellefonte for the production of electricity and Tritium is the most logical decision

(A) Another source of electricity for future increasing Demands

(B) A Portion of the sale of this electricity will pay back the tax dollars spent to produce it.

(C) Economic Benefits for the NE AL, N.W. GA & TN areas around the Bellefonte Plant.

It's the logically correct choice for the Nation.

Ronald L. Forster

1/07.08

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Ronald L. Forster
Organization: Cataract, Inc (RCM Technologies)
Address: 14 Hillcrest Ct
City: Ringgold State: GA Zip Code: 30736
Work phone: (706) 937 4304 Home phone: 706 937 6199
Fax: CataractRF @ aol.com
E-Mail Address: ↗

12/10/98

Commentor No. 215: Erich R. Gonce

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments

PRIOR

to Leaving the Meeting

Comments: Bellefonte yes - most logical and economical way to go for TVA [illegible] the production of power and the production of Tritium.

1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Erich R. Gonce
Organization: [illegible]
Address: [illegible]
City: [illegible] State: [illegible] Zip Code: [illegible]
Work phone: [illegible] Home phone: [illegible]
Fax:
E-Mail Address:

12/10/98

Commentor No. 216: Dick Hoesly

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I SUPPORT ANY BELLEFONTE OPTION FOR THE PRODUCTION OF THE NATIONS TRITIUM SUPPLY.

I FEEL THAT THESE OPTIONS ARE THE CHEAPEST FOR DOE, & THE NATIONS TAX PAYERS. THE LIFE CYCLE COSTS FOR BELLEFONTE OPTIONS RETURN DOE MONEY THRU SHARING IN NET CASH FROM Electricity SALES.

THE USE OF WATTS BAR WILL PROVIDE NO ECONOMIC BENEFIT TO THE AREA AROUND WATTS BAR. IT WILL ALSO PUT AT RISK BASE LOAD PLANTS WHICH TVA NEEDS FOR POWER SUPPLY.

DURING THE CONGRESSIONAL SESSION LAST SUMMER THE ALABAMA DELEGATION & THEIR CONSTITUENTS SPEAR-HEADED THE DRIVE TO OVERTURN THE MARKEY-GRAHAM LANGUAGE. WHEN THIS LANGUAGE RETURNS AGAIN THIS YEAR WHERE WILL DOE GET THEIR SUPPORT? SUPPORT WILL NOT COME FROM AN AREA THAT DOESN'T GAIN ANYTHING.

1/07.08

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) DICK HOESLY
Organization:
Address: 2905 CLEMONS RD
City: SCOTTSBORO State: AL Zip Code: 35769
Work phone: Home phone: 256-259-6373
Fax:
E-Mail Address:

12/10/98

Commentor No. 217: John Johnson

Comments of john johnson 12-14-98

john johnson
PO Box 281
Chatt TN 37401
423-624-3935

TO Sec. Energy Bill Richardson:

* The Cold War IS OVER! (all together now —
The Cold War IS OVER!
The Cold War IS OVER!
* We DO NOT Need more nuclear weapons — we should dismantle the ones we have. No More Nukes!

1/01.01

* i oppose this tritium project (w/ TVA) — it violates the spirit intent, if not the letter, of the Law (AEA + NNPT)

2/01.04

* DOE makes a mess wherever it goes
  - Oak Ridge
  - Savannah
  - Hanford

3/08.02

* By producing tritium for nukes you are not, contrary to popular opinion, preventing nuclear war — You are, in fact, making nuclear holocaust more of a certainty.
* in short you are all slaves to the imperatives of technology and war criminals and you should resign and go camping in the wilderness with your families.

1(cont'd)

Commentor No. 218: Larry Kuka

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments

PRIOR

to Leaving the Meeting

Comments: PRODUCTION OF NUCLEAR WEAPONS MATERIAL SHOULD BE DONE AT DOE OF DEFENSE FACILITIES NOT COMMERCIAL POWER PRODUCING GENERATING PLANTS. **1/01.09**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Larry Kuka
Organization:
Address: 6601 Ramsey RD
City: Harrison State: TN Zip Code: 37341
Work phone: 423 344 7777 Home phone: Same
Fax: 423 344 0022
E-Mail Address: mltpg@am-pub.com

12/10/98

Commentor No. 219: Mr. & Mrs Ford P. McCuisten Jr.

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments

PRIOR

to Leaving the Meeting

Comments: I join the large majority in favoring the production at the Bellefonte site.

I spent my vacation in Washington asking for help in the completion of that near finished plant.

I do not favor the use of Watts Bar nor Sequoyah because they offer nothing positive to the area. and I feel the CLWR option would not be alive if the people of Jackson County AL. had not taken a firm stand.

Please make Bellefonte the choice of DOE, it is clearly the choice of the people

Thank You **1/07.08**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Mr & Mrs Ford P. McCuisten Jr.
Organization: International Brotherhood of Boilermakers
Address: PO Box 315
City: Dutton State: Al Zip Code: 35744
Work phone: 256-574-8810 Home phone: 256-657-2477
Fax:
E-Mail Address:

12/10/98

Commentor No. 220: Mark D. Phillippe

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I support any of The Bellefonte Options
WATTS BAR / SEQ OPTIONS ARE TOO Costly As compared to BELLEFONTE OVER THE LIFE OF THE PROJECT and PER KILOGRAM OF TRITIUM PRODUCED.
WATTS BAR / SEQ DO NOT PRODUCE JOBS FOR THE VALLEY.
WATTS BAR / SEQ PUTS TVA AT RISK DUE ELECTRICAL BASE LOADS

1/07.08

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) MARK D PHILLIPPE
Organization:
Address: 3002 SCENIC DR
City: SCOTTSBORO State: AL Zip Code: 35769
Work phone: 256-574-8713 Home phone: 256 ~~57~~ 259-3969
Fax:
E-Mail Address: MPHILLIP@ HIWAAY.NET

12/10/98

Commentor No. 221: Steven Sax

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I AM AGAINST THE WATTS BAR OPTION BECAUSE of the power reliability problems using Watts Bar. Bellefonte would be operated as a DOE Reactor unit and any output of electricity would be purchased by TVA. DOE could make the decisions about how the unit would be operated. Watts Bar must be operated to TVA'S needs for power production and NOT DOE production needs. In times of power shortages - TVA may not be able to shut down Watts Bar for DOE tritium needs.

1/07.08

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Steven Sax
Organization: Fort Payne Improvement Authority
Address: PO BOX 680619
City: Fort Payne State: AL Zip Code: 35967
Work phone: (256) 845-0671 Home phone:
Fax:
E-Mail Address:

12/10/98

Commentor No. 222: George E. Schmidt Jr.

COMMENT FORM

COMMERCIAL LIGHT WATER REACTOR PROJECT

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: We do NOT want Watts Bar and Sequoyah used to make tritium nor do we want Bellefonte completed nor used to make tritium. **1/07.02**

Please send me the means I have as a citizen to prevent the making of tritium. **2/05.21**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) George E. Schmidt, Jr.
Organization: U.S.A. Citizen
Address: 214 East 8th Street
City: Chattanooga State: TN Zip Code: 37403
Work phone: 423-266-1618 Home phone: 423-266-6091
Fax:
E-Mail Address:

12/10/98

Commentor No. 223: Lucy W. Taylor

COMMENT FORM

COMMERCIAL LIGHT WATER REACTOR PROJECT

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: As a citizen, as a TVA ratepayer, and as a tax payer, I totally oppose the production of tritium. **1/23.13** Now that Soviet deterrance no longer "justifies" our production and stockpiling nuclear weapons, there is no justification.

We deserve a national debate over continued production of nuclear weapons. **2/01.01**

Under what circumstances would we launch such weapons? Even if we were attacked with a nuclear weapon, how could we responsibly, morally respond with a nuclear attack? Any such use would harm the land, air and water of all the "enemy's" neighboring countries. Given the power of our current bombs any attack would adversely ~~the air~~ impact water and land of our entire planet. **3/01.10**

The sums of money to produce tritium and the continued production of nuclear weapons is obscene. A billion people barely survive on $1.00 a day. Terrorism thrives on their desperate poverty. We could use our wealth and science to alleviate the desperate impoverishment which is our newest cold war adversary. **1(cont'd)**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Lucy W. Taylor
Organization:
Address: 2720 Folts Drive
City: Chattanooga State: TN Zip Code: 37415
Work phone: 266-1618 Home phone: 267-0765 (423)
Fax:
E-Mail Address:

12/10/98

Commentor No. 224: Marie Weir

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I AM IN FAVOR of THE BELLEFONTE PROJECT BECAUSE of THE ECONOMICAL BENEFITS IT WILL GEERATE FOR THE ENTIRE AREA. **1/07.03**

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) MARIE WEIR
Organization: RESIDENT OF RHEA COUNTY (TN VALLEY)
Address: 8507 DAYTON MTN. HWY.
City: DAYTON State: TN Zip Code: 37321
Work phone: 698-4163 Home phone: 775-0356
Fax: 698-4932
E-Mail Address:

12/10/98

Commentor No. 225: Mark A. Wheeler

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I am the vice president of the IBEW local #175. I represent the 3,400 membership of my union. We have constructed and maintained the TVA nuclear plants from the start. Having had hands-on experience with these plants, we know that they are very safe. **1/07.02**

As American citizens who love this country and the freedom that it stands for all around the world, we want a strong defense potential to deter any enemy assault. **2/01.01**

As Tax paying citizens, we want commercial light water reactors used in lieu of an accelerator because the commercial reactors are a much less expensive option. **3/07.01**

As residents of the Tennessee Valley, we need additional power capacity to maintain our way of life and to be able to attract new industry to this area. We see the Bellefonte option as by-far the best. It would give the D.O.E. economical tritium and this region will get much needed power. **4/07.03**

The Watts Bar/Sequoyah options, while a far second, would be much better than the accelerator because of the smaller expense and would give additional revenue to TVA which would offset rate costs and/or provide funds for additional power facility construction. While the accelerator would provide for the national defense, it would be economically irresponsible. **3(cont'd)**

Please choose the Bellefonte option!

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Mark A. Wheeler
Organization: IBEW #175
Address: 1406 Garden Farm Dr.
City: Hixson State: TN Zip Code: 37343
Work phone: (423) 843-6914 Home phone: (423) 842-7204
Fax: (423) 847-6870
E-Mail Address: MWhe 814315 @ aol.com

12/10/98

Commentor No. 226: Mrs. Susan Cassidy Wilholt

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I am opposed to the Watts Bar facility being used to produce tritium. 1/07.07

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Mrs. Susan Cassidy Wilholt
Organization:
Address: 534 Evergreen Drive
City: Dayton State: TN Zip Code: 37321
Work phone: 423-775-6781 Home phone: 423-775-6781
Fax:
E-Mail Address: Swilholt@volstate.net

12/10/98

Commentor No. 227: Charles R. Williams

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: Being a taxpayer and a TN Valley ratepayer, I strongly believe TVA has a proven track record for nuclear safety. Having worked at both the Sequoyah and Watts Bar plants I have seen first hand the minute detail to safty concerns at these plants. 1/07.02

Knowing the economic impact of Sequoyah Nuclear Plant 7 miles from my home and the impact in economics around the Watts Bar Nuclear Plant, I feel for the people in Alabama who at one time invisioned a chance for growth. As it is now, Bellefonte stands as a giant eyesore of no use for anyone. The completion of Bellefonte is the only win-win choice for Ratepayers - Taxpayers and the citizens in and around the Bellefonte Plant. 2/07.08

Thank You.

Charles R Williams

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Charles R. Williams
Organization: IBPAT
Address: 108 Porter St.
City: Soddy, Daisy TN State: TN Zip Code: 37379
Work phone: (423)698-4163 Home phone: (423) 332-5333
Fax:
E-Mail Address: Rw1954@AOL.com

12/10/98

Commentor No. 228: Anonymous (6)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: we at Midpoint International support the Belefont plane becouse it makes More beter/discusion and best for the Country Econmic | 1/07.03

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization: Mid point
Address: 8044 Ray Mears Blvd
City: State: TN Zip Code: 37919
Work phone: Home phone: 691-5657
Fax:
E-Mail Address:

12/10/98

Commentor No. 229: Anonymous (7)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I live in Rhea Co. & we don't want tritium here. | 1/07.07

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional)
Organization:
Address:
City: State: Zip Code:
Work phone: Home phone:
Fax:
E-Mail Address:

12/10/98

Commentor No. 230: Anonymous (8)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: As a neighbor of the Watts Bar Nuclear Plant, I have a very real concern about the proposed production of tritium in the existing reactor. There are definite increased risk considerations to us local residents and no economic benefits – only negative ones. 1/07.07

If this option is approved and it seems the leading contender, I believe TVA/DOE should reflect some of the large monetary exchanges to our local governments as some compensation to us local ratepayers and taxpayers. Please make this part of the decision process 2/23.23

[My wife = a Tennessee housewife does not want Watts Bar - Sequoyah option either, Mr. Secretary] 1(cont'd)

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) ________
Organization: ________
Address: ________
City: ________ State: ____ Zip Code: ____
Work phone: ________ Home phone: ________
Fax: ________
E-Mail Address: ________

12/10/98

Commentor No. 231: Anonymous (9)

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: If Mr Richardson is to do what's best for the "Nation as a Whole", the Bellefonte option is clearly the only choice that can be made. 1/07.03

If any other choice is made it will send or confirm the message that "Political Prostitution" has prevailed again. 2/05.26

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) ________
Organization: ________
Address: ________
City: ________ State: ____ Zip Code: ____
Work phone: ________ Home phone: ________
Fax: ________
E-Mail Address: ________

12/10/98

Commentor No. 232: Mike Womacks

I want to direct my comments to the proposal written by Craven Crowell to Sec. Richardson, and express my opposition to Bellefonte.

Under the subject social economics it is stated that thousands of jobs will be created both long and short term. I submit to you that the bulk of short term jobs will be taken by the unions from Tenn which is wonderful for them, but hardly helpful to the citizens of Jackson County. The 800 long term jobs hardly approach the number thousands as stated in the letter. I submit again the citizens of Jackson County will not recieve the bulk of these jobs as we are somewhat short of nuclear engineers and other workers qualified to work in a nuclear plant. 1/13.05

Under Public & Political Support, I grant you have local political support and some congressional support. However the following members of Congress have stated opposition to the production of tritium at Bellefonte. (Sessions, Reed Sessions) As far as the local citizens are concerned, I can tell you there is absolutely not a majority in favor of Bellefonte production, and I challenge the local politicians or TVA to 2/01.02

Commentor No. 232: Mike Womacks (Cont'd)

conduct an election or referendum to let the people speak for themselves. That's the democratic way. Also why were not the negative EIS comments included in this letter. 3/23.22

No one has addressed the issue of local property values, and they will surely go down, also our local taxes will rise. There is definetly a economic benefit to local residents in Scottsboro. 4/13.06

In conclusion, I understand the need for jobs and support the construction of a natural gas plant. I don't appreciate the citizens of Tenn or anywhere else telling me what is good for my community. 5/07.06

As for our national security, I spent 23 yrs in the military which included involvement in 3 wars, and believe me we have enough nuclear bombs to destroy any adversary. 6/01.01

If we do need more tritium lets put it in an area that is already contaminated, not contaminate a new one. 7/07.07

Commentor No. 233: Larry Hancock

December 14, 1998

Hello,

My name is Larry Hancock. I am the Recording Secretary for the International Brotherhood of Electrical Workers, Local 721, Chattanooga, Tennessee. Our local represents approximately 700 members which consists of Operators, Electricians and Instrument Mechanics at Sequoyah Nuclear Plant, Bellefonte Nuclear Plant, and other TVA facilities in the immediate area.

I am here tonight to stand in opposition to the proposal of using Watts Bar and Sequoyah as the producers of Tritium for the Department of Energy. There is much to be lost by TVA and the valley if Tritium is produced at Watts Bar and Sequoyah, and much to be gained by producing it at Bellefonte!

Watts Bar and Sequoyah are both base load units for TVA, and as such are needed on line as much as possible. If they are used as Tritium producers for D.O.E. they could be shut down if needed by D.O.E. to support our National Defense. TVA and the valley can't afford to be without the power that these two plants generate! Since both of these plants are up and running, successfully, I might add, there is absolutely nothing to be gained for this area if those units produce Tritium, even if TVA management says that either selection is a win for TVA and the valley. That is a bald-faced lie! There will not be any construction jobs or permanent jobs produced by selecting Watts Bar and Sequoyah! The only win for TVA and the valley is for Tritium to be produced at Bellefonte. *1/07.07*

If Tritium is produced at Bellefonte there are many economic benefits for TVA and the valley. First and foremost is all the employment possibilities that exist for the entire area. During construction, many of this areas construction workers will have the opportunity for gainful employment at Bellefonte. There will not be any construction jobs produced by selecting Watts Bar and Sequoyah! Additionally, the local that I represent anticipates gaining much more than a hundred new members as Bellefonte is staffed with permanent workers.

Another issue that I would like to raise is: **WHY ARE WE EVEN HERE TONIGHT?** There are many reasons why the CLWR option is still open to D.O.E. **All of them are because of the efforts put forth by the many organizations that helped fight the fight to keep the CLWR open!** Organized labor, Business leaders, Education leaders, Bipartisan political and a strong community support have kept this option open. All of their efforts were for one selection and one selection only. **That was the completion of Bellefonte.** There was a lot of time and money invested by all of these organizations to see this happen. Now that all those efforts were successful, it appears that Secretary Richardson wants to let Watts Bar and Sequoyah slip in under the door. We must not let that happen! Swapping projects at this time is very disappointing and would appear to be a deceptive move by the Department of Energy. *2/07.08*

Commentor No. 233: Larry Hancock (Cont'd)

The facts show that the CLWR option is the best one of the of the dual path options for D.O.E., and the selection of Bellefonte as the CLWR facility is the only selection that must be made. *3/07.01*

In conclusion, I urge Secretary Richardson the do the right thing and make his selection for the CLWR option with Bellefonte as the primary CLWR producer.

Thank you.

Commentor No. 234: Dwight Wilhoit

(1)

In 1986, Ned Ray McWhorter was elected Governor of Tennessee and after serving two terms in the Governor's mansion, Governor McWhorter left public office in 1994 as one of the most popular and beloved elected officials in the 200 year history of Tennessee. In fact, Time Magazine wrote that the only reason that Governor McWhorter was not elected to the United States Senate in 1994 was because he did not run. In the first cabinet meeting held by Gov. McWhorter, with the heads of all the departments present, Gov. McWhorter ended the cabinet meeting with ~~his~~ this simple and straightforward directive: "Remember, It's never too late to do the right thing". He didn't say to do what was easy or to

Commentor No. 234: Dwight Wilhoit (Cont'd)

(2)

do what was cheap. He told his cabinet to do the right thing.

For years, the citizens of this country have been subjected to people of power and influence who were only interested in what was easy or what was cheap. One only has to look a few miles from this very spot to see such an example. The large coal companies of the 20's and 30's who would come to an area and strip mine the coal and rape the land and when they left, the land was devastated and lives destroyed. They had done what was easy and what was cheap. So the citizens of the area looked to their government to see that the right thing was done. And legislation was passed that forced the

Commentor No. 234: Dwight Wilhoit (Cont'd)

(3)

coal companies to reclaim the land and return it to the way it was found. It was the right thing to do. Or one can look at the chemical companies of the 50's and 60's, captains of industries and corporate CEO's who dirtied our air and fouled our water. In the early 60's, the Cayahoga River that flows through Cleveland, Ohio, became so polluted that the river caught on fire, or the most infamous example of all – Love Canal where chemicals were dumped and scores of innocent children died years before their time. The chemical companies had done what was cheap and what was easy. So the people turned to their government to do the right thing. And the Clean Air Act and the Clean Water Act were passed. It

Commentor No. 234: Dwight Wilhoit (Cont'd)

(4)

wasn't what was cheap; it wasn't what was easy; it was the right thing to do.

Now the secretary of Energy is faced with making a choice of where this country's new supply of Tritium will be made. His choices are simple. He can place it at Watts Bar where the people have expressed their opposition towards it and by placing it there will do nothing to help the economic well being of the citizens of the Tennessee Valley. This is the cheap way, this is the easy way. Or he can place it at Bellefonte Nuclear Plant in North Alabama where the citizens of that area have shown time and time again, their over whelming support to have the production of Tritium in their area and by placing it at

1/07.08

Commentor No. 234: Dwight Wilhoit (Cont'd)

(5)

Bellefonte Nuclear Plant, help a depressed area by bringing thousands of construction jobs and hundreds of permanent jobs to an area where unemployment is running 9 to 10 percent. Mr. Secretary, this is the right thing to do. Please, Mr. Secretary, do not take the cheap or easy way, thereby saying that you don't give a damn about the people of the Tennessee Valley. Mr. Secretary, in the words of Gov. McWhorter, remember, it's never too late to do the right thing. *1(cont'd)*

Commentor No. 235: Mary Dennis Lentsch

Mary Dennis Lentsch
1236 N Concord Road
Chattanooga TN 37421

I am pleased to have the opportunity to speak at this meeting. I have prepared a chart that spells TRITIUM down the side.

Next to each letter I have placed a quality or characteristic that I believe can be ~~lined~~ linked with our tritium topic this evening.

TRUTH

The truth is that we do not need more tritium! It is my understanding that the U.S. has a reserve of tritium now and the DOE estimates this is enough tritium to last until 2016. Considering the half-life of tritium it does not seem wise or needed to produce and stockpile more tritium at this time. The truth is that we do not need more tritium! *1/02.01*

RESPECT

Respect among nations seems to be the key to moving nations of the world away from reliance on nuclear weapons. The U.S. has prevailed upon other nations to maintain a complete ban on the use of commercial facilities for military nuclear purposes. The proposed tritium production at Watts Bar and Sequoyah is an apparent contradiction in our nuclear weapons policies. How can the U.S. break the ban and maintain respect among nations? *2/01.09*

INTEGRITY

The U.S. cannot maintain its integrity when it produces tritium which is a violation of the nuclear nonproliferation treaty which the U.S. agreed to in 1970. I believe when we are talking about nuclear nonproliferation that U.S. integrity is critical. We must NOT move ahead with a new tritium program that has the potential to undercut a long-standing nonproliferation policy. *3/01.04*

TRUST

We trust that the decision made by Secretary Bill Richardson and the Department of Energy will say "NO" to tritium production. In saying "NO" to tritium production the U.S. would be showing the world we are committed to reducing the nuclear danger which hangs over all of us. *1(cont'd)*

Commentor No. 235: Mary Dennis Lentsch (Cont'd)

INTERDEPENDENCE

Interdependence among nations in ~~enforcing and~~ living up to the agreements of the nuclear nonproliferation treaty is vital for all nations. I believe the U.S. plans to use commercial nuclear power plants to produce tritium for nuclear weapons blurs the lines between civilian and nuclear applications of nuclear power and sends a dangerous nonproliferation message to other nations. *3(cont'd)*

UNDERSTANDING

It is beyond understanding why there is such urgency for tritium production at Watts Bar and Sequoyah plants when there seems to be an emerging consensus for significantly reduing the U.S. nuclear arsenal. *4/01.12*

MERCY

If the decision is made to produce tritium at the Watts Bar and Sequoyah plants, all I can say is MERCY ME! OH, LORD , HAVE MERCY! The impact and consequences of tritium production at the local level, the national level, and the international level cause me to say- MERCY ME! OH, LORD HAVE MERCY! *5/07.07*

Commentor No. 236: Joseph A. Imhof

Juno e-mail printed Thu, 10 Dec 1998 20:21:27 , page 1

From: debhof
To: debhof@juno.com
Subject: PUBLIC HEARING ON DEC. 14 , 1998 .

PUBLIC HEARING FOR CONSIDERATION

OF USE OF WATTS BAR & SEQUOYAH

UNITS FOR LONG TERM PRODUCTION

OF TRITIUM

EVENSVILLE , TENNESSEE

DECEMBER 14 , 1998 .

" A PLAN WE CAN LIVE WITH —

A COMMON SENSE SOLUTION . "

Juno e-mail printed Thu, 10 Dec 1998 21:00:04 , page 1

From: debhof
To: debhof@juno.com
Subject: PUBLIC HEARING – DEC. 14 , 1998

________PREAMBLE______________

In a ~~more~~ perfect world , human concerns (and not vested interests) would be a BASIS for policy decisions , not just a CONSIDERATION . Human Concerns , here , meaning taking into account the factual known impacts of actual , real operating nuclear facilities upon the health and welfare of individual human beings and other biological entities.

_________ THESIS ____________

The best policy would be one which entails the least amount of harm to the fewest individual human beings and the smallest number of biological entities . This means that the impact of tritium production should be minimal , period.

__________ ACTION PLAN ______

Use existing facilities to produce tritium whenever humanly possible without impacting new areas of population and generating additional expense to American taxpayers . Avoid creating new health risks and environmental concerns by using existing facilities.

1/07.08

Commentor No. 236: Joseph A. Imhof (Cont'd)

Juno e-mail printed Thu, 10 Dec 1998 21:39:18 , page 1

From: debhof
To: debhof@juno.com
Subject: PUBLIC HEARING , DEC 14, 1998 .

______ RECOMMENDATION _____

Based on consistency with the best policy , a recommendation is made to use Watts Bar as the main unit for production of tritium , while maintaining Sequoyah as a back -up facility . Bellefonte would have prime consideration as a natural gas electric power production facility , costing billions less than a nuclear plant , and providing plentiful power to the Tennessee Valley ; thus fulfilling TVA'S mission without relying on corporate welfare . Bellefonte should NOT be considered as a coal - fired plant , as this would be a source of acid rain , particulate matter , and an aggravation to those with respiratory illnesses.

__________ CONCLUSION _________

In a perfect world , there would be no need for nuclear arms , anti-missile missiles , or Strategic Defense Initiatives . However ; if we must accomodate the nuclear defense industries' need to proliferate the use of nuclear weaponry , let us do it in a manner which does the least amount of harm to biological entities (esp. ; us) and the least possible damage to our precious life support system , the environment .

In conclusion , let 's strive for minimum impact by using existing facilities for

1(cont'd)

Commentor No. 236: Joseph A. Imhof (Cont'd)

Juno e-mail printed Thu, 10 Dec 1998 21:39:18 , page 2

tritium production and limit the amount we project for future needs to what is realistic for an era in which the demand will surely decrease . 1(cont'd)

SUBMITTED BY

JOSEPH A. IMHOF
HUNTSVILLE , AL
256 - 880 - 1019

Commentor No. 237: Steve Tanner

Comments of Steve Tanner at DOE Public Meeting on TVA's Watts Bar/Sequoyah Services Offer - December 14, 1998, Evansville, TN

Good Evening, my name is Steve Tanner. I come here today representing myself and my family as residents of Hamilton County, as ratepayers, and as U.S. Taxpayers.

You have asked for our input regarding TVA's Watts Bar/Sequoyah Services Offer. Let me begin by stating that we support your efforts in obtaining as much input as you can regarding public opinion. In fact, this past summer I received a response from Vice President Gore regarding tritium production legislation that was pending at the time. In that response, the Vice President assured me his intention was to act in the best interest of all citizens. Holding this meeting this evening, we believe, supports that intent.

You have stated the selection criteria being considered. You also stated the overall consideration is "What's in the best national interest". One criteria you did not list though, which is stated in Public Law, involves the "liabilities and benefits of the technologies including benefits like revenues".

In comparing the WBN/SQN Services Offer and the Bellefonte Offers against the criteria, all of the TVA Offers whether Bellefonte or Watts Bar/Sequoyah, meet the criteria, and all can be implemented in a manner that supports reduced tritium needs as well as any perceived proliferation concerns. We believe, though, that the Watts Bar/Sequoyah Offer is not the best selection. WHY? Here's three major reasons:

1. There are liabilities and risk. The offer commits two baseload nuclear power generation plants to a mission that would no longer be solely to produce power. This places a liability of tritium production on TVA with increased risks to TVA's ability to provide reliable low cost power to their customers and ultimately to us as ratepayers. 1/07.08

2. There are no benefits. There is no direct benefit to Hamilton or Rhea counties or the State of Tennessee. No new jobs and no increase in the tax base. This offer does not salvage use of an existing government asset, there is no revenue sharing to DOE, and the positive environmental benefit of new power generation without greenhouse gas emissions does not occur.

3. The overall cost is higher than using Bellefonte. The total cost with this offer to me as a taxpayer, even though it has low annual payments, is higher than the TVA Bellefonte Offers and is for a shorter period of time.

Commentor No. 237: Steve Tanner (Cont'd)

We believe that Bellefonte is the best selection because it meets the selection criteria, has the lowest cost to us as taxpayers, does not have the liabilities and risk of a baseload plant, and provides distinct benefits. Benefits that are shared not only locally and regionally, but also on a national level. National benefits such as lowest cost to the taxpayer, an environmental benefit of new power generation without greenhouse gases, and revenues allowing for cost recovery.

In addition, DOE must not forget that the Department has other missions in addition to national security. DOE's core mission statement starts off with these words: "To foster a secure and reliable energy system that is environmentally sustainable,..". As part of DOE's FY99 budget process, DOE stated they had established five key goals that drive all strategic planning and budgeting decisions. Three of those goals are directly supported by a selection of Bellefonte but are not supported by a selection of Watts Bar/Sequoyah.

Selection of Bellefonte:

1. Has DOE promoting clean efficient energy and enhancing energy security through new nuclear power generation capacity,
2. Shows DOE stabilizing and protecting the environment by preventing a new fossil fueled power generation with greenhouse gas emissions, and
3. Has DOE stimulating U.S. economic productivity through creation of new jobs and multi-regional economic development.

Selection of Watts Bar/Sequoyah does not promote, enhance, stabilize, protect or stimulate anything associated with these goals.

Investment in new power generation is not outside of DOE's mission. Bellefonte meets the criteria, can be available to produce tritium when and if DOE has the need, can fully support key DOE goals, and provides benefits not available with the Watts Bar/Sequoyah Offer.

My family and I contend that the Secretary's decision should not just select an acceptable option, but should select the option that - using the Vice President's words - is in the "Best Interest of all citizens".

1(cont'd)

Commentor No. 237: Steve Tanner (Cont'd)

Last week the Vice President also said that one of the last things his father said to him was "always do right". We sincerely hope that after hearing the public opinions from tonight's meeting, the Secretary will in fact, "do right".

In conclusion, DOE - Do not select the TVA Watts Bar/Sequoyah Services Offer, instead select an offer that partner's DOE with TVA in the completion of Bellefonte, providing local, regional and national benefits versus regional liabilities and risks, and which can do all of this while providing an assured supply of tritium.

1(cont'd)

Commentor No. 238: Steven Howell

AKZO NOBEL

Industrial Fibers

December 14, 1998

Re: Comments by Steven Howell
Yarn Plant Manager
AKZO Nobel Industrial Fibers, Inc.
Scottsboro, AL.

TO: Secretary Bill Richardson, DOE

I represent a 750,000 square foot facility located in Scottsboro, Alabama. We employ approximately 715 people at our facility and have annual sales of close to 150 million dollars.

I am totally against the use of Watts Bar/Sequoyah as the site for proposed Tritium production. This is based on the adverse impact to the regions power supply that this would have. As I am sure you are aware that by completing Bellefonte it would add approximately 1200 MW of new power generation to the TVA power system. This is in contrast to the use of Watts Bar/Sequoyah which would compromise the power generation of these units. This past summer the shortage of power generation in the TVA system caused millions of dollars of extraordinary high power bills for Tennessee Valley Industries.

This past summer TVA generation could not meet the power demand and had to purchase power from outside systems. This cost our plant in an excess of one (1) million dollars this past summer. The economic benefit to the whole Tennessee Valley would be best served by completing Bellefonte. In addition to the economics of using Bellefonte an added benefit would be that by using Bellefonte for power generation fossil fire generation would not be needed to meet peak demands. This would reduce the greenhouse gases that are released to the atmosphere. 1/07.08

Therefore, based on environmental and economic benefits from the completion of Bellefonte to make Tritium I strongly request that Secretary Richardson after reviewing all aspects will select Bellefonte. By doing so the best interest of our country as well as the Tennessee Valley will be served.

Thank you for allowing me to speak on this most important matter to the Tennessee Valley.

Sincerely,

Steven Howell
Yarn Plant Manager

Akzo Industrial Fibers, Inc.
7526 Akzo Blvd.
Scottsboro, AL 35768-8106
Phone: 205-574-7200
Fax: 205-574-7274

Commentor No. 239: Groups Opposed to CLWR Tritium Production

GROUPS ACROSS THE NATION OPPOSE COMMERCIAL REACTOR PRODUCTION OF TRITIUM

December 14, 1998

The Honorable Bill Richardson
Secretary of Energy
1000 Independence Avenue
Washington, DC 20585

Dear Secretary Richardson:

The undersigned organizations, representing thousands of concerned citizens throughout the country, strongly oppose U.S. plans to utilize any commercial nuclear power plants to produce tritium for nuclear weapons. In our view, such a plan would blur the line between civilian and military applications of nuclear power and thus sets a dangerous precedent from a non-proliferation standpoint. In addition, further reductions in nuclear arsenals, supported by your administration and increasingly likely, would make a new source of tritium unnecessary. 1/07.02

As you are aware, it has been the long-standing policy of the United States to separate military and civilian uses of nuclear technology. We stand behind that policy and continue to believe that in this area, the United States must make non-proliferation concerns paramount. Recent revelations that the Indian government procured tritium for its nuclear weapons program from Western-built 'civilian' reactors reinforces our view.

Section 56e of the Atomic Energy Act forbids special nuclear material produced in a commercial reactor from being used "for nuclear explosive purposes." While definitions of "special nuclear material" do not include tritium, this technicality does not mask the fact that the Department of Energy plans to use a source of civilian electricity as a source of material to boost the destructive power of the nuclear weapons in the U.S. arsenal. As a former Ambassador to the United Nations you must be able to appreciate how apparent contradictions in our nuclear weapons policies undercut our ability to champion the cause of nuclear non-proliferation abroad. 2/01.09

The U.S. timeline for securing a new source of tritium is based on out-dated thinking in terms of the size of the U.S. nuclear arsenal. The United States still bases its planning on maintaining a START (Strategic Arms Reduction Treaty) I arsenal. Implementation of START II, now pending ratification in the Russian Duma, will delay the "need" for new tritium until at least 2011 since the tritium from nuclear weapons being retired under the provisions of the START treaties can be recycled into the nuclear weapons slated to remain in the arsenal. The lower force levels envisioned under the broad outlines of START III agreed to by Presidents Clinton and Yeltsin last year would delay the "need" for new tritium even further into the 21st Century. 3/02.01

Commentor No. 239: Groups Opposed to CLWR Tritium Production (Cont'd)

We are particularly concerned about the prospect of using taxpayer dollars to complete the construction of the Tennessee Valley Authority's Bellefonte nuclear reactor to produce nuclear weapons tritium. In addition to the substantial burden this proposal would present for taxpayers, bringing Bellefonte on-line would add to the ever growing amount of nuclear waste in the United States. A problem for which there is no adequate solution. 4/23.13

We understand that your office is under considerable pressure to choose between a number of potential tritium sources, each of which has considerable fiscal or non-proliferation drawbacks. At a time of emerging consensus on the desirability of significantly reducing the U.S. nuclear arsenal we urge you to make the courageous decision of "none of the above" regarding tritium sources. We stand ready to work with your office on the removal of legislative language forcing the United States to maintain a massive Cold War-sized arsenal. 3(cont'd)

The United States does not need to move forward with a new tritium program that will waste further taxpayer dollars and has the potential to undercut long-standing non-proliferation policy. 4(cont'd) 5/01.04

Sincerely,

NATIONAL ORGANIZATIONS

Susan Gordon
Alliance for Nuclear Accountability

Bruce Hall
Peace Action

Bob Kinsey
United Church of Christ
Peace and Justice Task Force

Michael Mariotte
Nuclear Information and Resource Service

Betty Obal
Sisters of Loretto

Jim Riccio
Public Citizen's
Critical Mass Energy Project

Susan Shaer
Women's Action for New Directions

REGIONAL AND LOCAL ORGANIZATIONS

Jim Allen
Vine and Fig Tree
Montgomery, AL

Bill Akin
Mid-South Peace & Justice Center
Memphis, TN

Commentor No. 239: Groups Opposed to CLWR Tritium Production (Cont'd)

Jacqueline Cabasso, Executive Director
Western States Legal Foundation
Oakland, CA

Tom Carpenter
Government Accountability Project
Seattle, WA

Donald Clark
Cumberland Countians for Justice & Peace
Pleasant Hill, TN

Judy Cumbee
Justice-Peace-Human Rights Committee of Alabama New South Coalition
Montgomery, AL

Bruce and Maggie Drew
Prarie Island Coalition
Lake Elmo, MN

Marjie Edguer
Cleveland Peace Action
Cleveland, OH

Don Hancock
Southwest Research & Information Center
Albuquerque, NM

Ralph Hutchison
Oak Ridge Environmental Peace Alliance
Oak Ridge, TN

Carol Jahnkow
Peace Resource Center of San Diego
San Diego, CA

Marylia Kelley
Tri-Valley CAREs (Citizens Against a Radioactive Environment)
Livermore, CA

Marcus Keyes
Office of Justice, Peace & Integrity of Creation
Roman Catholic Diocese of Knoxville
Knoxville, TN

Reinard Knutsen
Shundahai Network
Las Vegas, NV

Adele Kushner
Action for a Clean Environment
Alto, GA

Greg Mello
Los Alamos Study Group
Santa Fe, NM

Michelle Neal-Conlon
Foundation for Global Sustainability
Knoxville, TN

Rick Nielsen
Citizen Alert
Las Vegas, NV

Harry Rogers
Carolina Peace Resource Center
Columbia, SC

Susan Lee Solar
Grandmothers and M/others Alliance for the Future
Austin, TX

Lynne Stembridge
Hanford Education Action League
Spokane, WA

Diane Swords
Peace Action Central New York
Syracuse, NY

Ellen Thomas
Proposition One Committee
Washington, DC

Commentor No. 239: Groups Opposed to CLWR Tritium Production (Cont'd)

Harvey Wasserman
Citizens Protecting Ohio
Bexley, OH

Commentor No. 240: Ronald W. Boles

Ronald W. Boles
DOE Hearing on Tritium Production
Rhea County High School
Evansville, Tennessee
December 14, 1998

My name is Ronnie Boles. I am Chairman of the Electric Utility Board in Huntsville Alabama. I come to you as a concerned member of the electric power community. My concerns with TVA producing tritium at the Watts Bar and Sequoyah nuclear power plants encompass the electric power production capabilities of TVA under this proposal, economic development, national security and the life cycle costs.

Allow me to be specific.

TVA offers you a plant at Bellefonte dedicated to the production of tritium. The production cycle of 12 months maximizes the amounts to match DOE's needs. Over the lifetime of this plant, you are assured of a reliable source and the repayment of the money you invest.

Under the Watts Bar/Sequoyah proposal, tritium production is secondary to electric power production. Otherwise this shutdown of the plants will raise TVA's power production costs when the plant is shut down for tritium collection. This past year, during the hot summer months, TVA had to go off-line to purchase power because it could not meet the demands of its customers. During such times, our industrial customers on interruptible service have to pay higher than usual prices for electric power, reflecting TVA's higher costs for this supplemental energy. Tritium collecting will shut down this dedicated plant, causing higher energy prices to be paid by these valued customers. I submit that this is not fair for the electric power consumers of TVA to underwrite tritium collection costs for DOE.. 1/07.08

This leads me to discuss other economic development issues. DOE has shown that economic development is one of its concerns as an agency. Production of tritium at Watts Bar/Sequoyah will produce no new jobs and no new electric power. I don't need to remind you of what economic expansion will ensue with your decision to support tritium production at Bellefonte in Jackson County, Alabama, but the benefits derived from having 1200 megawatts of new electric power will benefit a whole region of the United States.

Under the Watts Bar/Sequoyah proposal, Watts Bar will be your main source of tritium; Sequoyah is designated as a backup should difficulty persist at Watts Bar. As you know, Sequoyah will be decommissioned in 2022. National security demands a stable source for tritium far past that year. Only Bellefonte offers the life span to match DOD's expectations. This fact should not be ignored.

If the issue is just dollars, DOE/DOD can buy tritium from Russia. But we cannot permit our weapons program to be vulnerable to a foreign power, merely on the basis of cost. That has never been policy in the DOD/DOE Program. A short term decision could have long term consequences for DOD, DOE, TVA and the whole nation. 2/01.14

The support for the completion of the Bellefonte Nuclear Plant has been chronicled in the media from the Tennessee Valley all the way to Washington. Congressmen and Senators from the six states served by TVA fought long and hard to give you this option. I dare say we would not be here tonight discussing light water reactors if their valiant efforts had not been successful. 1(cont'd)

Those people expended great political capital to afford DOE this opportunity. To now see a third option considered has been disheartening, at least from my point of view. You still have support from local, state and national figures to proceed with Bellefonte. The economics should convince you Bellefonte is the logical choice.

Thank you for allowing me to present these views to you tonight.

Larry Bishop
Team Leader

TVA

Tennessee Valley Authority, Post Office Box 328, Huntsville, Alabama 35804-0328

December 3, 1998

for your info.

Tlanie
12-10-98

Mr. Bill Pippin, General Manager
Huntsville Utilities
Post Office Box 2048
Huntsville, Alabama 35804-02048

Dear Bill:

Due to the volatility of last summer's Economy Surplus Power (ESP) prices, TVA has placed an indefinite moratorium on the offering of new amounts of Limited Interruptible Power (LIP) and Limited Firm Power (LFP) to directly-served and distributor-served customers. The moratorium will provide us with time to evaluate, and if necessary, restructure the LIP and LFP programs to meet the future needs of TVA and its customers.

The majority of existing LIP and LFP customers also contract for some ESP. Also, some existing ESP customers may be large enough to potentially qualify for LIP (20 MW) or LFP (30 MW). Due to the price volatility of ESP prices during the summer of 1998, some existing ESP, LIP, and LFP customers may view a possible conversion of ESP to LIP and/or LFP as a means to pay a less volatile energy rate and also reduce the probability of power being suspended during peak load periods. Without this moratorium, system operating flexibility might be lost and costs might increase if a significant amount of ESP load was converted to LIP and LFP. This moratorium will temporarily cap the amounts of LIP and LFP made available by TVA at the amounts that are under contract as of the effective date of the moratorium. 1(cont'd)

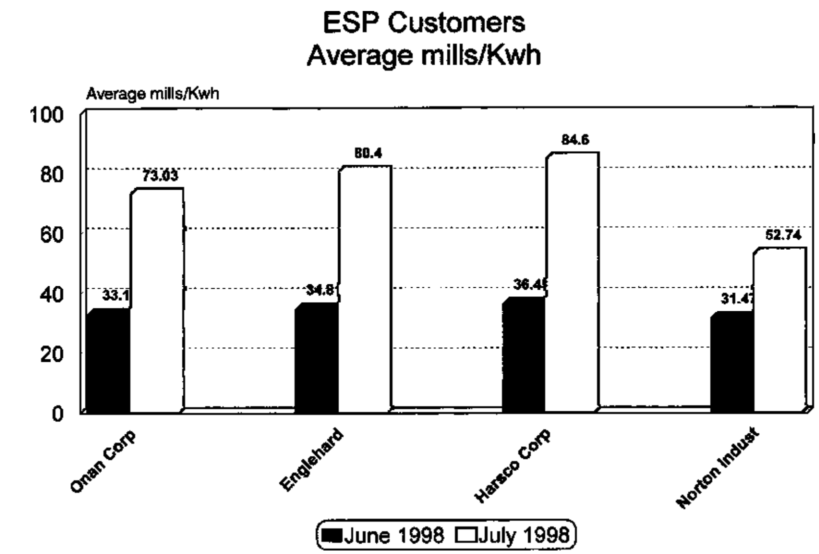
However, LIP and LFP will still be available as an industrial development tool for loads which would otherwise be eligible for TVA's Growth Credits.

If you have any questions, please contact Darrel Smith of this office or me.

Sincerely,

David Hooks
Senior Customer Service Manager
Huntsville Customer Service Center

Commentor No. 240: Ronald W. Boles (Cont'd)



Commentor No. 241: Ann Harris

Ann Harris, Executive Director, We The People, Inc., of Tennessee
305 Pickel Rd., Ten Mile, TN 37880
(423) 376-4851 fax (423) 376-8864
December 14, 1998

DOE Public Hearing Concerning Watts Bar Tritium Production

In the October meeting here at Evensville, TVA stated that they do not have a waste water program that will extract tritium from the reactor coolant water prior to release to the Tennessee River. Now I find that all you boys are aware that an extraction facility such as is needed for these light water reactors is in place in Canada. They have extracted 14 kg of tritium since 1988. And except for a small amount sold to industry and for research it remains in storage at the Canadian site. The market price is $30,000 per gram. Send a buyer to Canada and buy what is already produced. Quit fixing what ain't broke. *1/01.14*

Further, tritium gas does not readily absorb in to the body. BUT tritiated water virtually jumps into the body. Tritium enters the body through the skin or open wounds, absorbed into materials such as gloves, clothing and in particular metal. Now this Watts Bar plant is made of medal. Why would we want to use it? Let us go out and make another superfund site for the American tax payers and my children and grandchildren. *2/14.04*

Tritium has been detected in the soil, rainwater and groundwater surrounding a research laboratory in California and in New York. Tritiated water is found in local creeks in the same areas. Now DOE says that there is no easy way to treat low levels of tritium found in water or soil. In addition, the position that one dose or short term exposure is not hazardous produces the notion that tritium is not dangerous . It is the extended exposure to tritium that produces the damage. Bourbon has never killed anyone BUT the extended *3/14.25*

Commentor No. 241: Ann Harris (Cont'd)

abuse and use has killed millions of Americans. DOE----TVA--- and those boys from the NRC that are hiding in the background are misleading these communities.

Permit me to give you some of your own research data back to you

#1: University of Chicago---------high birth deaths rates

#2: Lawrence Livermore Laboratory------reduced levels of necessary DNA germs in females

#3: University of California @ Berkley--------mutations (cell damage)

#4: Neuherberg, Federal Republic of Germany--------death of birth mothers

#5: Central laboratory for Radiological Protection, Wasrsaw, Poland-------- high rates of lung and testes cancer

#6: Medical Research Council, Oxon, England--------- Mass loss in male testis----even in low dosage

You boys are from the government and you are here to help me!!!!!!!!!!!!!!

What you are bringing to my community and river is nuclear thylidomide. It is the equivalent of the drug that was given to pregnant women for morning sickness in Europe and produced massive birth defects and deaths. And you are bring[ing] the men another "agent orange." Don't help us anymore! *3(cont'd)*

The question of the safety of the primary coolant system at Sequoyah and Watts Bar are of such recognized bad design and are virtually inoperable at any give time that they are of little use during any heat up of the reactor. The TVA employee that identified these problems has received death threats on the job site at Watts Bar and at his home. These are all questions that have received little or no attention by DOE or TVA in consideration of making TVA rate payers responsible for DOE's continuing mismanagement coupled with TVA's current standards and mismanagement. It begs the question of whether or not tritium production at TVA is an asset to the valley and can the rate payers afford this type of long range and unknown consequences? *4/09.10*

Commentor No. 242: Carl Fowler

Sheet Metal Workers' International Association

LOCAL UNION NO. 48

1108 29th Street North
Birmingham, Alabama 35234
Phone (205) 322-9016

December 14, 1998

My name is Carl Fowler, Assistant Business Agent of Sheet Metal Workers' Local Union #48, Birmingham, AL. On behalf of our members and myself, as concerned tax paying citizens, I would like to address the issue of Tritium production.

By the year 2011, the United States supply of Tritium will be depleted. President Clinton has ordered that new Tritium be available by 2005. Since 1995, the Department of Energy has been investigating alternative methods for Tritium production. By law, the Secretary of Energy must decide before the end of this year on whether the department will use a commercial light water reactor or another method. I would like to briefly compare those alternatives.

In 1997, an experimental reactor at the Hanford Nuclear Reservation in Washington State was put on "a hot standby" as a possibility. That reactor is only capable of producing 1 ½ to 2 kilograms of Tritium a year at full Capacity. The reactor at Hanford would have to be recommissioned at a cost of 200 million dollars or more and the annual operating expense would be about 88 million dollars. Hanford doesn't need more trouble, contends a spokesman for the group Government Accountability Project, who states, and I quote "There's already enough waste there to fill a football field to 250 miles in the sky-high enough that the space shuttle would bump into it." Sheet Metal Workers' stand opposed to the Hanford site. *1/06.03*

A second possibility is the Proton Accelerator, which if chosen, would be built in South Carolina. In 1995, a Department of Energy report, listed the cost at between 9 and 12 billion dollars. Also, the accelerator would require a significant power supply. It's estimated that the accelerator would consume 400 mega watts of electricity a year and cost taxpayers between 100 and 200 million dollars in electrical cost alone. Also, the Proton accelerator uses a technology that's unproven. Are we going to dig another hole in the ground and call it "Super Collider II?" Also, the Proton Accelerator cannot meet the schedule of Tritium production by 2005. Sheet Metal Workers stand opposed to the Proton accelerator. *2/07.01*

Then there is the final alternative of producing Tritium in a Commercial Light Water Reactor. Within the last month there are now basically two proposals for using a light water reactor, the Watts Bar/Sequoyah Service offer and the Bellefonte Nuclear Plant service offer. Let's compare the two options. *3/07.08*

(1) Costs:
With revenue sharing the Bellefonte offer would provide the D.O.E. with an opportunity to recover the initial investment. In other words, Bellefonte's total investment plus interest would be repaid in full. TVA recently submitted a Bellefonte reduced payment offer which reduces D.O.E. payments by more than 700 million dollars. With or without revenue sharing, the Bellefonte offer has a lower life cycle cost to D.O.E. for Tritium production than any other alternative including the Watts Bar/Sequoyah offer. Tritium is sold commercially for about 30 million dollars a

Commentor No. 242: Carl Fowler (Cont'd)

kilogram. The Watts Bar/Sequoyah offer will cost close to 26 million dollars a kilogram compared to Bellefonte's offer for the same service in the range of 0 to 12.38 million dollars. Neither of these two offers includes other program cost, such as, target rod fabrication, transportation nor the construction and operation of the Tritium Extraction Facility, all of which makes the Bellefonte offer far below the commercial cost of Tritium. *3(cont'd)*

(2) Production capability:
Although the numbers are classified, the D.O.E. will need between 2 and 3 kilograms of Tritium each year to replace the material in nuclear weapons. Watts Bar/Sequoyah will produce up to 3 kilograms of Tritium a year with a 18 to 24 month production cycle, with only 25 years of production. With the Watts Bar/Sequoyah offer, electricity will be the first priority and Tritium as a secondary mission. On the other hand, Bellefonte will produce up to 5.6 kilograms of Tritium per year with a 12 month production cycle if needed and a source of Tritium production for up to 40 years. Bellefonte will be totally dedicated to the production of Tritium. In other words, Tritium first, electricity second.

(3) Economic Impact:
The Watts Bar/Sequoyah offer will mean no new jobs, no regional economic benefits and no increase to state and local revenue. The Bellefonte offer will mean thousands of new jobs, both short term and long term, a positive regional benefit and increase state and local revenue. Bellefonte Tritium Plant will not just be an Alabama plant for only Alabama workers. With the labor unions' jurisdiction over Bellefonte 75 percent are based in Tennessee. It's estimated that 50 percent of the workforce will be from Alabama, 45 percent from Tennessee and 5 percent of the workers will be from Georgia.

(4) Support:
There has been no local public, government, state, organized labor or congressional support for the Watts Bar/Sequoyah offer. As a matter of fact, there has been public opposition with no supporting comments from the environmental impact study public meetings. Bellefonte has active support from local, government, state, organized labor and congressional support. There were more than 80 environmental impact study comments in favor of Bellefonte. Sheet Metal Workers' stand opposed to the Watts Bar/Sequoyah offer.

Here we are at the 11th hour of decision and still no choice. Let's choose the most logical and feasible choice. That choice is Bellefonte. Only Bellefonte provides new jobs, the lowest cost to taxpayers, provides multi-state economic benefits and offers a revenue payback to benefit taxpayers. Only Bellefonte has local, state, bipartisan Congressional support and organized labor support. Finally only Bellefonte would offer production flexibility with operating cycle lengths and would be totally dedicated to the production of Tritium.

Let's not play politics with our future and the future of our country. The facts speak for themselves. Only one choice, Bellefonte Tritium Production Facility must be chosen.

Thank-you.

Commentor No. 243: Don Nelms

Plumbers & Steamfitters LOCAL UNION NO. 498
P.O. BOX E 3803 WEST MEIGHAN BOULEVARD
GADSDEN, ALABAMA 35904
Phone: (205) 546-6791 Fax: (205) 547-6330

December 13, 1998

Secretary of Energy Bill Richardson
Forestall Building
1000 Independence Ave., S.W.
Washington, D.C. 20585

Secretary Richardson,

I am Don Nelms, Business Manage for Local 498, Plumbers & Pipefitters of Northeast Alabama. I am here on behalf of our members and their families, who in support of the use of Bellefonte for D.O.E.'s Tritium Production Plant.

First let me say we don't understand a government that will spend $40 million Plus dollars to take one man out of a job that he is doing very well, but will not jump at a chance put thousands of it's tax payers to work. WE JUST DON'T UNDERSTAND THIS.

Our members and their families live in the Bellefonte area and want to work and raise their children there.

There are many reason Bellefonte should be the choice of D.O.E.

New Jobs, Lowest Cost, Very Strong Support, A New Electrical Source, and Provides At Least 15 Years more use than Watts Bar / Sequoyah.
Bellefonte provides at least 40 years to you, Watts Bar/ Sequoyah only 25 years. 40 years of jobs for taxpayers, payback to D.O.E. only at Bellefonte not Watts Bar/ Sequoyah.
At Bellefonte Tritium will be the main product, electric power will be a by-product. Not so at Watts Bar/Sequoyah. The use of Watts Bar/Sequoyah would force more Use of Fossil Fuel Plants that will cause more Air Pollutant. Not at Bellefonte. It will be another source of much need clean Electrical Power 1/07.08

Does Public Support cause a problem for D.O.E. ?

At Bellefonte you have the support of the People in the area, Local, State, and Congressional Political Leaders, and all Labor groups in the area.
Not So Anywhere Else.

T.V.A. was founded to create Jobs and Electric Power for the American People. The selection of Bellefonte is the only offer on the table in which T.V.A. & D.O.E. can continue to provide Either of these to America.

Thank You
Don Nelms
Don Nelms
Business Manager
Plumbers & Steamfitters LU 498

AFFILIATED: American Federation of Labor and Building and Construction Trades Department.

Commentor No. 244: James B. Sandlin, P.E.

Scottsboro ELECTRIC POWER BOARD
P.O. Box 550
404 E. Willow Street
Scottsboro, Alabama 35768
(256) 574-2680 Fax: (256) 574-5085
Web address: www.scottsboropower.com

Date: December 14, 1998

Re: Comments by James B. Sandlin, P.E.
Manager of Scottsboro Electric Power Board
Scottsboro, Alabama

To: Secretary Bill Richardson, DOE

I am totally against the Watts Bar/Sequoyah Tritium proposal from TVA to meet the nation's tritium supply. My comments will be focused on the impact to the regions power supply, as operated and maintained by TVA, and the cost and availability of said TVA power.

Choosing the Watts Bar/Sequoyah Tritium option would substantially compromise the regions power supply during moderate to extreme loading conditions. The summer of 1998 brought criticality to the supply and price of interruptible power for many Tennessee Valley industries. As my colleague from the Scottsboro Akzo Nobel Industrial Fibers facility will explain, that while power was available, the price incurred created cataclysmic conditions for these industries. My customer, Akzo Nobel, saw a significant increase in power cost over the late summer months. 1/07.08

MONTH	Electric Bill
May 1998	$464,786.11
June 1998	$731,904.84
July 1998	$841,469.13
August 1998	$558,995.82

New generation of approximately 1200 MW will be added to the TVA power system a Bellefonte unit is completed. This would decrease the risk of sharp price increases because TVA would have more generation to meet the Tennessee Valley's demand for electricity. If the Watts Bar/Sequoyah option is chosen, the valley could see an even greater risk of interruptible power price instability. Generation capacity supplied by Watts Bar could become unavailable if the DOE/DOD needs to extract tritium burnable absorption during extreme load conditions.

Also, municipal and cooperative (consumer-owned) electric distribution systems would be even further jeopardized because wholesale power cost would rise if TVA Nuclear generation were not available. Fossil-fired or natural gas turbines used to meet the Valley's demand during a nuclear unit outage would also add

Commentor No. 244: James B. Sandlin, P.E. (Cont'd)

Mr. James B. Sandlin pg. 2
Comments to DOE – December 14, 1998
Rhea County High School, Evansville, Tennessee

greenhouse gasses to the environment and additional costs, respectively. Clearly, nuclear power plays an important part in supplying power for our country. If we expect to maintain a robust economy and keep unemployment low, our country must rely on nuclear power to meet its' growing demand for energy.

The TVA Bellefonte options are clearly the best choice for tritium production. I strongly encourage that Secretary Richardson weigh its merits and definite tangible benefits of competing Bellefonte. The Tennessee Valley Power Distributors unanimously support the completion of Bellefonte and its role in our national defense. After all, the mission of TVA from its inception provided resources to assist other agencies and departments in keeping our national defense strong. *1(cont'd)*

I appreciate the opportunity to speak to you on this important matter.

Sincerely,

Jimmy Sandlin
Manager

Commentor No. 245: Monica Blanton

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I feel the US needs to live up to its responsibility as a world leader + practice the policies we espouse to others - such as keeping separate the commercial + military uses of nuclear power. *1/01.09*

We are a prosperous nation in prosperous times + the cost to produce tritium should not be the major factor determining where it is produced *2/23.16*

I'm opposed to TVA's production of tritium at any of its facilities *3/07.04*

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Monica Blanton
Organization:
Address: 1629 Berkley Circle
City: Chatt. State: TN Zip Code: 37405
Work phone: Home phone: 423 756 3237
Fax:
E-Mail Address:

12/10/98

Commentor No. 246: Mary Brooks

COMMERCIAL LIGHT WATER REACTOR PROJECT

COMMENT FORM

Please Turn in Your Written Comments
PRIOR
to Leaving the Meeting

Comments: I am opposed to the projected use of Watts Bar for the production of Tritium. We do not want this to be produced here in Rhea County. 1/07.07

Thank you for your input. Please use additional sheets if necessary and attach them to this form.

Name: (optional) Mary Brooks
Organization:
Address: 263 [illegible]
City: Dayton State: TN Zip Code: 37321
Work phone: 423 775 9071 Home phone:
Fax:
E-Mail Address:

12/10/98

Commentor No. 247: Robert W. Van Wyck

Radiological Consultant

Robert W. Van Wyck, Certified Health Physicist
709 Helmsdale Place, North
Brentwood, TN 37027
Tel. 615-373-9176

Stephen M. Sohinki, Director
CLWR Project Office
US Dept. of Energy
PO Box 44539
Washington, DC 20026-4539

Dec. 12, 1998

Dear Mr. Sohinki:

I received a phone call from someone in your office on Friday, 12/11, informing me that you plan to hold a hearing at the Rhea County High School in Evensville, TN on Monday, 12/14, regarding the proposal to manufacture tritium in one or more of the TVA Light Water Nuclear plants. I received a memo in the mail today (Saturday, 12/12) confirming the meeting.

It is not clear why this meeting is being held, particularly with such short notice. The EIS has not been completed to my knowledge. Therefore, the local residents who attend will not be adequately informed or be able to carry out any meaningful discussion about the project.

It is also not clear why such a "sudden" meeting has been called for this purpose. Since I feel it would be a serious mistake to manufacture tritium as proposed and I am strongly opposed to it, perhaps I was notified as an "after thought". 1/05.31

In any event, I cannot make the meeting at this time with such short notice. Therefore, I hurriedly prepared the attached letter to State Senator Gene Elsea, in whose district the meeting will be held, and handed it to him on Friday at his office here in Nashville. I hope that he, or a representative, will be able to attend and provide useful information from my perspective.

In the future, I request that you give at least two weeks notice of any planned meetings on this proposal so that plans can be made to attend.

Sincerely,

R. W. Van Wyck

Robert W. Van Wyck, CHP

Commentor No. 248: Mayor Donald B. Clark

Department of Energy
Public Meeting
December 14
Rhea County High School
on Watts Bar and Sequoyah
nuclear power plants for the production of
TRITIUM
Comments of Donald B. Clark

The Cumberland Countians for Peace & Justice, a coalition of individuals and religious congregations in neighborinmg Cumberland County, is an affiliate of Peace Action and, as you might suspect, is strongly opposed to the manufacture of tritium, period !! No where, no how! 1/01.01

On August 7, 1997, my testimony referred to National Council of Churches, World Council of Churches, Friends Committee on National Legislation, and United Church of Christ positions on nuclear weapons,the Plutonium Economy, and nuclear power. I concluded by saying that it can be safely said that THE MAINLINE RELIGIOUS COMMUNITY STANDS AGAINST ANYTHING THAT WILL EXTEND THE LIFE OF A NUCLEAR REACTOR, MAKE IT EVEN SLIGHTLY LESS UNECONOMIC TO OPERATE, DELAY ITS DEMISE, OR PUT IT ON ADDITIONAL WELFARE. We certainly would be opposed to the Department of Energy helping TVA complete a nuclear power plant. We view nuclear power as a "costly mistake" in the first place. 2/07.02

We have been working for years trying to stop the Department of Energy from building nuclear bombs, in Oak Ridge and elsewhere. We support the Nuclear Non-Proliferation Treaty, the Comprehensive Test Ban Treaty, no furher nuclear testing of any kind and the rapid dismantlement of nuclear weapons. 3/02.01 We do not believe that $5 billion should be spent a year on our nuclear weapons arsenal, creating more deadly H bombs out of old ones. 4/23.13 We believe the program is not politically appropriate, responsible, moral or logical. 5/01.10

In that testimony, we quoted from the June 1997 issue of PHYSICS TODAY that contained several articles on radioactive waste and nuclear safety, mentioning a 12 year tritium leak to groundwater from a spent fuel holding tank of a reactor at Brookhaven National Laboratory. I mentioned the public trust of the management of any nuclear reactor or research laboratory anywhere in the world is slim and justifiably should be nonexistant. The history of secrets, deceptions, denials and lies preclude trust and engenders anxiety. Those in the industry and the NRC are seemingly confident that nuclear science has the answers and must be pursued no matter what the costs. We consider this a faith based on self-dillusion and blind arrogance. 6/08.04 Aklternatively using the economic resources devoted to nuclear reactors and weapons, by the United States alone, for only a few 4(cont'd)

Commentor No. 248: Mayor Donald B. Clark (Cont'd)

months, could solve the world hunger and literacy problems and fund world wide environmewntal restoration. Redirecting the human resources of the nuclear and war industries to the meeting of creation needs is essential, in my view. 4(cont'd)

I conclude that testimony by claiming that NO ONE CAN JUSTIFY FURTHER TOXIC IMPACTS ON THIS REGION, citing several toxic impacts of Oak Ridge reported in the newspapers back in 1997. Since then the *Tennessean* newspaper has had several articles on the health of employees and area communities as well as a Special Report on the toxic impacts of nuclear and secondary sites accross the nation. An editorial on the date of the special report, September 29,1998 is attached. 7/10.04

Copies of my testimony on August 7, 1997 and Fdebruary 26,1998, less several attachments, are also provided.

Thank you for the opportunity to present our views again.

Donald B. Clark

Since my last testimony, I have been elected Mayor of Pleasant Hill, TN and, in addition to involvements listed previously, have been added to the Steering Committee of the OBED Watershed Association and the Cumberland Chapter of Save Our Cumberland Mountains.

United Church of Christ, Network for Environmental & Economic Responsibility
Donald B. Clark, Convenor P.O.Box 220, Pleasant Hill, TN 38578
(931) 277-5467 Fax: 277-5593 clarkjd@multipro.com

Cumberland Countians for Peace & Justice
Donald B.Clark, Chair of Steering Committee
P.O.Box 220, Pleasant Hill, TN 38578
(931) 277-5467 Fax: 277-5593 clarkjd@multipro.com

CUMBERLAND COUNTIANS FOR PEACE AND JUSTICE

NEER
Network for Environmental and Economic Responsibility

SOCM

UNITED CHURCH OF CHRIST · THAT THEY MAY ALL BE ONE
United Church of Christ

Commentor No. 249: Stephen A. Smith

__________________Forward Header__________________
Subject: TVA and Tritium
Author: <sasmith@TnGreen.com>
Date: 12/17/98 10:44 AM

Steve,
I wanted to get the summary of my TVERC comments the other night.

1. We do see the need for Tritium at this time, DOE has not presented a compelling case for the need. **1/02.01**

2. We see the use of a CLWR as a clear violation of the non-proliferation treaty, no matter which reactor is chosen. **2/01.04**

3. We feel strongly that the Vice President's office has influenced this decision, and this will compromise his ability to stand before the world community in the future if elected to a higher office and argue against weapons of mass destruction. We see that he has been too involved in moving this TVA agenda. We will also work hard to expose his role both nationally and internationally if this goes forward in the coming months. **3/01.15**

4. Given the options of Bellefonte and Watts Bar, we see the Watts Bar option as the least environmentally destructive, given that Bellefonte is a "clean site". We also see Watts Bar has offering the greatest flexibility at the least cost given the future likelihood of addition weapons reductions.

5. We feel it has been a great miss characterization of the facts to say there is over whelming support for Bellefonte in Alabama. This is not true outside of those who have a direct economic benefit from the proposal. The fact that Alabama State Rep. John Robinson from Scottsboro was reelected by a 70-30 margin while he was vocal in his opposition to the Bellefonte proposal is clear evidence of this, and the closest thing to a citizen vote to date. We feel there is a large but not vocal opposition to Bellefonte and tritium in the community in Alabama. **4/07.08**

If these could be gotten directly to the Richardson that would be great, I have zero confidence that Sohinki can respresent our view objectively.

Thanks for your help

Stephen A. Smith, DVM
Executive Director
TVERC

Commentor No. 250: Oak Ridge Environmental Peace Alliance

OAK RIDGE ENVIRONMENTAL PEACE ALLIANCE
100 TULSA RD, SUITE 4A • OAK RIDGE, TN 37830 • 423 483 8202 • orep@igc.org

10 December 1998

The Honorable Bill Richardson, Secretary
The United States Department of Energy
1000 Independence Avenue, SW
Washington DC 20585

Dear Secretary Richardson:

We are writing to express in the strongest possible terms our opposition to the production of tritium for nuclear weapons in the Watts Bar, Sequoyah, and Bellefonte commercial nuclear reactors of the Tennessee Valley Authority or in a linear accelerator at Savannah River. We hold these strong beliefs for these reasons: **1/07.02**

WE DO NOT NEED MORE TRITIUM

According to DOE's own estimates, the US has enough tritium to last until 2016 (see the Tritium Programmatic Environmental Impact Statement).

WE SHOULD END THE ARMS RACE, NOT PROLONG IT

The proposed "need" for tritium is based on maintaining a huge START 1 arsenal well into the next century. This action, and its accompanying billion dollar price tag, is incomprehensible. The Department of Defense recently advocated deeper than START 2 cuts in the US arsenal. General Lee Butler, retired in 1994 as the head NATO strategic forces, has called for abolition. Former President Jimmy Carter has also called for steps to abolish nuclear weapons. Why is the Department of Energy proceeding to build up the arsenal? **2/02.02**

MAKING TRITIUM IN COMMERCIAL REACTORS VIOLATES US POLICY

The US has prevailed upon other nations to maintain a complete ban on the use of commercial facilities for military nuclear purposes. This ban is so thorough, the US can not purchase Uranium from foreign suppliers to make tritium in TVA reactors. Now the US proposes to unilaterally break the ban, sending a clear message to the rest of the world. **3/01.09**

Commentor No. 250: Oak Ridge Environmental Peace Alliance (cont'd)

MAKING TRITIUM VIOLATES THE NONPROLIFERATION TREATY

The 1970 nuclear nonproliferation treaty obligates the United States to pursue complete nuclear disarmament, not spend more than $2 billion to maintain a huge arsenal. Producing tritium we do not need and will not use is a step in the wrong direction. 4/01.04

MAKING TRITIUM WASTES BILLIONS OF TAX DOLLARS

By DOE's own estimates, the cost of producing tritium we do not need and will never use will range from two to seven billion dollars. This is our money. We paid it in taxes. DOE does not have our permission to spend it in a senseless and illegal action 5/23.13

IT IS TIME TO SHOW COURAGEOUS LEADERSHIP

Mr. Secretary, this is a moment for courageous leadership. Your predecessor, Hazel O'Leary distinguished herself when she stood up to the weapons labs and declared the US would not conduct further nuclear weapons tests because we did not need them. Her courage and honesty, and her clear vision of the post-Cold War world, enabled the US to achieve a Comprehensive Test Ban Treaty with other nations. 6/01.01

This is a moment when you can rise above your already distinguished career and demonstrate world-caliber leadership. We do not need tritium, and you know it. To step back from this decision would be to show the world we are committed to reducing the nuclear danger. Such a step costs us absolutely nothing, saves billions of dollars, and positions the US to lead the other nations of the world away from reliance on nuclear weapons. It could, indeed, be the first step away from the nuclear shadow which has hung over all the world since 1945.

We appeal to you for leadership and courage. Say "No" to tritium.

Sincerely,

This has got to stop!

Commentor No. 251: Tim & Jennifer Proffitt

December 15, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki:

Please consider our request - Do not produce Tritium in the Tennessee Valley expecially Watts Bar reactor.

We are raising samll children here and have everything to loose and nothing to gain from this. We do support the safety of our Country but we also support the safety and health of our family and friends of the Tennessee Valley. PLEASE do not bring this to Tennessee. 1/07.07

Thanks for our consideration.

Yours truly

Tim Proffitt
Jennifer Proffitt

cc: Zach Wqmp, Congress
Al Gore, Vice President

Tim Proffitt
Route 1, Box 221
Decatur, Tn. 37322

Commentor No. 252: Ned & Joyce Proffitt

December 15, 1998

U.S. Department of Energy
Commercial Light Water Reactor Project Office'
P.O. Box 44539
Washington, D.C. 20026-4539

Dear Mr. Sohinki and All I May Concern:

Please do not produce Tritium in the Tennessee Valley and especially at Watts Bar and Sequoyah reactors. 1/07.07

I am not against protecting our country and being ready to defend our country. Please consider there are too many people down river from Watts Bar in case of an accident. This is the water that most people drink including Chattanooga. 2/15.03

Please do not contaminate the whole country. Leave it in the Savanah River area that already has the damage. 3/08.02

Please condiser the lives of the people of the Tennessee Valley. 1(cont'd)

Yours truly,

Ned Proffitt
Joyce Proffitt

cc: Zach Wamp, Congress
Al Gore, Vice President

Ned Proffitt
Route 1, Box 249
Decatur, Tn. 37322

Commentor No. 253: Kristina K. Stark

FAX COVER SHEET

FAX

OAKLEY HIGH SCHOOL
118 W. 7TH
OAKLEY, KS 67748
785 [redacted]-672-3241
FAX - [redacted]-672-3743
785

DATE: 1-18-99

TO: Commercial Light Water Reactor Project Office
Attn: Stephen Sohinki

FAX NO.: 1-800-631-0612

NO. PAGES: 2
INCL COVER PAGE

From: Oakley High Debate

Commentor No. 253: Kristina K. Stark (Cont'd)

We are members of the Oakley High School Debate Team from Northwest Kansas. As you may, or may not know, this year's debate topic deals with the United States and Russian foreign policy. We have encountered a proposal that seeks to import Russian tritium from nuclear reactors to meet United States defense needs. We realize that there may be a tritium shortage in the United States in the future, but we believe importing Russian nuclear by-products will have negative consequences. We are searching for information showing that the United States will be able to produce its own tritium supply for the future. We have read information on the APT project, and we believe that this may be a possible means of obtaining tritium. We would appreciate any information supporting the conclusion that the United States will be able to produce its own tritium. Thank you for your time. 1/01.14

Kristina K. Stark
Derek Leite

Commentor No. 254: Petition

December 9, 1998

The Honorable Bill Richardson
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Secretary Richardson:

RE: TRITIUM PRODUCTION

We the undersigned have strongly supported and continue to strongly support tritium production at TVA's Bellefonte Nuclear Plant. For the past year we have put forth our energy toward the ultimate goal of the DOE selection of the Bellefonte option. All of our efforts (i.e., letter writing, contacting U.S. Representatives and Senators, opposing legislative language that would have eliminated use of Commercial Light Water Reactors, attending meetings, etc.) has been exerted **only for Bellefonte**. Had it not been for the efforts of people such as we, the Commercial Light Water Reactor option **would not be available** to DOE today. We continue to **support only Bellefonte** for the following reasons:

1. ECONOMIC REASONS
   - **Only Bellefonte** provides new jobs
   - **Only Bellefonte** provides lowest cost to the taxpayers
   - **Only Bellefonte** provides multi-state economic benefits
   - **Only Bellefonte** revenue offer provides payback provisions to benefit the taxpayer 1/07.03
2. PUBLIC POLICY
   - **Only Bellefonte** has strong local and state support
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   - **Only Bellefonte** has strong organized labor support
3. TECHNICAL REASONS
   - **Only Bellefonte** would be a dedicated facility for tritium production
   - **Only Bellefonte** would offer production flexibility with operating cycle lengths
4. ENVIRONMENTAL REASONS
   - **Bellefonte completion** provides new electric power generation with no additional greenhouse emissions and supports recent Administration clean air initiatives

NAME	ADDRESS
Daryl G. Page	OPS-2B Sequoyah
Paul L. Jackson	OPS-2B SEQUOYAH

Commentor No. 254: Petition (Cont'd)

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1(cont'd)

NAME	ADDRESS
MONICA CROSS	134 KENSINGTON DRIVE FLORENCE, AL
James Dillard	P.O. Box 1167 Florence, AL
Charles E Frederick	842 Marr Hill Rd, Florence, AL
M. Diane Rieks-Genenette	715 1/2 S. Washington St. Tuscumbia AL

Commentor No. 254: Petition (Cont'd)

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1(cont'd)

NAME	ADDRESS
Sonya Gillespie	102 Co Rd 543, Moulton AL 35650
Keith McPeters	~~Rt 1~~ 1270 W Rex L Rd Florence, AL 35633
Calvin L. Brawley	135 Brawley St. Leighton Al. 35646
Jacque Anderson	305 Dowdy Ln. Florence, AL 35633

Commentor No. 254: Petition (Cont'd)

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1(cont'd)

NAME	ADDRESS
Carl Scarbrough	STC-25 SQN
[illegible]	STC-25 SQN
[illegible]	STC 25-SQN
Michael D. [illegible]	STC 25-SQN
Joseph D. [illegible]	STC-25-SQN

Commentor No. 254: Petition (Cont'd)

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1(cont'd)

NAME	ADDRESS
Robert J Poole	6419 Sea Haven Drive Hixson TN 37343
Jack L Adams	5260 [illegible], Hixson, TN 37343
Christopher Carey	1151 Lakeside Circle, Hixson, TN 37343

Commentor No. 254: Petition (Cont'd)

RE: TRITIUM PRODUCTION

NAME		ADDRESS
Kenneth D. Pulliam	[signature]	6720 Harbor Circle Chattanooga, TN 37416
Ronald R. Hughes	[signature]	2337 Chimney Hills Rd. Soddy-Daisy TN 37379
Jerry V. Mills	[signature]	512 New Union Circle, Dayton TN. 37321
Vonda Sisson	[signature]	3698 Wauchula St, Chatt. TN 37406
Terry S. Orr	[signature]	1845 Bay Hill Dr. Hixson, TN 37343
Brenda Smreil	[signature]	7017 Hunter Glen Dr. Ooltewah, TN 37363
David M Lefever	[signature]	1920 Gunbarrel Rd #1005, Chattanooga TN 37421
Walter M Justice	[signature]	6410 Sail Pointe Ln Hixson TN 37343
John F. Thomas	[signature]	7807 Haverton Crossing Hixson, TN 37343

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1(cont'd)

NAME	ADDRESS
Wayne L. Smathers	37859 Hwy 95 N, [illegible], Tn. 37742
[signature]	5607 Ridgetop Rd Knoxville TN 37921
[signature]	730 Germantown Cr. East Ridge, TN 37412

Commentor No. 254: Petition (Cont'd)

NAME	ADDRESS
[illegible]	2021 [illegible] Ave CHATT TN
Donald Sutton	6512 [illegible] Dr. Hixson, TN.
[illegible]	6605 Harvest Run Dr. Harrison, TN
Wm J Kagny	7709 Ridge Bay Drive, Hixson, TN
[illegible] Patel	1805 [illegible] Ln. Hixson, TN
L Nicholson	1275 Lakeside Ln Hixson TN
G L Wade	513 River Landing Dr Soddy Daisy, TN
[illegible]	6447 Ridge Lake Rd Hixson, TN
Francis D. Smith	277 [illegible] Lane, Dayton, TN 37321
Timothy M. Griffith	326 N Knob Creek Rd Sevmoor TN
Frank T Bradford	8848 Wooten Rd. Chatta. Tn
Sue Payne	1810 Hidden Harbor Rd Hixson, Tn
Glenda Hill	10005 Hixson Pike, Soddy-Daisy, TN
[illegible]	318 Union St. Sale Creek, Tn
James F. Nichols Jr.	1576 Walkertown Rd. Dayton Tn
Howard L Fleming	726 Creek Drive Chatt / TN
[illegible]	1418 [illegible] Cir. Hixson TN.
Judy Collier	8935 Dallas Hollow Rd Soddy-Daisy, Tn
[illegible]	3106 [illegible] Circle, [illegible]

Commentor No. 254: Petition (Cont'd)

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1(cont'd)

NAME	ADDRESS
John Rathjen [illegible]	10738 Moss Lake Dr Hixson, TN 37343
Michael D. Stutz [illegible]	49 Lakeside Dr, Scottsboro, AL 35769
W. Michael Holley [illegible]	530 Spring St, Signal Mtn. Tenn. 37377

Commentor No. 254: Petition (Cont'd)

December 9, 1998

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1(cont'd)

NAME	ADDRESS
Randy Hartwig	1910 Cumberland Ave SW Decatur, AL 35603
[illegible]	1215 Parkview Wood Rd Huntsville, AL 35640
[illegible]	2223 Victoria Dr Decatur, AL 35603

Commentor No. 254: Petition (Cont'd)

December 9, 1998

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U.S. Department of Energy
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Washington, DC 20585

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1(cont'd)

NAME	ADDRESS
Steven A. Ziegler	2222 Essex Dr SW Decatur, AL 35603
[illegible]	2309 Warwick Ave SW, Decatur AL 35603
[illegible]	607 Dogwood Dr. Decatur, AL. 35603
[illegible]	3530 Modaus Rd., Decatur, AL 35603

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James H. Gaines	MPB 1B-M
Phillip L. Llewellyn	MPB 1B-M

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NAME	ADDRESS
Robert M. Chriga	24910 Co Rd 14 Florence, AL 35633
C. M. Evans	778 Co. Rd. 584 Rogersville, al. 35652

Commentor No. 254: Petition (Cont'd)

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NAME	ADDRESS
Sonja D. Denton	836 Cumberland Street Florence, AL 35630
Joan Polly	2422 Cty Rd 103 Killen, AL 35645

Commentor No. 254: Petition (Cont'd)

December 9, 1998

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1(cont'd)

NAME	ADDRESS
DAVID P. BRANHAM	OPS-3C SEQUOYAH NUCLEAR PLANT, SODDY-DAISY, TN,
Michael E. Anderson	124 Rackham Rd Hixson TN 37343 37379

Commentor No. 254: Petition (Cont'd)

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Louvain L. Edmondson Jr. [signature] 8235 Blue Spruce Dr. Hixson TN 37343

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William_David_Herston_CTR1D/M

Commentor No. 254: Petition (Cont'd)

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NAME	ADDRESS
W. Wayne Scott	3906 Windward Ln. Soddy-Daisy, TN 37379
Calvin Underwood	2304 Clearview Pl. Decatur, AL 35601

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1(cont'd)

NAME	ADDRESS
Whitney A. Dell	915 Tennessee Avenue, Athens, TN 37303
James [illegible]	3006 Byrdstown Hwy, Monroe Tn 38573
Joseph C. [illegible]	232 Pugh Rd. Crossville, TN 38555

Commentor No. 255: Petition

December 14, 1998

To: Secretary of Energy Bill Richardson, Congressman Zach Wamp
Congressman Van Hillary, Senator Bill Frist, Senator Fred Thompson
Vice-President Al Gore, President Bill Clinton

We, the undersigned, are residents of Tennessee, and we are totally opposed to the production of tritium at the Watts Bar Nuclear Facility. We do not want the production of tritium in our area. Thank you for your support in this matter. *1/07.07*

1. Margaret Brooks 1268 Duane Rd Chattanooga TN 37405 Margaret Brooks
2. Matt Long 615 Bob Long Rd Dayton TN 37321
3. Dede Jones 1746 Riverpoint Rd Dayton TN Dede Jones
4. Gary Smith 444 Evergreen Dayton TN
5. Linda Smith 444 Evergreen Dayton TN
6. Becky Earles 457 Pine Hollow Rd. Dayton, TN
7. Susan Willet 537 Evergreen Dr. Dayton, TN.
8. Benjamin L. Simpson 1530 Riverpoint RD. Dayton, TN 37321
9. Amy Earles 457 Pine Hollow Rd. Dayton. TN 37321
10. Mary Parks 263 Bales Landing Dayton TN 37321
11. Charlotte Johnston Oak Street Dayton, Tn 37321
12. Dean Dreman 330 Highland Dr. TN 37321
13. [illegible] Nevans 330 Highland Dr. TN 37321
14. Adam McKenzie 161 Oak St. #2 Dayton, Tn 37321
15. Pat Beck 148 Oakcrest Ave. Dayton, TN 37321
16. Mary Mae Beck 1368 Market St #101 Dayton Tn 37321

Commentor No. 255: Petition (Cont'd)

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17. Catherine McDonald 1746 Riverpoint Road Dayton TN 37321
18. Nan Simpson 1530 Riverpoint Rd. Dayton TN 37321
19. Robert Simpson 1530 Riverpoint Rd Dayton TN 37321
20. Susan Simpson 1530 Riverpoint Rd Dayton TN 37321
21. Robert Aikman

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Dana Shroom, 135 Tom Garrison Rd., Evensville, TN 37332
Charles [illegible], 735 Tom Garrison Rd, Evensville, TN 37332
Jean Read 166 LAMPLIGHTER CT. DAYTON, TN 37321
Yvonne West 1305 Shaverloop Rd Dayton TN 37321
[illegible] Johnson 672 Pine Hill Dr. Dayton, TN 37321

Commentor No. 147: Petition

AN ASSESSMENT OF THE DRAFT CLWR EIS
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

We, the undersigned, have reviewed the draft Environmental Impact Statement (EIS) for the production of tritium in a Commercial Light Water Reactor (CLWR) dated August 1998. We find the proposed tritium production program to be environmentally safe and to produce no measurable health effects. In addition, we conclude that Bellefonte Nuclear Plant should be named in the EIS as the preferred alternative based on its least life cycle cost to the U. S. taxpayer and the positive socioeconomic effects of the project. A summary of the primary points from the draft EIS used to reach this conclusion are shown on the attached pages. *1/07.03*

OPEIU International

International Association of Machinists and Aerospace Workers

Engineering Association

International Union of Operating Engineers

International Association of Heat and Frost Insulators and Asbestos Workers

International Brotherhood of Painters and Allied Trades

International Brotherhood of Boilermakers, Iron Ship Builders, Blocksmiths

Operative Plasterers' and Cement Masons' International Union

Forgers and Helpers - International Union of Bricklayers and Allied Trades

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry

United Brotherhood of Carpenters and Joiners of America

United Union of Roofers, Waterproofers and Allied Workers

International Brotherhood of Electrical Workers

Sheet Metal Workers' International Association

International Association of Bridge, Structural and Ornamental Iron Workers

International Brotherhood of Teamsters

Laborers' International Union of North America

Commentor No. 147: Petition (Cont'd)

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

USES OF TRITIUM *1(cont'd)*

Tritium is a radioactive isotope of hydrogen. If not properly controlled it can be dangerous, but when controlled properly is safe and can save lives. Tritium is:

- Used for life science and drug metabolism studies to ensure the safety of potential new drugs
- Used for self-luminous aircraft and commercial exit signs
- Used for luminous dials, gauges and wrist watches
- Used to produce luminous paint
- Used in Doppler Radar
- Used as a triggering component (i.e., boosts yield) in nuclear weapons

NONPROLIFERATION ISSUES
(Nonproliferation is defined as preventing the increase or spread of nuclear weapons)

Interagency Review of Nonproliferation Implications concerning tritium production was completed on July 14, 1998 and concluded the following:

- Nonproliferation policy issues associated with a Commercial Light Water Reactor (CLWR) are manageable and DOE should continue to pursue the CLWR option.
- No legal or treaty prohibitions against tritium production in a CLWR.
- Many exceptions have been made over the years to separation of civilian and military use of nuclear energy.
- Reactors producing tritium can remain on IAEA Safeguards List.
- No bilateral "peaceful uses" agreements will be violated. Reactors making tritium will use U.S. - origin uranium fuel.
- TVA's charter gives it a national security responsibility.

A House of Representatives Task Force (chaired by Lindsey Graham of South Carolina) issued a report to the Speaker of the House in 1995 concluding:

- Production of tritium in a commercial reactor is not a proliferation concern.
- Producing tritium in a reactor is no different than producing tritium in an accelerator.
- Raising nonproliferation concerns is simply an argument to sell the accelerator option.

Bellefonte would be operated as a electrical power generation facility with the ability to provide DOE with irradiation services for tritium production.

1

Commentor No. 147: Petition (Cont'd)

ISSUES REVIEWED BY EIS

- Land use
- Visual Resources
- Air Quality
- Water Quality and Use
- Archeological and historic resources
- Biotic (living things) resources including threatened and endangered species
- Socioeconomics (interaction of social and economic factors)
- Public and Worker Health and Safety

ENVIRONMENTAL IMPACTS OF OPERATION OF BELLEFONTE REACTORS

1(cont'd)

- EIS verifies that the incremental impacts of producing tritium in a commercial reactor are small with no measurable health effects.
- No air quality standards will be exceeded.
- No impacts to threatened or endangered species are expected.
- There will be a visual impact from the cooling tower vapor plume.
- Minimal impact on Guntersville Reservoir (0.2% of the flow).
- Minor impacts to aquatic resources from impingement in cooling water intake screens.
- Positive socioeconomic impacts
  - 800 Bellefonte workers
  - Up to 800 indirect jobs
  - Unemployment rate would stabilize approximately 2 % below current levels.

RADIATION EXPOSURE

SOURCES OF PUBLIC RADIATION EXPOSURE
- Natural Radon - 200 millirems per year
- Cosmic Radiation - 28 millirems per year
- Terrestrial - 28 millirems per year
- Internal (your own body)- 39 millirems per year
- Medical X-Ray - 39 millirems each time
- Nuclear Medicine - 14 millirems each use
- Drinking Well Water - 1 to 6 millirems per year
- 5 Hour Airplane Flight - 2.5 millirems
- Eating Food Grown with Phosphate Fertilizers - 1 to 2 millirems per year
- Wearing porcelain dental crowns or dentures - 0.7 millirems per year
- Cooking with Natural Gas - 0.4 millirems per year
- **Bellefonte Reactor Operation with Tritium Production - 0.32 millirems per year**
- **Bellefonte Reactor Operation - 0.26 millirems per year**

Commentor No. 147: Petition (Cont'd)

PUBLIC RADIATION EXPOSURE COMPARISON
- Average U.S. resident (Background) - 363 millirems per year
- Resident of Denver, Colorado (Background) - 442 millirems per year
- Resident of Jackson County, AL (Background) - 355 millirems per year
- Resident of Jackson County, AL (Background plus **Bellefonte Reactor Operation**) - 355.26 millirems per year
- Resident of Jackson County, AL (Background plus **Bellefonte Reactor Operation with Tritium Production**) - 355.32 millirems per year

CONCLUSION: BELLEFONTE SHOULD BE THE PREFERRED ALTERNATIVE!

1(cont'd)

The draft CLWR EIS does not identify a preferred alternative for producing tritium. A no action alternative is for DOE to build an accelerator in South Carolina. After reviewing the draft EIS and comparing the potential impacts associated with the alternatives, including the no action alternative, we believe that the **preferred alternative should be identified as any alternative that includes Bellefonte**. This belief is based on the following:
- Negligible environmental impacts with no measurable health effects.
- Positive socioeconomic impacts supporting economic growth and development
- Flexible tritium production capacity to meet changing tritium needs
- Proven technology compared to the No Action alternative
- No proliferation issues that are not manageable under existing laws and controls associated with CLWRs
- Least Total Life Cycle Cost

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Signature	Address
Robert B. Frederickson	2807 McTavish Ave SW, Decatur, AL 35603
[illegible]	912 Delores Dr. Hixson, TN 37343
[illegible]	334 Co Rd 565 Town Creek, AL 35672
[illegible]	3031 Old Moulton Rd Decatur AL 35603
[illegible]	1813 Livingston Road, Killen, AL 35645
Kerry Moody	22196 Chickasaw Dr, Athens, AL 35613
Dennis Moss	565 Congress St. Schenectady, NY 12303
[illegible]	84 Old Uncasville Rd Norwich, CT 06360
[illegible]	2601 E Hartford St 1B Hernando FL 34442
[illegible]	771 Cornelia Dr, HSV, AL 35802
C.W. [illegible]	313 Huxley Rd, Knoxville TN 37922
[illegible]	13500 Hatchie Lane, Athens, AL 35611
[illegible] Whitaker	6607 River Winds Ln, Hixson, TN 37343
Charles T. [illegible]	1605 W Market St Athens AL 35611
Mike L Poole	26185 Easter Ferry Rd. Elkmont AL 35620
Johnnie [illegible]	464 Sterling Meadow Rd Somerville AL 35670

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

5

Commentor No. 147: Petition (Cont'd)

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FOR
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Signature	Address
Ronald D. Phillips	320 Oak St. N.E. Decatur, AL
Rodger L Douglas	1604 Wellington Ct SE, Decatur, AL 35601
Michael P Moore	616 N. Brook Drive, Hixson, TN
[illegible]	213 Lanes West Dr. Killen AL 35645
[illegible]	7629 Hunter Rd. Hixson, TN. 37343
William L. Aldredge	1814 Sherwood Dr. SE, Decatur AL 35601
[illegible]	111 Lawson Wall Dr. Huntsville, AL 35806
[illegible]	1309 Garth Ave, Decatur, AL 35601
Gina Cummins	114 Michli Rd, Madison, AL 35758
Stephen H McKnight	1918 S. Beechwood de Florence Al 35630
[illegible]	21 Powell Circle Five Pts TN 38457
Lloyd B Blackwood	1952 County Road 53 Rogersville, AL 35652
Phillis Davis	115 Progress Lane Madison, AL 35758
Harland Dodson	106 Charing Cross, Florence, AL 35633
[illegible]	142 Co Rd 53 Rogersville, AL 35652
David [illegible]	405 Louise St Florence AL 35630

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

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Signature	Address
Larry R Hays	876 Spring Cove Rd; Florence AL 35634
[illegible]	16189 E. Glenn Valley Dr Athens Al 35611
Clayton Carpenter	3504 Co. Rd 136, Town Creek Ala
Ronald E Moody	201 Birch Run, Florence, AL 35630
Dwight K Cook	17355 Holland Hts Athens, AL 35613
Ray B Emanuelson	9560 Mitchell Bend Ct. Granbury, TX 76048
Norman Roy	4722 Stoneclipse Dr. Huntsville, AL 35806
Michael L. [illegible]	363 CR 172 Iuka, MS 38852
C. Earl Williams	125 Royal Dr. apt 2609 Madison, ALA 35758
Deborah B. Franks	9424 Sgt Holden Ln Athens Al 35614
Linda Bell	102 Buchanan St. Morrilton AR 72110
Thurman [illegible] Clayton	1806 [illegible], Prospect, TN 38477
Thomas W Jordan	400 E Maple St Muscle Shoals Al 35661
Anthony G. Hastings	102 Penna Place Athens, AL 35613
[illegible]	127 Springwater Madison AL 35758
Larry M Walker	98 Alissa Lane, Grant, AL 35747
Ralph L [illegible]	1202 Byron Ave SW, Decatur, AL 35601

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
[illegible]	15023 Lexmore Dr. Hsv. AL 35803
John Burchfield	35557 County Rd 8 Florence, Al. 35634
Jim Byrd	603 Springwood Cir. Hsv., AL 35803
[illegible]	323 Mary Lee Dr Florence Al. 35634
Tommy E [illegible]	180 Yancy Rd MADISON, AL 35758
Joyce A. McAllister	3736 Co Rd 33 Stevenson, Al. 35772
Lisa [illegible]	12255 Lukers Way Athens, AL 35611
A. L. Haygood	114 Evergreen Drive Florence AL 35634
Thomas F. Newton	133 Parker Drive Florence, AL 35633
[illegible] Byrd	119 Matt Phillips Rd Huntsville AL 35806
[illegible]	603 Auburn Ave Huntsville, AL 35801
Ken Johnson	501 CO RD 54 Florence AL 35633
Diane [illegible]	135 CR 81 Florence, AL 35633
[illegible]	12104 Lukers Way Athens AL 35611
[illegible]	2201 Duncansby Dr SW Decatur, AL 35603
Rodney Briggs	200 Barnyard Blvd Florence, AL 35634
Deborah [illegible]	706 Ashley Dr. S.W. Decatur, AL 35601

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AN ASSESSMENT OF THE DRAFT CLWR EIS
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1(cont'd)

Signature	Address
Clyde H. Hensley	510 Jenkins Simpsonville, S.C.
Suzanne Sharp	1753 E Moore St Southport NC
Samuel J. Sharp	P.O. BOX 331 LEXINGTON AL
B. T. [illegible]	227 Harbor Drive P.O. Box 218 Spring City, TN 37381
Delford Johnson	6346 Bowling green rd Scottsville Ky 42164
Paul M. [illegible]	1 JASPER PROVIDENCE R I 02904
Daniel L. Armstrong	27 VARICK ST. OSWEGO, N.Y. 13126
David [illegible]	PO Box 3094 OSWEGO NY 13126
[illegible] Abbott	6461 Oak Ridge Rd, Vicksburg, MS 39180
David C. [illegible]	1201 Riverfront PKWY Chattanooga TN 37402
Frederick W. Griscello Jr.	2004 Lancaster Ave S.W. Decatur Al. 35603
Thomas L. Stockton	2520 MAHALA LN. CHATTANOOGA, TN, 37421
Robert J. Smith	5435 Ricks Lane Tuscumbia AL 35674
Hoy Allen	9534 Hy. 17 Flo. Ala. 35634
Michael G. [illegible]	103 2nd AVE S Loretto, Tn 38469-2122
Byron Mitchell	360 Point Rd. Muscle Shoals, AL. 35661
[illegible]	55 Co Rd. 317 Florence, Al 35634

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Commentor No. 147: Petition (Cont'd)

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1(cont'd)

Signature	Address
[illegible]	8927 S. East End Ave Chicago, IL 60617
Kenneth L. Flemming	222 So Kyser #84, Madison, AL 35758
David Weatherford	1135 East Jefferson St. Pulaski, TN. 38478
Barry D. [illegible]	2506 Spring Ave SW Decatur AL 35601
Richard [illegible]	114 Lighthouse Dr Downingtown PA & 10906 Douglas Dr. Athens AL
Cathy C. [illegible]	321 County Rd 97 Rogersville, AL 35652
[illegible]	11344 Crawford Rd. Athens, AL 35611
Pete Thompson	105 Park Terrace Sheffield Al 35660
Michael [illegible] Briggs	1206 Cantwell Ave SW Decatur Al 35601
Greg Ezell	522 County Rd 52 Anderson AL. 35610
David L. [illegible]	1347 Richmond Drive Melbourne FL. 32935
Earl Rutledge	1700 31st ST Sheffield, AL 35660
Angie Thorn	686 Brown Rd Danville, AL 35619
Walter [illegible]	1346 Water Tank Rd. Union Grove Al 35175
[illegible] R. Mitchell	775 Co Rd 489, Lexington AL 35648
Jim F. Mayfield	1701 Co Rd 122 lot 86 Florence AL 35634
Marilyn J. Swanner	1050 Harborview N.E. Decatur, Al 35601

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
Billy G. Gamble	1945 Caples Dr. Florence, Ala. 35630
William Howell	P.O. 25 Rogersville, Al. 35652
Donna T. Crunk	61 Kimberly St. Decatur, Ala. 35603
Randy Sumler	Rt. 2 Box 196B Corinth, Ms. 38834
Mike Cotton	9711 Hwy 72 west Athens Ala 35611
Willie J. Bailey	2561 County Rd 71 Killen, AL 35645
Terry A. Balch	15443 Arlington Rd Athens, AL 35611
[illegible]	80 Bridge Circle Killen Al 35645
Larry Walker	2900. RD 586 Rogersville Al. 35652
Kenneth R. Phelps	1247 Green Brook Ln. Hixson, TN 37343
Donald Finley	10268 Hwy 72 Russellville AL
Wayne Sletton	13000 Hwy 72 Rogersville, Al. 35652
Dwight Collier	210 Guntersville St Sheffield, Al. 35660
Julie Brown	13030 County Line Rd Muscle Shoals 35661
Jesse J. Bolden	208 Sanderson Rd. Meridianville, AL 35759
Jonathan Nuttall	615 Lake Six Rd Killen, AL 35645
Robert T. Shelton	600 County RD 470 Lexington AL 35648

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Signature	Address
William S. Law	5555 Weakley Creek Rd Lawrenceburg, TN 38464
Paula A. Slaton	21545 upper Ft Hampton RD Elkmont Al 35620
Larry W. Hester	1101 Buena Vista Muscle Shoals Ala 35661
Bobby N. Brewer	6695 Woodmont Dr Tuscumbia, AL. 35674
Wayne Andrews	294 Tubbs Road Russellville Ala 35654
Ronnie Miller	1501 Hwy 49 Russellville Al 35653
James L Coy	2313 Brighton St. SW. Decatur, AL. 35603
Walter H. [illegible]	19 Poplar Russellville, AL 35653
Terry G. Hanks	617 Hwy 4 Vina Al, 35593
Thomas Meadows	14247 Ellis Lane Lester, AL 35647
Bobby L. Peel	[illegible] Tanner, AL 35671
Richard K. Stump	108 County Rd 355 Florence AL 35634
Kenny [illegible]	10 S. Quail Dr Lawrenceburg, Tn 38464
Larry Pitman	1551 CR 450 Lexington, Al. 35648
Loring H. [illegible]	1214 Campground Cir. Scottsboro, Al. 35769
Billy Garrett	3401 Tarpley Shop Rd Pulaski Tn 38478
John [illegible]	100 Ben Franklin Cir Madison, Ala 35758

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Signature	Address
[illegible]	371 Leona Dr. Florence, AL 35633
[illegible]	P.O. Box 1535 Decatur AL 35602
Elizabeth White	920 W. Mobile St. Florence, AL 35630
[illegible]	102 Douglas St. Madison, AL 35758
[illegible]	2379 2nd Ave S.E. Cullman, AL 35055
Susan Camargo	9386 Poplar Pt. Athens AL 35611
[illegible]	1402 Edwards Muscle Shoals AL 35661
[illegible]	1700 Co Rd 76 Rogersville, Al. 35652
[illegible]	4290 Co Rd 76 Rogersville, Al. 35652
[illegible]	1014 [illegible] Madison, AL 35758
[illegible]	Flagstone Apt 215 Madison AL 35758
Billy R [illegible]	1423 Henderson Point Rd Tuscumbia, AL 35674
John M. Killen Jr.	262 Oakview Circle Killen, AL 35645
[illegible]	1902 Co Rd 124 Florence, Al 35633
[illegible]	1413 Martin Florence, Al 35630
[illegible]	15484 Curlissa Dr. Athens AL 35611
[illegible]	1378 County Rd 36 Killen AL 35645

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Signature	Address
[illegible]	Box 434 County Rd 442 Killen, AL 35645
T. R. Thompson	2303 East 6th St. Muscle Shoals, Ala 35661
[illegible]	774 W. Alabama St. Florence, AL 35630
[illegible]	12152 Co. Rd 47 Florence AL 35634
Vincent V. Pitt	190 Wayne Dr Tuscumbia al 35674
[illegible] Eaton	15139 7-Mile Post Rd Athens, al 35611
[illegible] Creasy	1035 Co Rd 142 Florence, Al. 35634
[illegible]	4810 Keith Rd Ringgold GA 30736
[illegible]	922 County Rd 425, Killen, Al. 35645
Thomas W. Kerr	15125 Hobbs Rd, Athens, AL 35614
Sandra K. Woody	521 Lawson St., Athens, AL 35611
[illegible]	18021 Cox Rd Athens, AL 35611
[illegible]	[illegible] Huntsville, AL [illegible]
[illegible]	232 Francis Dr Killen AL 35645
Michael [illegible]	249 CR 442 Killen Al 35645
[illegible]	617 South Tinde Street Florence Ala 35630

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1(cont'd)

Signature	Address
[illegible]	102 Jefferson St Florence Al 35630
Mark B. Sherrod	1701 E. 32nd St. Sheffield, AL 35660
Jack Watson	501 Shoal Creek Rd Hartselle, AL 35640
Mary Goodwin	P.O. Box 5025 Huntsville, AL. 35805
[illegible]	22131 [illegible] Dr Athens, AL 35613
[illegible]	6010 Dogwood Dr Harrison, TN. 37341
Robert L. Klym	9193 Hawkins Dr Athens AL 35611
[illegible] Turner	687 Cambridge Dr Madison, AL 35758
Donna Hardy	855 Raintree Drive Tuscumbia Al 35674
[illegible]	106 Brady St Tuscumbia Al 35674
James H. Johnson	1703 Iris St. SW Decatur AL 35601
James A. Johnson	1210 [illegible] Av SW Decatur AL 35601
[illegible] O'[illegible]	220 Cedar Ln. Killen, AL 35645
Gary M. Connor	1310 Runnymead Ave SW Decatur, AL 35601
Danny Bohlender	3308 Cedar Cove SW Decatur, AL 35603
[illegible]	205 Sunset Dr. Athens AL. 35611

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1(cont'd)

Signature	Address
Delbert V. Little	25343 Maplewood Dr, Athens AL 35611
Dennis Mayfield	205 Marbelaze Dr, Florence, AL 35630
Judy Evans	16559 Evans Rd. Athens, Al 35611
Lorinda M. Gooch	109 Fox Run Florence, Al. 35633
[illegible] C. Pettit	4407 Danville Rd, Decatur Al. 35603
John H White	130 Christopher Circle Athens Al 35611
Jimmy Hudgins	1612 7th Ave SE, Decatur AL 35601
Deborah Brown	3282 County Rd 50 Rogersville, Al 35652
[illegible]	201 N.E. Commons Tuscumbia, AL 35674
Jerry [illegible]	2028 Lancelot Dr Decatur, Al 35603
A. D. [illegible]	891 Moontown Rd Brownsboro, Al. 35741
Elaine Reece	206 [illegible] Drive Athens, AL 35611
Stephen K. Hogan	349 County Road 396 Killen, Alabama 35645
Ronald W. [illegible]	7792 Co. Rd 136 Town Creek AL 35672
[illegible]	164 Cove Court Florence, AL 35634
George J. Ballew	3202 Sweetbriar Road SW, Decatur AL 35603

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1(cont'd)

Signature	Address
John E. Williams	1125 County Rd 66 Anderson AL 35610
[illegible]	25535 Copeland Rd Athens AL 35613
Roy [illegible]	271 Ridge Rd Killen, Ala. 35645
[illegible] B. Cole	1636 Iron Man Rd. Hartselle, Ala. 35640
[illegible]	606 Richton Ave Muscle Shoals AL
[illegible]	1404 Parsons St Sheffield Al.
[illegible]	820X County Rd #25 Killen Al 35645
[illegible]	3849 County Rd 47 Florence Al 35630
[illegible]	212 Britt St Florence AL 35633
[illegible]	1962 Caples Dr, Florence AL 35630
Edward [illegible]	9900 upper Snake Rd Athens Ala 35614
Ronald [illegible]	614 Butler Mill Rd Woodville AL 35776
[illegible]	2402 Tanner Dr Hartselle, al 35640
[illegible]	607½ Winchester Rd Huntsville Al 35811
[illegible] Black	800 Vaughn BDG RD Hartselle Al 35640
[illegible]	141 Riverchase Dr Florence, AL 35634

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1(cont'd)

Signature	Address
[illegible]	1407 Alpine St SE Decatur AL
[illegible]	865 Cty Rd 144 Killen, Al 35645
[illegible]	3172 Co. Rd. 33 Killen Al 35645
Thomas E. [illegible]	175 Hardy Rd Pulaski TN 38478
[illegible]	2044 Co Rd 8 Florence Al 35633
Wayne [illegible]	104 Big Oak Circle Madison, Al. 35758
Edward G. Brown	314 central ave Muscle Shoals 35661
[illegible]	P.O. Box 836 Killen, AL 35645
[illegible] Black	17375 Martin Dr. Athens Al. 35611
[illegible]	816 Smith Ave. Decatur Al. 35603
[illegible]	11438 Hwy. 64 East Lexington Al. 35648
[illegible]	582 Co. Rd 107 Killen AL 35645
Curtis W. Killen	344 Wilson Dam Rd Florence, Alabama 35630
[illegible]	491 Meadow Grove Lane Florence, AL 35633
[illegible]	200 James St Muscle Shoals Al. 35631
[illegible]	1045 CR 411 Killen, AL. 35645

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1(cont'd)

Signature	Address
Keith McCarley	1315 Roan Rd N.E., Hartselle, AL 35640
Cecil Pace	906 E. Moss Ave Muscle Shoals Al 35661
David A. Watts	713 West Lakeside Florence AL 35630
[illegible] Hall	495 County Road 564 Rogersville AL 35652
Julian Bass	P.O. Box 114 Rogersville AL 35652
[illegible]	[illegible] Cherokee Ala 35616
Sharon Tidwell	P.O. Box 474 Killen, Al. 35645
W E Walden	#40 Betsy Ross Lane Florence Ala. 35633
Stacy K. Reid	100 Ben Franklin Cir. Madison, AL 35758
[illegible] Butler	P.O. Box 836 Killen AL 35645
Jimmy W. Taylor	675 Starnes Loop Rd Grant, AL 35747
Steve Kimbrough	135 Oliver Dr. Tuscumbia, Ala. 35674
Robert McClure	4861 Chisholm Road, Florence, AL 35634
Dennis McMurtrey	5505 County Rd. 25 Killen, AL 35645
Loretta J. Pardue	463 Hwy 364, Tishomingo, MS. 38873
Theron Dawson	70 [illegible] Rd Leighton AL 35646

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1(cont'd)

Signature	Address
Michael W. Gamble	2259 Co. Rd. 33 Scottsboro, AL
William [illegible]	103 Gant Hill Road Scottsboro, AL
[illegible]	P.O. Box 85 Pisgah, AL
Wanda F. McCutchen	P.O. Box 434 Bridgeport, AL
Charles L. [illegible]	2194 Co Rd 209 Bridgeport, AL
[illegible]	3041 Co Rd 58 Pisgah AL 35765
Vella D. [illegible]	100 Co Rd 584 Stevenson, AL 35772
Jimmy K. Dicus	55 Co Rd 321 Scottsboro, AL. 35768
Billy R. Newman	P.O. Box 532 Bridgeport, AL 35740
Robert E. Lowe	180 Jewell Ln. Whitwell TN 37397
Randy Turner	P.O. Box 316 Valley Head, AL. 35989
[illegible]	P.O. Box 1005 Bridgeport, AL 35740
[illegible]	1334 Main [illegible] Chatt., Tn 37421
[illegible]	P.O. Box 436 Stevenson Ala. 35772
Dewey Holifield	111 Sharon Dr. Stevenson, AL 35772
Morgan C. Thomas	P.O. Box 377, 550 Co Rd 66 Section, AL 35771
[illegible]	298 Co Rd 275 Bridgeport Al 35740

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We, the undersigned, have reviewed the draft Environmental Impact Statement (EIS) for the production of tritium in a Commercial Light Water Reactor (CLWR) dated August 1998. We find the proposed tritium production program to be environmentally safe and to produce no measurable health effects. In addition, we conclude that Bellefonte Nuclear Plant should be named in the EIS as the preferred alternative based on its least life cycle cost to the U. S. taxpayer and the positive socioeconomic effects of the project. A summary of the primary points from the draft EIS used to reach this conclusion are shown on the attached pages.

1(cont'd)

Signature	Address
[illegible]	730 Germantown Cir. Apt 613 East Ridge, TN 37412
[illegible]	8908 Chimney Point Knoxville TN 37922
[illegible]	1622 Brandi Ln Hixson TN 37343
[illegible]	121 Hendricks Blvd Apt 2 Chattanooga TN 37405
[illegible]	189 Water Oak Dr.; Madison, Ala. 35758
[illegible]	6512 [illegible] Dr, Hixson, TN 37343
[illegible]	6601 Dandy Dr Chattanooga TN 37421
Wm. J. Kagay	7704 Ridge Bay Dr., Hixson TN 37343
[illegible]	6605 Harvest Run Dr., Harrison, TN 37341
Wayne L. Smathers	37859 Hwy 95 N, Greenback, TN 37742
Louis R. Nichols	1275 Leaside Ln, Hixson, TN 37343
George P. Tallent	318 Union St Sale Creek, Tn 37373
Linda I. Hill	10005 Dixson Pk., Soddy-Daisy, Tn 37379
Paul R. Hill	" "
Timothy M. Griffith	326 N Knob Creek Rd, Seymour TN 37865

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

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1(cont'd)

Signature	Address
[illegible] Rogers	16721 E. Glenn Valley, Athens, AL
U. N. Shah	14014 Maebeth Dr. Hsv. AL.
[illegible]	2309 Richmond St, SW, Decatur, AL
[illegible]	69 Aqua Vista Dr, Killen, al
[illegible]	13[illegible] Stoney [illegible] Tr, Madison AL [illegible]
Sharon [illegible]	P.O. Box 354 Rogersville, AL 35652
D. L. Matthews	15283 Hobbs Road, Athens, AL 35614
B. W. Garner	8509 Snake Rd., Athens, AL 35611
Louis C. Eichenberger	2306 Quince Dr, SE Decatur, AL 35601
[illegible]	22422 Easter Ferry Rd, Elkmont, AL 35620
[illegible]	2242 Westmeade Dr., Decatur, AL 35603
[illegible]	25079 [illegible] Rd Lester, AL 35647
David O. Elkins	22218 Chickasaw Dr. Athens, AL 35613
[illegible]	1403 Henry Dr, Athens, AL 35611
M Ballard	3312 Cedarhurst Dr SW Decatur AL 35603
Charles K. Dollar	701 Henry Drive, Athens, AL 35611
W. McCall	12271 Lakers way, Athens, AL 35611

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
FOR
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1(cont'd)

Signature	Address
[signature]	903 Jessie Dr, SW Decatur, AL 35603
Joseph S. Germain	113 Daniel St SW Decatur, AL 35601
Jeffrey E. Miskell	1787 Hwy 207 Rogersville AL 35652
[signature] Butler	4041 County Rd 26 Rogersville, AL 35652
[signature]	311 [illegible] Decatur, AL 35603
Marie C. King	208 Roosevelt Av Muscle Shoals Al 35661
Bridgett B. Harding	6220 North Pike Cherokee, AL. 35616
Donnie L. Church	106 Lagrange Muscle Shoals Al 35661
[signature]	2525 S Aspen Springfield Mo 65807
Gary W. [signature]	1708 Granddaddy Rd Lawrenceburg TN. 38464
Danny Dodd	116 Royal Oak Rd. Florence, AL 35633
William L. Taylor	692 Co. Rd. 1474 Cullman Al 35058
Louis E Hartzog	Rt #1 Box 381 Killen Al 35645
Stanley R Wallace	476 Roy Richardson Drive Greenhill, AL 35645
[signature]	61 Kimberly St. SE Decatur, Al 35623
Roger [signature]	330 Walnut Creek Lk Killen AL 35645

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
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1(cont'd)

Signature	Address
Randall L. Hartwig	1910 Cumberland Av. SW, Decatur, AL 35603
[signature]	2223 Victoria Dr Decatur, AL 35603
Dwight [signature]	1544 Coffman Springs Rd LaFayette, GA 30728
[signature]	63 Clearmore St. Springfield, MA [illegible]
[signature]	Knutsvägen 9NB 72352 Västerås Sweden
[signature]	[illegible]
[signature]	1408 Cumberland St Dr, Hixson TN 37343
J. Lewis	118 Jay Drive Madison AL 35758
[signature]	[illegible]
E.B. [signature]	604 N Valley Dr Chattanooga TN 37415
[signature]	1315 Perkins Wood Rd Hartselle AL 35640
T. E. Hartwig	631 [illegible] Drive, Hartselle, Al 35640
[signature]	2213 Inverness Ln. Decatur, AL 35603
Kevin T. [signature]	106 Autumn Oak Ln Harvest AL. 35749
J. [signature]	207 [illegible] Drive Florence, AL 35630

4

Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
[illegible]	2222 Essex Dr SW Decatur, AL 35603
[illegible]	2305 Warwick Ave SW, Decatur, AL 35603
[illegible]	130 Billy Lee Rd OXR, AL 35763
[illegible]	320 Poplar Springs Dr. Killen, AL 35645
[illegible]	101 E. Meadow Hill Dr. Florence, AL 35633
[illegible]	102 Shady Ln Athens, AL 35613
DeLana Walton	2128 Mackey St, Rogersville, AL 35652
[illegible]	9754 Barker Rd Athens AL 35614
[illegible]	2503 Chesley Ave SW Decatur AL 35603
[illegible]	613 Courtland Ave Muscle Shoals AL 35661
[illegible]	410 Madison St Muscle Shoals, Ala. 35616
[illegible]	530 Poplar Springs Dr, Rogersville, Al 35652
[illegible]	138 Heatherwood Dr., Madison, AL 35758
[illegible]	P.O. Box 684 Athens, AL 35612
[illegible]	905 Garrett Dr. Athens, AL 35611
[illegible]	1802 Canton Cir. SW, Decatur, AL 35603-3160
[illegible]	222 Pin Oak Dr, Madison AL 35758

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
[illegible]	[illegible] AL 35613
[illegible]	1021 Horizon Lane Huntsville AL
[illegible]	22217 Chickasaw Dr; Athens, AL 35613
Daniel A. Simmons	400 Meadowbrook Dr. Huntsville AL 35803
[illegible]	P.O. Box 684 Athens, AL 35612
[illegible]	PO Box 195 RT 6 Decatur, Al 35603
[illegible]	[illegible]
[illegible]	[illegible] Decatur AL [illegible]
[illegible]	2003 New Center Rd. Somerville AL 35670
[illegible]	2901 Huntwood Dr. Decatur AL 35601
[illegible]	3001 Aurelia Dr. Madison, AL 35757
[illegible]	1417 Grant St. SE Decatur, 35601
[illegible]	P.O. Box 1057 Killen AL 35645
[illegible]	21286 [illegible] Loop Elkmont AL 35620
[illegible]	16633 Zehner Rd Athens AL 35611
Robert Mears	13485 New Cut Rd Athens, Al 35611
[illegible]	20 [illegible] Pvt. Dr. Decatur, AL 35603

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Commentor No. 147: Petition (Cont'd)

**AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
[signature]	STC-1I SQN
[signature]	PSC 1F-M MS
Mary E. McKnight	PSC 1F-M

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Commentor No. 147: Petition (Cont'd)

**FOR
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Signature	Address
Sonya D. Worden	4WAR 1A-MS
Brenda Holly	WAR 1A-MS
[signature]	2106 Bay Pointe Dr, Hixson TN 37343

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Signature	Address
Patricia Zbulita	1311 Dickens Lane Madison, AL 35756
Marie Kovak	1015 Townview St. Decatur, AL 35601
Kara Logston	320 Julie Dr. Lexington, AL 35648
[illegible] Ray Bearley	2220 Chimney Hill Dr Soddy-Daisy, TN 37379

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Signature	Address
Chris W. McCormick	183 Ellis Rd Trenton, Ga. 30752
Mark D. Bruning	1020 Victoria Ave Jasper TN 37347
Gary E. [illegible]	1402 Highcrest Dr Hixson, TN 37343
GREGG S. HAWKINS	665 HENLEY COVE RD 37380
Ronny Holt	212 - 167 Co Rd. Section AL 35771
William E. Sprinkle Jr	P.O. BOX 217, BRIDGEPORT, AL 35740
David J. [illegible] Jr.	123 WOODLAWN DR., BRIDGEPORT, AL 35740
Sharon L. Beavers	2397 Hwy 156 South Pittsburg, TN 37380
John W. Brock	7207 N. CHESTFIELD LN. HIXSON TN 37343
Wesley McGill	1908 [illegible] Dr. Chatt. TN 37421
Warren W. [illegible]	991 Hancock Rd., Jasper, TN 37347

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Signature	Address
[illegible]	572 New Union Cl. Dayton, TN. 37321
[illegible]	2337 Chimney Hill Dr. Soddy-Daisy TN 37379
Terry S. Orr	1845 Bay Hill Drive, Hixson, TN 37343
Teresa D. Chapman	8933 Lazy River Drive, Harrison, TN 37341
[illegible]	8260 Oxford Dr., Hixson, TN 37343
[illegible]	3628 Waucheea St, Chattanooga, TN 37406
John Thomas	7807 Haverton Crossing, Hixson TN 37343
[illegible]	5705 Moody Sawyer Rd, Hixson, TN 37343
[illegible]	9421 Shadow Point Circle Chattanooga TN 37421
[illegible]	169 Richeson Rd Sweetwater TN 37874
[illegible]	759 Highland Dr Dayton TN 37321
[illegible]	6419 Sea Haven Drive Hixson TN 37343

Commentor No. 147: Petition (Cont'd)

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Signature	Address
Carol J. Wukes	TVA (LP 5N-C) 1101 Market St. Chattanooga, TN 37401

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Signature	Address
Stephen L. Keever	MR 2T-C

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Signature	Address
Sonja B. Newton	4WAR 1A-MS
Brenda Holly	WAR 1A-MS

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Signature	Address
Haife	637 Battery Pl #7 Chatt. TN 37403

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Signature	Address
J.L. Burkhardt	ADM IL-WBN
Richard [illegible]	8901 [illegible] Circle [illegible] TN 37379
[illegible]	155 [illegible] Street, Dayton TN 37321
[illegible]	ADM IL-WBN
[illegible]	ADM IL-WBN
M. DeWayne Davis	11135 Crown Point Drive, Knoxville, TN 37922
S. D. Hudson	ADM IL-WBN
[illegible]	ADM IL-WBN
Paul [illegible]	ADM IL-WBN

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1(cont'd)

Signature	Address
[illegible]	8235 Blue Spruce Dr Hixson TN 37343
Larry M Bezley	813 Fox Chase Ln. Hixson TN 37343
Rebecca L. Evans	8236 Blue Spruce Drive Hixson, TN 37343
Navin S Shah	1295 Leaside Lane Hixson, TN 37343
[illegible]	1711 Rock Bluff Rd Hixson TN 37343
[illegible]	1115 E. Woodshire Dr, Knoxville, TN 37922-5651
[illegible]	6424 Lake Shadows Cir. Hixson, Tenn. 37343
[illegible]	5603 Cold Springs Rd Hixson TN 37343
George R Bell	1948 Light Tower Cr. Hixson, TN 37343
Stanley R Parsons	2630 Poe Rd, Soddy-Daisy, TN 37379
[illegible]	2709 Autumn Chase Dr, Chattanooga TN 37421
[illegible]	9670 Lovell Rd Soddy [illegible]

4

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1(cont'd)

Signature	Address
[illegible]	[illegible]

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Signature	Address
Delores P. Walker	#1 3617 N. Crestview Dr. Huntsville, AL 35816
Johnny Whisenant	922 Rocky Branch Dr. Guntersville, AL 35976
Joseph E. Wheeler, Jr.	1204 Brandywine Ln. SE. Decatur, Al 35601
[illegible]	601 Dogwood Dr Decatur AL 35603
[illegible] Gilbert	3530 Meadows Rd Decatur, AL 35603

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AN ASSESSMENT OF THE DRAFT CLWR EIS
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Signature	Address
[illegible]	319 Harris Dr. Florence Al. 35634
Raymond Wright	3203 Trails End Decatur Al 35603
M. [illegible]	2118 Sky Park rd Florence AL 35634
Douglas C. Dyer	610 Martha St SW Decatur AL 35601
[illegible]	8304 Island Point Dr. Harrison TN 37341
Gerald Lowery	9425 Shadow Pt Cr Chattanooga, TN 37421
[illegible]	306 Honeysuckle Pt. Dr. Hartselle AL 35640
Donald B. Ricketts	22221 East Yorkshire Dr. Athens, AL 35613
[illegible] Burrell	4502 Autumn Lake Tr Decatur AL 35603

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1(cont'd)

Signature	Address
[illegible]	2216 Lynn Rd., Huntsville AL 35810
[illegible]	26897 Poplar Dr Athens, Al 35613
Clifford Williams	P.O. Box 124 Belle Mina, ALA. 35615
Willard E. [illegible]	23 Orchard Hill Rd, Fayetteville, Tn. 37334
John K Allen	255 County Road 470 Lexington Al. 35648
[illegible] R. Martin	3315 Co. Rd 93 Anderson AL 35630
Larry W. [illegible]	464 Co Rd 168 Killen ALA 35645
[illegible]	631 Oak View Circle Killen, AL 35645

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1(cont'd)

Signature	Address
[illegible]	574 Wheeler Rogersville Al
[illegible]	1763 Co Rd 257 Town Creek AL
Emmett King Jr	3011 Fort Ave Muscle Shoals al.
Jimmie Brewer	144 Co. Rd 1227 Vinemont Al
[illegible]	Rt 5 P.O Box 173 Rogersville Al
[illegible]	21956 Al Hwy 127 Elkmont Al
[illegible] Hall	101 School Cutoff Rd. Jacksonville Ala.
[illegible]	748 [illegible] Rd. Scottsboro, AL.
James [illegible]	8370 Co. Rd. 214 Trinity, AL.
[illegible]	713 Slack St Gadsden AL
James W. Rouse	17611 Nuclear plant Road Athens Ala
Owen Ezell	239 Rose Rogersville, Al 35652
Robert McAfee	1927 Pisgah Ridge Rd Pulaski, Tn 38478
[illegible]	1340 C. [illegible] Road Leighton Al 35646
[illegible] Harrison	1323 Co. Rd. 134 Town Creek AL 35672
Vickey Kelly	538 Co. Rd. 175 Florence, AL. 35634
William T. Weldon	2145 Co. Rd. 38 Hanceville ala 35077
Kenneth [illegible]	109 Strong Lane, Gurley, AL. 35748

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Commentor No. 147: Petition (Cont'd)

TVA TODAY UPDATE

Friday, September 18, 1998

Language Dropped That Blocked TVA Tritium Production

A House-Senate conference committee in Congress has agreed to drop language that would have blocked a plan to produce tritium at Bellefonte Nuclear Plant.

The Department of Energy has been directed to provide tritium to the Department of Defense by 2005. DOE is considering the production of tritium either at Bellefonte or at a proposed linear accelerator at DOE's Savannah River site in South Carolina.

The House of Representatives had included language in its version of this year's defense-authorization bill that would have prohibited using a commercial reactor such as Bellefonte's for tritium production.

Chairman Crowell issued the following statement today:

On behalf of the TVA Board, I deeply appreciate the hard work of members of the Valley congressional delegation to keep TVA's Bellefonte Nuclear Plant as an option to produce tritium. This roadblock has been cleared because of their hard work and leadership. Bellefonte remains in the competition, and it could not have been done without them. 1(cont'd)

Bellefonte is truly the best option because it:

- Saves taxpayers at least $4 billion when compared to the accelerator option, according to the Congressional Budget Office.
- Maximizes TVA's $4-billion investment in the plant.
- Creates 700 permanent jobs and hundreds more indirect jobs. That's not including the additional construction jobs at the plant.
- Uses a proven technology that is safe and environmentally friendly.
- Meets DOD requirements for national defense.

Completing Bellefonte is consistent with TVA's policy of only finishing a nuclear plant if we have a partner. Today, because of the help of the Tennessee Valley Delegation, we are one step closer to making that happen.

Tritium is an isotope of hydrogen that is required by all U.S. nuclear weapons. Because it decays at a rate of about 5 percent per year, it must be replaced periodically. The United States has not produced tritium since 1988, when the last tritium-production reactor was shut down at the Savannah River site.

TVA Today is a daily source of information for TVA employees. Please send items or ideas to Dan Adair in Employee Communications by e-mail (Microsoft Exchange), fax (423-632-7902) or interoffice mail (ET 6E-K), or call him at 423-632-8054.

Page 1

Commentor No. 147: Petition (Cont'd)

AN ASSESSMENT OF THE DRAFT CLWR EIS
FOR
TRITIUM PRODUCTION AT BELLEFONTE NUCLEAR PLANT

We, the undersigned, have reviewed the draft Environmental Impact Statement (EIS) for the production of tritium in a Commercial Light Water Reactor (CLWR) dated August 1998. We find the proposed tritium production program to be environmentally safe and to produce no measurable health effects. In addition, we conclude that Bellefonte Nuclear Plant should be named in the EIS as the preferred alternative based on its least life cycle cost to the U. S. taxpayer and the positive socioeconomic effects of the project. A summary of the primary points from the draft EIS used to reach this conclusion are shown on the attached pages. 1(cont'd)

Signature	Address
[signature]	60 Trottenham Rd. Killen Al 35645
Keith McClanahan	204 Phillips Drive, Killen Ala 35645
[signature]	321 Nottingham Rd, Florence, Ala 35633
[signature]	409 Congress Dr, Athens, AL 35611
[signature]	15066 Fielding Rd Athens, AL 35611
[signature]	17259 Gloze Rd. Athens AL 35611
Tommy Parrish	10910 New Cut Rd Athens ALA. 35611
[signature]	14226, Section Line Rd, Elkmont AL 35620
Mike A. [signature]	275 Woodcastle Dr. Florence AL, 35630
[signature]	1121 McCullough Dr Huntsville, AL. 35801
[signature]	1911 County Rd 28 Florence AL 35634
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[signature]	701 Sylvan Drive Rockwood, TN 37854

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Signature	Address
William H. Gorman (WILLIAM H GORMAN)	ANT-IA-NST
Jerry W. White	SUB-IA-CLT
[illegible]	ANT-IA-NST
[illegible]	CUF IA-CCT

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Signature	Address
Randy Beaty	700 La Ann Ct Antioch, TN 37[illegible]
[illegible]	105 T Court Circle Dover TN 37[illegible]
Charles W. [illegible]	163 Timbertop Drive Dover Tn 37058
John M. Smith	715 Kleeman Dr. Clarksville, Tn 37[illegible]

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1(cont'd)

Signature	Address
Dennis L Heineman	86 Ruth Lane Ringgold Ga 30736
[illegible]	5611 Sawyer Rd Signal Mtn TN 37377
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David T. Hicks	694 Charbell St. Hixson, TN 37343
[illegible]	6221 Shallowford Road # 81, Chattanooga TN 37421
[illegible] W. McDowell	1906 Oak Cove Dr Soddy Daisy TN 37379
[illegible] E. [illegible]	8810 Havendale Lane, Chatt, TN 37421
H. David Anderson, Jr.	6286 White Tail Dr, Ooltewah, TN 37363
Frank E. Perry	1803 Pine Needles Tr, Chatt, TN 37421
[illegible]	6510 Hunt Drive Chattanooga TN 37421
S. Michael Snell	4528 Kings Lake Ct, Chattanooga, TN 37416
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Richard L Bryson	5434 Poplar Springs Rd, Ringgold GA 30736

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

Commentor No. 147: Petition (Cont'd)

Louvain, from
Watts Bar Group 501
Amington
10/6/98

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1(cont'd)

Signature	Address
James S. Amington	EQB 2N-WBN
Larry L. Hall	EQB 2N-WBN
Gary T. Jordan	EQB - 1F- WBN
Jimmy L. Pierce	EQB-2N-WBN
W D Webb	EQB 2N - WBN
d.K. Bryant	EQB1F -WBN
[illegible]	EQB - 2N-WBN
L E Perry, Jr.	EQB - 2N-WBN
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R. A. [illegible]	EQB 2N-WBN
[illegible] C Walker	EQB-1F -WBN
Edward [illegible]	EQB-1F WBN
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Howard D Kononowski	EQB-2N-WBN
Gwen J. Barnfield	EQB - 1M - WBN
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Julio Gomez	EQB-2N-WBN

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Signature	Address
C.M. Key	EQB IF WBN
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Nicholas C. Horning	EQB IF-WBN
S. Paul Harlan	EQB-1F Watts Bar Nuclear
T.L. [illegible]	EQB-1F WBN
Maurice L. Young	EQB-2N WBN
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[illegible]	EQB-1F WBN
[illegible]	EQB-1F WBN
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[illegible]	EQB-1F WBN
[illegible]	EQB 1F WBN
[illegible]	EQB 1F WBN
Johnnie K. [illegible] Jr.	EQB 1M WBN
[illegible]	[illegible]
Sharon A. [illegible]	EQB 2N WBN

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Commentor No. 147: Petition (Cont'd)

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Signature	Address
Robert L. Colbert III	EQB 2N-WBN
[illegible] W. [illegible]	EQB 2N-WBN
Patrick E. Donahue	EQB 2N-WBN
James R. [illegible]	EQB 2N-WBN
Ernest T. Hart	EQB 2N-WBN
Kendrick Ware	EQB 2N-WBN

Return Petition to Louvain Edmondson, OPS 2B - SQN, by October 6, 1998

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Public Hearing – North Augusta, South Carolina
October 1, 1998

Commentor 500 (Bob Smith)

1/09.08 The commentor asks whether the schedule for completing construction of the Bellefonte Nuclear Plant Unit 1 (1999 to 2004) is hypothetical or real.

2/03.02 The commentor believes there is a logical disconnect between the Bellefonte 1 completion schedule (1999 to 2004) and the Presidential requirement to establish a tritium supply source by 2005. The commentor asserts that, if a one-year delay in the schedule occurs as a result of planned additional technology assessments or budget constraints, the Bellefonte Nuclear Plant would not be capable of meeting the Presidential requirement for two years because the irradiated tritium targets would not arrive at the Savannah River Site until 2007.

3/24.05 The commentor asks how a one-year delay in completing construction at Bellefonte 1 would impact the schedule to complete the Tritium Extraction Facility by 2005.

Commentor 501 (Lee Poe)

1/04.01 *[In response to a DOE statement that using a commercial light water reactor (CLWR) for tritium production is "technically straightforward and safe"]* The commentor asks if DOE takes the same position on the Accelerator Production of Tritium (APT) option.

2/05.04 The commentor asks if DOE would spend all of the money necessary both to design the APT and to complete reactor construction if either were designated as a backup source for tritium production. The commentor states that the information on the primary and backup tritium sources is difficult to understand—particularly the elements DOE requires for a facility and a backup and what that really means to public citizens.

3/23.14 The commentor asks to know the total costs to complete commercial reactor construction for use both as a primary and a secondary (backup) production source, including the Tritium Extraction Facility.

4/04.03 The commentor requests charts summarizing and comparing the environmental effects of CLWR tritium production with those of the APT and the Tritium Extraction Facility.

5/05.02 The commentor believes the CLWR Draft Environmental Impact Statement (EIS) summarizes the environmental effects of the proposed action, gives a very high level summary of the No Action Alternative, and "fixes it" so citizens will have a "very tough time" trying to understand what is being proposed. The commentor states that it is very difficult to understand the decisions that DOE is talking about, particularly when the EIS does not provide the reader with the no-action effects and merely tiers them off to some other document.

6/05.29 The commentor is concerned that the CLWR Draft EIS states that a CLWR Final EIS will be issued in December 1998, but the speaker mentioned January as a target date. The commentor postulates that, as a Secretarial decision is expected at about the same time that the CLWR Final EIS is issued, a decision already must have been reached. The commentor suggests that either DOE should not spend the money to write the CLWR Final, APT, and Tritium Extraction Facility EISs because their completion will not affect the decision, or DOE should work to make the Final EISs worthwhile. The commentor would like to see the CLWR, APT, and Tritium Extraction Facility EISs combined into one document.

7/06.03 The commentor postulates that: (1) having received only two responses to their request for proposals, DOE made the decision to build tritium-producing burnable absorber rods (TPBARs) for use in pressurized water reactors only, not boiling water reactors, which "cuts the territory down," and (2) this justified listing the five Tennessee Valley Authority (TVA) reactors in DOE's approach and excluding all others from the EIS analysis. The commentor asks why DOE analyzed all the pressurized water reactors not covered by the DOE/TVA proposal.

8/24.01 The commentor questions whether use of the TVA system is reasonable if DOE and TVA can't communicate with each other effectively. The commentor suggests an interagency discussion would help fulfill DOE's need to produce tritium.

9/03.03 The commentor states that the numbers of TPBARs cited by the CLWR Draft EIS clearly suggest DOE will use two or more reactors for tritium production.

10/19.04 The commentor states that, according to the numbers given in the CLWR Draft EIS, the TPBARs will release tritium at a rate of less than 22,780 Curies per year, not the 1,890 Curies per year cited.

11/19.05 The commentor questions why DOE would want to run the Tritium Extraction Facility furnaces within the top 90 percentile of their maximum temperature. The commentor states that there is no data in the EIS that addresses recovery efficiency in the Tritium Extraction Facility.

12/23.15 The commentor questions the fairness of giving the Bellefonte plant a significant credit for the sale of electric power, but not giving similar credits to the APT and the other reactors for revenue returns. The commentor points out that if it takes more than one reactor, the cost of using Bellefonte together with one or more CLWRs should be combined, and the costs and revenue returns of the CLWR option should be compared with those of the APT option.

13/23.16 The commentor proposes a cost document be appended to the CLWR Final EIS. The commentor states that a comparison of the costs for all the options should be available somewhere, if not in the Final EIS.

14/01.04 The commentor suggests appending the Interagency Review to the CLWR Final EIS. The commentor agrees that CLWR tritium production is not illegal because tritium is not a special nuclear material. The commentor believes the United States should abide by both the legal and technical implications of its actions and not try to set examples that will be misinterpreted by outside nations.

15/01.09 The commentor believes that weapons production and power generation should not be combined because it would set a precedent that would negatively affect U.S. nonproliferation objectives.

16/01.10 The commentor believes that CLWR tritium production is not illegal, but is morally wrong.

Commentor 502 (Dick Reynolds)

1/06.03 The commentor asks if TVA has withdrawn the irradiation services part of their bid. The commentor asks whether TVA will reconstitute their offer to provide irradiation services for DOE tritium production.

2/03.02 The commentor asks for confirmation that DOE would use the Watts Bar Nuclear Plant if there were any delays in completing Bellefonte for tritium production.

Commentor 503 (Gary Stooksbury)

1/01.04 The commentor believes the actions proposed in the CLWR Draft EIS will undermine the twin *[U.S.]* objectives of establishing a supply of tritium for national defense purposes and preventing the spread of nuclear weapons technologies and materials throughout the world. The commentor believes the Interagency Review that examined the impact of CLWR tritium production on U.S. nonproliferation objectives was flawed in its logic, vague in its conclusions, and erroneously implied that previous conversion of U.S. weapons facilities to civilian applications should make it easy to do the reverse. The commentor believes a worldwide outcry will result if the United States backs away from its strong nonproliferation stance and, in the end, the CLWR tritium production option will be abandoned after damaging the United States' international image and causing adverse impacts on the nuclear stockpile.

2/21.06 The commentor believes there are significant uncertainties that will affect TVA's ability to license a commercial light water reactor for tritium production, including public concern over new safety and environmental hazard and public discomfort with the proposal to commingle military and civilian reactor purposes. The commentor believes there is no insurance that the U.S. Nuclear Regulatory Commission (NRC) will issue a license or a license amendment for this endeavor and, if not, this would cause the CLWR option to be abandoned and would result in adverse impacts on the nuclear stockpile.

3/23.02 The commentor believes DOE has significantly underestimated the costs associated with the CLWR option and that these estimates should be subjected to an independent third-party review.

4/23.17 The commentor states that the CLWR Draft EIS discussed the use of TVA's Watts Bar and Sequoyah nuclear facilities, yet it is widely reported that TVA has withdrawn those facilities. The commentor states that DOE cites the TVA estimate of $2.4 billion to complete Bellefonte 1 and questions TVA's ability to bring anything on line, on time, and under budget. The commentor states that another nuclear facility has estimated that over $4 billion would be required to complete Bellefonte and that the Government Accounting Office says that TVA's estimates are very unreliable—past overruns of several hundred percent were experienced at plants that TVA assessed to be 80 percent complete.

5/09.09 The commentor states that, as someone who grew up in the shadows of Watts Bar and remembers reading the newspaper articles and what it took to bring that facility on line, he is appalled that DOE would even discuss Watts Bar.

6/23.20 The commentor believes that capital costs for the Bellefonte reactors will be significantly more than for the APT and that life cycle costs will be comparable.

7/04.01 The commentor believes there are no programmatic advantages related to the CLWR option and that, instead, it has serious, if not fatal, deficiencies.

8/05.07 The commentor believes the CLWR EIS must include analyses of the potential worldwide environmental impacts resulting from a higher probability that some nation will initiate or continue nuclear weapons research testing and production programs as a result of U.S. CLWR tritium production.

9/15.07 The commentor requests the CLWR EIS human health effects analyses to fully explain the basis for assuming that 10 percent of the tritium released from the melted targets will be in an oxidized form within the contaminated atmospheres. The commentor believes tritium may be available in the contaminated atmosphere and may be released to the environment. The commentor requests that the EIS analyses quantify the estimated release and the environmental effect; address the disposition of tritium remaining in the reactor facility; and address the environmental impacts associated with disposition of all tritium released in a design-basis accident.

10/05.05 The commentor believes the CLWR Draft EIS does not evaluate the environmental impacts of all the program options under consideration.

11/03.03 The commentor asks for information concerning how many reactors DOE/TVA plans to use for tritium production. The commentor also asks for information about the specific TPBAR design and fuel site that DOE says would allow one reactor to make three kilograms of tritium per year, and how they are different from those described in the CLWR Draft EIS. The commentor believes that if a one-reactor option is being considered, then the EIS should be corrected to describe and analyze the appropriate TPBAR design and fuel site. If two or more reactors are needed, then DOE's program and budget planning needs to reflect that fact.

12/23.18 The commentor states that the Congressional Research Service review raises a serious question about the ability of Bellefonte to generate sufficient revenue to offset operating costs, much less amortize construction.

Commentor 504 (Peter Gray)

1/01.09 The commentor believes it is U.S. policy to maintain the separation of civil and military facilities, and the United States should set an example for the world by not making weapons in civilian facilities. The commentor believes the examples of using a facility for both military and civilian purposes that are described in the CLWR Draft EIS are not comparable to the proposed action because the facilities were first used for military purposes and later converted to civilian use.

2/21.05 The commentor believes the NRC is likely to delay DOE defense programs assigned to a CLWR.

3/04.02 The commentor states that, if cost is the real discriminator, DOE owns another, less expensive, tritium production concept that would cost about $600 million—less than a third of the cost of CLWR tritium production and about a quarter of the cost of building an accelerator. The commentor calls for a review of this device. The commentor believes that, failing the use of the less expensive device, DOE should use the Savannah River Site because of its nearly 45 years of tritium experience and the readiness of its workers to serve the nation again capably, safely, efficiently, cost-effectively, and in an environmentally sound manner.

4/03.03 The commentor did not understand that production of 3 kilograms of tritium per year was a surge goal and that the “day-in, day-out” goal was something lower.

5/23.16 The commentor states that the surge goal would nearly double the number of fuel assemblies needed and, correspondingly, the amount of spent fuel for disposal. The commentor asks that these costs be addressed in the CLWR Final EIS so that the public will know what it would cost to produce 3 kilograms of tritium per year.

Commentor 505 (David Losey)

1/01.09 The commentor believes the United States has intended for years to separate its commercial and defense interests, and now is the time to move toward more integrity by avoiding legalistic word-splitting (tritium is not a special nuclear material) and maintaining the separation of civilian and military nuclear facilities.

Commentor 506 (Donald Morris)

1/06.03 The commentor asks about media reports that TVA has withdrawn their offer for irradiation services.

2/05.27 The commentor asks whether DOE is considering purchasing a TVA reactor or the irradiation services of a reactor.

3/23.19 The commentor asks about reports that TVA has offered to complete construction of the Bellefonte reactor for irradiation of the TPBARs, and that TVA's Chairman has stated that TVA will require all the funding "up front" before undertaking completion and licensing of the Bellefonte reactor. The commentor asks what guarantees DOE will require of TVA to ensure that construction and NRC licensing of the Bellefonte plant will be completed within the stipulated costs.

4/ 23.21 The commentor asks whether the fixed price for completing the Bellefonte plant would also include defense of the project against any nuclear activist suits or intervenors.

Commentor 507 (Bob Schwartz)

1/02.01 The commentor questions the need for tritium production. The commentor believes DOE tritium production is a jobs program, not a vital necessity.

2/08.02 The commentor believes the Savannah River Site has enough problems of its own without assuming new missions.

Public Hearing - Rainsville, Alabama
October 6, 1998

Commentor 600 (Mike Womacks)

1/23.02 The commentor is concerned about cost overruns, in view of the Tennessee Valley Authority's (TVA) history, and asks how the public may assume that the $1.9 billion or $2.1 billion TVA says it will take [to complete Bellefonte for tritium production] will be sufficient.

2/01.04 The commentor asks if the United States is now willing to allow other countries to produce tritium in their commercial nuclear power plants.

3/14.20 The commentor notices that the health risks and impacts analyzed in the Draft EIS deal with tritium production only, and not the risks and impacts of the plant itself (without tritium production). The commentor asks to know the health risks and impacts resulting from both tritium and nuclear power production. The commentor is concerned that people already are affected by nuclear power production and an additional 1.1 percent, or about 1,500 people, would die of cancer as a result of the proposed action.

Commentor 601 (Charles Anderson)

1/14.21 The commentor asks if his chances of winning the Georgia Lottery without buying a ticket are better than his chances of dying from radiation released by a tritium-producing Bellefonte nuclear power plant.

Commentor 602 (Joseph Imhof)

1/11.11 The commentor cites a quote from the CLWR Draft EIS on page 5-53 [the commentor refers to Appendix C, page 5-53, but the reference is misquoted], the first sentence in the section on Threatened and Endangered Species: "Operational impacts on threatened or endangered species could occur through the release of thermal, chemical, or radioactive discharges to the atmosphere or the river." The commentor asks why it is necessary to discharge radioactive material into the river and whether there is any alternative.

2/11.12 The commentor asks whether the small amounts of radiological and chemical materials normally discharged into a river by a nuclear power plant are processed before being discharged.

Commentor 603 (Melvin Brewer)

1/24.06 The commentor asks where the tritium produced by a CLWR would go and what would be done with it.

2/01.01 The commentor asks why the United States needs nuclear weapons.

3/01.10 The commentor asks if nuclear weapons are meant to be genocide weapons and states that, wherever they want to make tritium, he'll be there actively opposing it. The commentor also states that he has heard talk about jobs, but asks when people are going to start talking about humanity.

Commentor 604 (Roger Graham)

1/02.02 The commentor asks if it is true that, for America to maintain its nuclear weapons capability, the country must be able to produce tritium by the year 2005.

2/01.04 The commentor asks whether it is true that, even if the United States doesn't have nuclear weapons, other countries will have them.

3/07.01 The commentor is in favor of tritium production in the United States.

4/07.03 The commentor thinks that we owe it to the people in the military to provide the best technology to help them protect us. The commentor doesn't care whether tritium is produced in Alabama or South Carolina, but does think our elected officials should be prudent in their decisions to spend taxpayer dollars. The commentor states that the Bellefonte Nuclear Plant could be ready to produce tritium for less than $3 million, and that it uses a proven safe technology that will produce revenues from the sales of much-needed electricity. The commentor compares this figure to the cost of building an accelerator—$16+ billion for an accelerator that may not work and would cost $155 million a year to operate.

Commentor 605 (Jerry Ward)

1/23.15 The commentor asks how the projected $1.9 billion cost to complete the Bellefonte plant for tritium production compares with the total costs to develop and construct the Savannah River option (the APT option at the Savannah River Site).

Commentor 606 (C. A. Frees)

1/11.09 The commentor asks the distance between the Bellefonte plant's point of discharge into the river and the point where the Jackson County Water Department draws water from the river for public use. The commentor, upon hearing the answer is 4.5 miles, asks if the public water source that was measured is the one for Fort Payne. The commentor also asks the location of the other public water sources in Jackson County and their distance from the Bellefonte plant's discharge point.

Commentor 607 (Doug Grice for U.S. Congressman Bud Cramer)

1/07.03 The commentor reads a statement from Congressman Cramer in support of completing the Bellefonte plant for tritium production because it is safe and economically sound; area residents have a work ethic; and it would create jobs.

Commentor 608 (Angie Culvert for U.S. Senator Jeff Sessions)

1/07.03 The commentor, speaking for Senator Sessions, expresses support for the completion of the Bellefonte plant for tritium production because it is right for the taxpayers, the Department of Defense, the nation, and northern Alabama.

Commentor 609 (Paul Housel for U.S. Congressman Robert Aderholt)

1/07.03 The commentor reads a statement from Congressman Aderholt in support of completing Bellefonte for tritium production because all the facts concerning safety, national defense readiness, and budgetary issues point to the Bellefonte plant as the best option, and it would bring enormous potential benefits to northern Alabama.

Commentor 610 (John J. Federico, Jr.)

1/07.03 The commentor states that he attended the scoping meetings and spoke in opposition to CLWR tritium production; but after being invited to tour the Bellefonte plant, he now believes the plant can be operated safely.

2/05.27 The commentor objects to the December 1995 Record of Decision that allowed DOE to either initiate purchase of an existing commercial reactor or buy reactor radiation services. The commentor is concerned that this decision allows DOE to purchase the Bellefonte plant if it chooses. The commentor fears that the checks and balances that are common to private industry and ensure proper oversight over commercial plants (e.g., external peer, regulatory, and fiscal reviews) would disappear because DOE nuclear defense facilities are not governed or licensed by the NRC, nor are they obligated to adhere to the Institute of Nuclear Power Operations' industrial standards of excellence. The commentor states that if Bellefonte comes on line, it must never be allowed to become a government-owned, contractor-operated defense facility that will go unchecked by the mechanisms designed to ensure it is managed with the safety of the citizens and the environment as its primary concern. The commentor also states that DOE's environmental record has been horrific in the way it conducted its nuclear business during the Cold War, and that DOE has created numerous Superfund sites that will take years and millions of dollars to clean up. The commentor doesn't think it is smart for taxpayers to spend $4.5 billion on constructing Bellefonte up to this point and then just let the plant sit there and not produce a return on the investment.

3/06.05 The commentor asks if the reference to the 1995 Record of Decision can be deleted from the CLWR Final EIS. The commentor is concerned that if the reference stays in the EIS, then somewhere down the line DOE will have the option to purchase the Bellefonte plant and make it a defense facility. The commentor is concerned that this might occur 40 years from now at the end of the Bellefonte plant's lifetime, when the NRC won't renew the plant's license, but there is still a need for tritium. The commentor believes that DOE could then buy the plant and operate it without TVA. The commentor believes that the language referring to this Record of Decision in the CLWR EIS should be deleted, at least where it pertains to conversion to a defense facility, and the December 1995 Record of Decision should be amended accordingly.

4/17.03 The commentor is concerned about spent fuel storage. The commentor states that if the Nuclear Waste Policy Act of 1982 mandates that spent fuel will be managed at a national repository, then DOE should expedite this effort and assist in resolving the siting issues instead of creating additional onsite spent fuel storage facilities. The commentor also states that the last major planning assumption in Section S.3.2.1 on page 17 of the CLWR Draft EIS Summary should be changed to state that spent fuel rods resulting from the tritium project will be stored in an existing spent fuel facility until a national repository becomes operational, in accordance with the 1982 Nuclear Waste Policy Act.

5/14.04 The commentor believes that nothing should be done that puts citizens and the [Tennessee] River at risk. The commentor states that one cancer death in 154,000 years is too many.

6/07.04 The commentor believes that Bellefonte can safely do its part for DOE, which includes helping to keep the nation's nuclear stockpile credible while producing electricity.

Commentor 611 (State Senator Lowell Barron)

1/07.03 The commentor reports that 77 percent of respondents answering a political poll in Jackson County supported completion of the Bellefonte plant for tritium production. The commentor believes that regional public support for tritium production at the Bellefonte plant is based on the view that it would provide jobs and keep the nation's military strong. The commentor supports tritium production at the Bellefonte plant because it is safe and it is in the best interest of the nation and the local area.

Commentor 612 (David Thornell)

1/07.03 The commentor has several statements in support of completing the Bellefonte plant for tritium production from various area officials and organizations, including Mayor Louis Price of Scottsboro, Alabama; Mayor Glenda Hodges of Woodville, Alabama; Mayor Elizabeth Hayes of Hollywood, Alabama; the North Alabama Mayor's Association; and the Chamber of Commerce and its affiliated organizations. The commentor and his employer enthusiastically support completing the Bellefonte plant for tritium production because it is both a win/win situation for Jackson County and the nation, and the wisest and best choice.

Commentor 613 (Dutton Mayor Philip Anderson)

1/07.03 The commentor believes that tritium production at the Bellefonte plant would be a very big plus for all of Jackson County and the surrounding area. The commentor asks DOE to give serious consideration to using the Bellefonte plant for tritium production.

Commentor 614 (Leroy Beasley)

1/07.03 The commentor, speaking on behalf of his professional association, supports tritium production at the Bellefonte plant because it is a positive step for TVA, for the region, and for DOE, and it can provide area residents with things they really need, such as additional electrical capacity. The commentor presents a petition signed by members of major labor unions at the TVA plants stating that they have reviewed the CLWR Draft EIS, and they endorse and support the development of the Bellefonte project. The commentor compares the $1.9 billion cost to complete the Bellefonte plant for tritium production to the cost of the accelerator option, which is conservatively estimated to be more than $9 billion.

Commentor 615 (Langston Mayor Butch Vaught)

1/07.03 The commentor, speaking on behalf of the residents of Gurley and Langston, supports completion of the Bellefonte plant for tritium production because it would provide an assured supply of tritium at the least cost to U.S. taxpayers, as well as much needed employment to an economically depressed area of the United States.

Commentor 616 (Joe Buttram)

1/07.03 The commentor, speaking for the county commission, supports the completion of Bellefonte as a nuclear power plant and for tritium production and believes the Bellefonte plant can be operated safely. The commentor thinks the people in Jackson County are generally in support of tritium production at the Bellefonte plant. The commentor states that there is nothing inherently dangerous about a United States-produced nuclear weapon. The commentor believes those in control of nuclear weapons in other countries are the problem because they do a poor job of producing them. The commentor states that if Bellefonte is completed, it will be the best and safest-designed nuclear plant ever built. The commentor thinks the dangers of operating the Bellefonte plant for tritium production would be minuscule, and that it would be good for Jackson County, the State of Alabama, and surrounding areas in Tennessee and Georgia. The commentor states that the risks area residents would be taking if Bellefonte were used for tritium production would be nothing compared to the risks other folks have taken for the nation's safety and freedom from other powers.

Commentor 617 (Ronnie Boles)

1/07.03 The commentor, speaking on behalf of his utility board, supports completion of the Bellefonte Nuclear Plant for tritium production. The commentor states that he and his fellow board members are comfortable with both TVA's ability to safely construct and operate this facility and DOE's ability to safely transport tritium out of the area.

Commentor 618 (Richard Ward)

1/07.03 The commentor, speaking on behalf of his union, supports DOE and TVA consideration of the completion of the Bellefonte Plant as a tritium production facility in support of national defense because using the Bellefonte reactor would be environmentally safe and economically sound. The commentor states that he and his fellow union members have carefully analyzed the Congressional Budget Office's cost comparison of the tritium production alternatives, and they believe it makes no sense to consider any facility other than the Bellefonte reactor for tritium production. The commentor urges DOE to select the Bellefonte Nuclear Plant as a primary tritium production source because it would promote a cooperative effort between organized labor, TVA, and DOE that would save taxpayers billions of dollars.

Commentor 619 (Don Bevill)

1/07.03 The commentor supports TVA and the completion of the Bellefonte plant for tritium production.

Commentor 620 (Ed Mann)

1/07.03 The commentor states that of all the places where he has prepared environmental impact studies, he would rate the nuclear facilities at Athens, Alabama, and Spring City, Tennessee, as the finest examples of TVA's work. The commentor states that if these facilities are an example of the finished product that TVA intends at Bellefonte, somebody should think very seriously about completing the effort.

2/24.09 The commentor states that, when his group of retired engineers, scientists, and physicists met in April of last year, someone told them there was absolutely no increase in any kind of disease, including cancer, in areas where TVA facilities are operating.

Commentor 621 (Carl Lansden)

1/07.03 The commentor encourages DOE to make the CLWR Draft EIS a reality because, after reviewing it, he finds it difficult to believe that prudence could bring tritium production anyplace else. The commentor states that, from an economic standpoint, it is certainly desirable for the facility to be located in the area, and this is reflected in the EIS. The commentor applauds the conclusion that must evolve from the EIS—that the inhabitants of Jackson County will be the beneficiaries of the prudence displayed by DOE, TVA, and the Congressional Budget Office.

2/23.13 The commentor believes that, for the first time in modern history, the United States is enjoying a surplus in the national budget, and it would be incomprehensible to turn around and waste $8 billion to $10 billion to build a facility in South Carolina to accommodate DOE and the nation's need. The commentor can't believe that anyone who is functioning and is consistent with the needs of society would waste that type of money when there are so many other things for which it could be used.

Commentor 622 (Louvain Edmondson)

1/07.04 The commentor knows from his experience that TVA operates its plants safely.

2/07.03 The commentor has collected 450 signatures of people that have read the summary of the CLWR Draft EIS and agree that this is the right thing to do. The commentor states that they know this is a win/win situation for TVA, DOE, and the citizens of the United States and Jackson County.

Commentor 623 (Carol Lomax)

1/04.04 The commentor asks if TVA and DOE will guarantee and promise the citizens of Jackson County that mixed oxide fuel will never be used at the Bellefonte plant.

2/23.03 The commentor asks, since DOE and the TVA plants are government-owned, when will everybody in the nation be responsible for TVA's $29 billion in debt, and how soon can ratepayers expect a rate reduction from the current TVA debt (i.e., why should the ratepayers be responsible for the proposed action, which they will be, since TVA has so magnanimously offered some of the money they will be making on the production of electricity to DOE, and why isn't the rest of the nation paying for the proposed action?).

3/15.01 The commentor states that insurance companies do not cover any losses of any type of nuclear power plant accident and asks if TVA and DOE or the Price-Anderson Act would provide 100 percent of the cost of replacement for any losses suffered by the residents of Jackson County. The commentor asks for the name of an expert on Price-Anderson coverage.

Commentor 624 (Steven Stutts)

1/07.01 The commentor, speaking for his union and a joint labor council of TVA workers, states that the Bellefonte plant should be selected by DOE as the primary tritium production source to meet U.S. defense needs because nuclear power is a proven technology that is safe and environmentally friendly. The commentor supports this position with the following statements: Bellefonte can be safely operated on a daily basis by TVA; the proposed accelerator alternative is a science project at best, since no accelerator of this size has been built or operated before. TVA's fail-safe mechanisms set the benchmark for the industry. Bellefonte meets the requirements of the U.S. Department of Defense because TVA could begin supplying tritium by 2005, as mandated by the Executive Order, while the accelerator would not be able to supply tritium until 2008. The Bellefonte option would cost $13 billion less than the accelerator option. While the Bellefonte option would cost $3 billion; the money spent by DOE to complete the Bellefonte plant would be repaid to the Federal Government because the revenues from electricity sales could be paid to DOE to pay off the investment with interest. Completing Bellefonte would create 800 permanent jobs and hundreds more indirect jobs, and this would have a significant economic impact on northeast Alabama, which must be strongly considered. The commentor states that, if you take all of these factors and add the appropriation of training for future work and the future generation of crafts, it sends a very strong signal and is very solid reasoning. The commentor states that using Bellefonte for tritium production would extend the past practice of using government-owned facilities for both civil and military purposes, not set a new precedent for proliferation.

Commentor 625 (Jennifer Stephens)

1/07.03 The commentor favors completion of the Bellefonte plant for tritium production to “bring the jobs back home” so that area workers won’t be forced to leave their families and seek employment in other states. The commentor states that if tritium is not produced at Bellefonte, it will be produced somewhere else and all of the socioeconomic benefits will go to some other area of the country. The commentor does not want this to happen anymore.

2/13.05 The commentor states that, in addition to jobs, completion of Bellefonte for tritium production would benefit the local economy because workers would spend the money they earn at home, not on the road.

Commentor 626 (Delbert Shelton)

1/07.03 The commentor, after touring the Bellefonte plant, states that he was thoroughly impressed with the safety features in place, and he thoroughly supports the completion of the Bellefonte Nuclear Plant for tritium production.

Commentor 627 (Randy Hartwig)

1/07.04 The commentor, speaking for his union of TVA employees, states that they have reviewed the CLWR Draft EIS, and they agree that the environmental and health impacts associated with producing tritium in a commercial reactor would be very small.

2/12.02 The commentor, speaking for his union, agrees that there would be only minimal impact on the Guntersville Reservoir— less than 0.2 percent of the flow—and only minor impacts to other aquatic resources.

3/13.05 The commentor states that his fellow union members were ecstatic about the positive socioeconomic impacts to the area (800 jobs).

4/14.22 The commentor states that the radiation exposure for residents of Jackson County, including background radiation and radiation from the Bellefonte reactor operations, would be 355.26 millirem per year, a lower dose than the average for U.S. citizens overall, which is 363 millirem per year.

5/07.03 The commentor states that no major modifications and only a few minor ones are needed for large-scale production of tritium at either the Watts Bar or Bellefonte Nuclear Plants. The commentor, speaking for his union, believes that Bellefonte should be DOE's Preferred Alternative because of its negligible environmental impacts; absence of measurable health effects; positive economic impacts; flexible tritium production capability to meet ever-changing needs; the fact that it is a proven technology compared to the Savannah River accelerator option; the fact that there are no proliferation issues that are not manageable under existing laws and the controls associated with light water reactors; and the fact that its total cost would be less. The commentor, speaking for his union, states that TVA's engineering work force is technically robust and has consistently demonstrated its ability to solve the most difficult technical and regulatory challenges, as demonstrated by the recent "1 Rating" given to the Browns Ferry and Sequoyah Nuclear Plants.

Commentor 628 (Ronald Forster)

1/07.04 The commentor, speaking from his experience, has found TVA's safety and environmental record to be one of the highest in the industry. The commentor states that driving a car or smoking would be much more hazardous than living near the Bellefonte plant (if completed for tritium production). The commentor states that tritium production in an operating reactor is proven, safe, and efficient, and is not an experimental process.

2/07.01 The commentor's major concern is as a taxpayer; he fully supports completion of the Bellefonte plant because it could happen much sooner than construction of the proton accelerator plant. The commentor assumes that funding for completion of the Bellefonte plant would come from taxes. The commentor states that projected funding for completion of the Bellefonte plant would be approximately $2 billion, while the alternative proton accelerator plant would cost approximately $9 billion—a cost of $7 billion more to the taxpayers.

3/07.03 The commentor states that future operation of the Bellefonte plant would provide a clean source of electricity for the area and would help meet the nation's increasing demand [for electricity]. The commentor states that a portion of the revenue collected from the sale of electricity would be returned to repay the taxes used to complete the Bellefonte plant, whereas the proton accelerator plant would be non income-producing and would carry a lasting debt.

Commentor 629 (Jyles Machen)

1/07.03 The commentor states that he admires TVA and supports the Bellefonte plant facility because it would be a win for everyone involved. The commentor encourages a fair and timely decision by DOE. The commentor believes the Bellefonte site meets the budget requirements; that by choosing the Bellefonte plant more than $7 billion in Federal resources and tax dollars would be saved over the life of the program; that the Bellefonte site can meet DOE's schedule requirements because the Unit 1 reactor is more than 85 percent complete and the design requirements are firm; that it is vitally needed for the region's power grid; the nation will get its vitally needed tritium for defense, and Savannah River will get the extraction and conversion facility in South Carolina. The commentor states that some people say the Markey-Graham language in the Defense Authorization Bill, which excluded TVA, was parochial, prevented competition, and would cost billions more to risk an untested accelerator. The commentor is pleased that this language was removed in the conference between the House and the Senate. The commentor states that other people are concerned about nuclear plant safety, but there are 110 nuclear power plants operating in the United States and not a single death by radiation exposure has been documented. The commentor believes TVA is up to the job because it is the nation's largest power producer and its Browns Ferry and Sequoyah Nuclear Plants recently earned the highest performance evaluation rating possible. The commentor further states that TVA has new leadership and positive management and can again serve the nation and the region.

2/24.06 The commentor states that tritium produced at Bellefonte will be transported in its solid state to a new $400 million extraction facility at DOE's Savannah River site, which will provide employment for roughly 300 people.

Public Hearing – Evensville, Tennessee
October 8, 1998

Commentor 700 (Steven Smith)

1/06.03 The commentor asks why DOE is talking so much about the Watts Bar and Sequoyah plants if, as reported by the media, TVA has removed the plants from consideration for tritium production. The commentor understood that DOE would use Watts Bar for tritium production only if there were problems at the Bellefonte plant, and that DOE's primary objective is to use the Bellefonte plant only for tritium production. The commentor asks for clarification on these points.

2/23.22 The commentor states that using the Watts Bar plant only for tritium production clearly is the least expensive reactor option and asks why TVA let this option expire. The commentor suggests TVA's reason was to preclude the lower priced option (Watts Bar only) so that Federal monies could be obtained to finish the Bellefonte Plant.

3/23.16 The commentor requests documentation to support DOE's conclusion that purchasing irradiation services at Watts Bar would be less expensive in the near term, but more expensive over the long term (plant life-cycle). [Commentor refers to a comparison of the tritium production costs for the Watts Bar and Bellefonte plants that DOE sent to the U.S. Congress.]

4/23.04 The commentor asks who would benefit from electricity sales revenues obtained from a completed Bellefonte Nuclear Plant—the taxpayers, TVA, or DOE?

5/17.16 The commentor asks if the speaker meant to say that: (1) reactor units at either the Watts Bar or Sequoyah plants would generate 75 percent more spent fuel if they were run at the higher rate required for tritium production; and (2) spent fuel generation would double if tritium were produced in one of the Bellefonte units.

6/03.03 The commentor asks about the size of DOE's projected target irradiation goal.

7/17.17 The commentor states that tritium production in excess of 2000 targets per year would generate additional spent fuel. The commentor requests clarification concerning whether any of the three TVA nuclear power plants is capable of managing their existing and projected spent fuel load and whether adding to it would only complicate the situation.

8/06.05 The commentor asks when DOE would use two or more facilities to avoid exceeding the Bellefonte plant's spent fuel generation limits. The commentor believes the analyses that will determine DOE's choice to use one or more reactors for tritium production should be made public because of the implications for TVA ratepayers and U.S. taxpayers.

9/06.06 The commentor is unclear concerning what the dots mean in the "measle chart" on page 3-12 of the CLWR Draft EIS and on page 18 of the CLWR Draft EIS Summary. The commentor would like to see the actual numbers, instead of dots, that were used to analyze the associated impacts of each alternative.

10/23.05 The commentor believes cost overruns are likely if TVA plants are used for tritium production. The commentor asks whether the CLWR Final EIS will include information concerning the potential liability of ratepayers for cost overruns. If not, the commentor asks why, when a TVA cost overrun in completing the Bellefonte plant would have socioeconomic impacts on TVA's debt reduction plan and, consequently, on area ratepayers. The commentor requests DOE to guarantee that the CLWR Final EIS will contain more discussion and analysis of the potential risks and consequences of cost overruns. The commentor believes that not doing so would be a mischaracterization of the NEPA process.

11/02.02 The commentor believes DOE has not made a compelling argument for the United States' near-term need for tritium, and that the CLWR Draft EIS is flawed because the numbers for the current U.S. tritium inventory are not provided.

12/03.01 The commentor believes that, before U.S. taxpayers are asked to pay several billion dollars for tritium production, the amount of tritium in U.S. inventories should be declassified and made publicly available so that citizens can determine when a real need for tritium will arise.

13/02.01 The commentor believes the United States should aggressively pursue the START II Treaty, which would extend the required date for new tritium production to 2016, or up to 2020, or to 2030.

14/05.02 The commentor believes the No Action Alternative discussed in the CLWR Draft EIS does not fully consider *no action* (i.e., avoiding new tritium production at this time); thus, it is not a true No Action Alternative under NEPA.

15/01.04 The commentor believes the discussion of nonproliferation impacts and issues in the CLWR Draft EIS is woefully inadequate. The commentor believes the United States' violation of its own nonproliferation policy, a policy that the United States seeks to impose on other countries, is hypocritical and encourages other nations to do likewise. The commentor points out that *Janes Defense Review* reports that India got its weapons tritium from a commercial reactor. The commentor believes the United States' nonproliferation concerns have significantly increased since the CLWR Draft EIS was issued, and there should be greater discussion about nonproliferation in the CLWR Final EIS.

16/01.09 The commentor disagrees with the conclusions of the authors of the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy*, and says this document cites no clear historic examples of using commercial nuclear facilities for military purposes. The commentor believes that by basing its assumptions about the nonproliferation impacts of CLWR tritium production on the examples cited in the *Interagency Review,* DOE is making an illogical argument and defying current U.S. nonproliferation policy.

17/23.06 The commentor is disconcerted as a TVA ratepayer to learn that, first, Chairman Crowell stated in TVA's 1996 Integrated Resource Plan that TVA will not engage in further nuclear power plant construction without a full partner, and now, under one of DOE's tritium production scenarios, TVA would invest $4.5 billion (essentially its current expenditures for construction of Bellefonte) into the partnership with DOE, resulting in someone else (DOE) completing the reactor at no additional cost to the ratepayers. The commentor believes DOE's CLWR tritium production proposal is nothing more than a thinly veiled attempt to subsidize TVA's attempts to complete the Bellefonte reactor with taxpayer money.

18/23.07 The commentor believes DOE needs to understand how delicate and fragile the contractual situation is with TVA's distributors, as well as the liabilities related to TVA's ability to meet the obligations of its 10-year debt [reduction] plan and the restructuring of the electric utility environment. The commentor believes these issues are significant and should be addressed socioeconomically to evaluate their long-term implications for the Tennessee Valley and for U.S. taxpayers.

19/06.04 The commentor asks whether the CLWR Final EIS will include information about the contractual agreements between TVA and DOE and the potential impacts of TVA's contract obligations.

20/01.02 The commentor thinks the real battle is yet to come before $2 billion is appropriated by the Congress for this project.

Commentor 701 (Ernest Haston)

1/04.01 The commentor requests a comparison of the technical risks associated with the CLWR tritium production option and the APT option. The commentor asks whether the technical risks for the two options will be included in the CLWR Final EIS or only in the final decision.

2/11.13 The commentor suggests the use of a device that measures wind velocities to gather data on prevailing winds in the region near the Watts Bar site (this device is already available at the plant).

Commentor 702 (Ralph Hutchison)

1/05.23 The commentor asks that DOE not try to intimidate or dismiss the public by saying, "Well, we're not going to do that," because commentors can only refer to the information they've been given.

2/05.30 The commentor states that the analyses of DOE's "most likely scenario" (2,000 TPBARs) are not in the CLWR Draft EIS, although some analyses apparently have been done. The commentor states that if DOE has a scenario other than those presented in the EIS, a scenario based on undeveloped, undetermined, secret information, the public can't comment on it, and that is a frustrating problem.

3/05.04 The commentor asks if DOE is going to pursue both the primary and back-up options (CLWR or APT) for tritium production; what the terms "primary" and "back-up" mean; and whether both options have been or will be developed.

4/23.16 The commentor asks whether DOE's economic analysis includes the costs of pursuing the CLWR and APT options as both primary and back-up alternatives to each other.

5/23.15 The commentor asks what percentage of the accelerator program would DOE actually pay for—i.e., of the nine billion total, how much is for the design, and vice-versa.

6/05.10 The commentor asks whether there is any incremental release of tritium from the TPBARs being tested in the Lead Test Assembly tests at Watts Bar.

7/01.02 The commentor wonders whether DOE is aware that the vote on the Markey-Graham Amendment was close and the U.S. House of Representatives was "pretty solidly in support of Markey-Graham."

8/01.05 The commentor wonders whether the *Interagency Review* panel (on nonproliferation issues associated with CLWR tritium production), DOE, etc., have decided it is permissible for India, Iraq, and North Korea to produce tritium in their commercial reactors for use in nuclear weapons.

9/01.01 The commentor thinks that many people are concerned about the United States' possession of nuclear weapons.

10/14.05 The commentor asserts that DOE would like the public to believe tritium production would have little or no environmental impacts, but says the CLWR Draft EIS states that, under the "normal operations, no accident scenario" for tritium production operations at Watts Bar, releases to the air would be 60 times higher than current levels, while total tritium releases to water would be five times greater than normal. In addition, under normal operations, the annual radiation dose for people living as far as 50 miles away from the Sequoyah Nuclear Plant would triple as a result of tritium production. The commentor further states that during accident conditions tritium releases to the air at Watts Bar would increase by nearly 300 times, and tritium releases to water would be nearly 30 times higher than normal. The commentor feels it is unfair for DOE to communicate information in the public meetings that is not found in the EIS. The commentor believes that DOE should highlight the actual expected releases of tritium to the environment to inform the public that, while the TPBARs were reported to be virtually leakproof a year or so ago, they are now assumed to leak 1 Curie of tritium per year, which is a lot of tritium.

11/01.04 The commentor states that the attempt made in the CLWR Draft EIS to skirt the significant nonproliferation concerns of the public by citing four instances of "exceptions to the practice of differentiating between the U.S. civilian and miliary facilities," each of which involved military facilities used for civilian purposes, is disingenuous, outrageous, and absurd. The commentor states that, while some people believe it is appropriate for us to do what we demand of others, our government seems to arrogate to itself the privilege of doing whatever it chooses and denying that same privilege to other countries. The commentor objects to the statement in the CLWR Draft EIS declaring that the TVA reactors are technically owned by the U.S. Government, making them roughly comparable to past instances of government-owned dual-purpose nuclear facilities. The commentor believes this statement insults the public’s intelligence and is duplicitous. The commentor states that on page F-10 of the CLWR Draft EIS, the response to the third comment on that page, DOE’s assertion that tritium production is consistent with and is fully supported by the commitments of the United States under a variety of treaties, including the Nonproliferation Treaty, is a lie. The commentor reports that the International Court of Justice ruled in 1996 that the United States is not upholding its treaty obligations under the Nonproliferation Treaty, and production of tritium for the sole purpose of maintaining a large arsenal into the next century directly contradicts the United States’ obligation under Article VI of the treaty.

12/21.03 The commentor states that, given the half-life of tritium, at least half of any tritium produced in the year 2005 would not be available when it is truly needed in 2016, so DOE would have to produce twice as much tritium in 2005 to meet its needs in 2016. The commentor believes that it doesn’t make sense to produce tritium until it’s needed, and earlier, unnecessary tritium production only increases the risks and the likelihood of environmental impacts.

13/22.01 The commentor states that the CLWR Draft EIS does not consider the risks of an attack by hostile forces on the proposed plants, but should do so because they would be making materials essential to the U.S. arsenal of nuclear weapons and would be the least protected and safeguarded of all U.S. nuclear weapons facilities.

14/05.05 The commentor states that the CLWR Draft EIS says conversion of the Bellefonte plant to fossil fuel is independent of this EIS, but also says such conversion would not occur until after a decision is made regarding the role of Bellefonte 1 and 2 in tritium production—indicating that conversion *is* dependent on the outcome of this EIS and the Bellefonte conversion EIS has been held up pending completion of this CLWR EIS. The commentor believes the CLWR EIS should acknowledge this fact.

15/13.08 The commentor states that, regarding environmental justice, it's not enough to assert that the impacts are not being disproportionately visited on people of color or low-income communities, nor is it adequate to disguise the adverse impacts on specific populations by describing a wide circle around the plant and making generalizations about the population living there. For example, the closest community to the Sequoyah plant is Soddy-Daisy, whose population is at less than half the income level for Hamilton County, which is circumscribed by a large circle.

16/20.02 The commentor states that the CLWR Draft EIS fails to include a comparison of the eventual costs of decontaminating and decommissioning Bellefonte as a nuclear site and as a fossil fuel electricity generating plant—which it should do, since those are the two possible futures for the plant.

17/01.10 The commentor states that the response to the final comment on page F-12 of the CLWR Draft EIS asserts that, "moral and ethical issues are beyond the scope of the Environmental Impact Statement." The commentor reminds DOE that NEPA clearly states an EIS must consider the whole of the human environment. The commentor believes that decisions to protect the natural environment and wildlife are moral ones, as are the inclusion of environmental justice concerns and economic issues, and it is possible to consider and even quantify the effects of many moral decisions. The commentor states that moral and ethical issues are already abundant in this EIS, and the issues raised in the scoping meeting, while uncomfortable to contemplate and difficult to quantify, deserve full consideration throughout this decision-making process. The commentor asks that DOE not forget that the CLWR EIS is about the making of weapons of mass destruction, which is a monstrous thing.

Commentor 703 (Ann Harris)

1/11.01 The commentor asks for a description of TVA's current wastewater program and procedures for cleaning up the reactor coolant wastewater prior to releasing it into the river; the schedule for testing the program to ensure its reliability; the criteria the NRC uses to monitor the program; and where this criteria may be found.

2/11.04 The commentor asks: (1) who is ultimately accountable for determining how much tritium can be released into the Tennessee River; (2) who has the authority to determine whether the procedures for the current wastewater program are correct; and (3) is the current program capable of providing complete and accurate numbers for the amounts of tritium that would be released into the river.

3/03.03 The commentor asks where in the CLWR EIS is it explained that, to meet its annual tritium production requirements, DOE probably would use a combination of the Watts Bar, Sequoyah, and Bellefonte Nuclear Plants. The commentor feels this information is hidden in the document.

4/18.05 The commentor asks whether transporting TPBARs from three different reactors in two states would increase the opportunities for a transportation accident.

5/18.06 The commentor asks whether DOE plans for a single truck to pick up irradiated TPBARs at each reactor and transport them collectively to the Savannah River Site.

6/24.13 The commentor asks for clarification concerning the cumulative effects of using three reactors simultaneously at three different sites.

7/19.06 The commentor asks why DOE assumed the failure of two TPBARS, which the commentor understands to be the national average, instead of the failure rate experienced by TVA alone.

8/14.03 The commentor asks whether DOE's analyses of the impacts of tritium production on the affected environment are based on current prevailing winds. The commentor points out that, according to the National Weather Service, 90 percent of the prevailing winds in the local area come straight up from Alabama to the [Tennessee] state line and do not expand widely. The commentor states that the graphics in the CLWR Draft EIS used to illustrate the area should be corrected because the lines run 50 miles in any one direction and do not reflect the national average for these valleys.

9/05.17 The commentor suggests DOE should not use five- and six-year old documentation for the CLWR EIS because Bellefonte hasn't had an EIS in this decade; the EIS for Watts Bar is three years old; and there have been some major weather changes recently.

10/14.02 The commentor reports that, according to the International Geological Society and the National Geology Group, it's improper to use a 50-mile radius around each of the TVA plants for impact analyses in this particular region. The commentor, therefore, believes the maximum meteorological impact assumed in the CLWR EIS in order to multiply that impact for the entire 50-mile radius is understated. The commentor suggests shaping these areas more like an oblong than a circle to account for the narrow corridor in which the prevailing winds move.

11/23.10 The commentor asks for clarification on DOE's position that, if TVA has an overrun on their bid for tritium production, DOE will not share in it and the overrun will be handled by TVA. The commentor asks what TVA will do in the case of a cost overrun.

12/15.01 The commentor wants DOE to address in the CLWR EIS how replacement costs for damage to private property would be handled if an accident occurs.

13/09.06 The commentor wants DOE to address in the CLWR EIS how TVA, the NRC, and DOE will establish a safe work environment where workers are free to raise safety issues. The commentor wants DOE to address in the EIS how workers will be protected from management abuse to the greatest and furthest extent of the law. The commentor asks the source for the numbers quoted in the EIS regarding abused employees that have been harmed as a result of raising safety issues at TVA.

Commentor 704 (Michelle Conlon)

1/05.18 The commentor believes the EIS process is very one-sided and thinks DOE and other Federal agencies may need to review it.

2/05.19 The commentor would like to see DOE's presentation of the CLWR EIS information to the public accompanied by a presentation from an independent reviewer.

3/14.23 The commentor thinks the DOE presentation failed to sufficiently emphasize the high radioactivity of tritium.

4/03.01 The commentor asks whether the amount of tritium currently stored in U.S. Government inventories is public knowledge, and if not, why not. The commentor believes the public needs to know the exact amount to make an informed decision about CLWR tritium production.

5/19.12 The commentor asks why DOE says the TPBARs would be under less stress in the reactor core than standard burnable absorber rods.

6/01.12 The commentor asks why DOE and the Federal Government are moving so quickly on tritium production, and why Secretary of Energy Bill Richardson believes he has to make the technology decision before the end of the calendar year.

7/24.06 The commentor asks whether DOE plans to proceed with extracting tritium from the irradiated TPBARs immediately after their arrival at the Savannah River Site and, if not, how long the irradiated TPBARs might be stored at the site.

8/02.02 The commentor questions the need to produce tritium by 2005 to 2007 if the plan calls for storing the tritium while it decays (i.e., wouldn't it be better to produce tritium only when it is actually needed?).

9/05.10 The commentor asks how many TPBARs were inserted into the Watts Bar reactor to conduct the Lead Test Assembly tests. The commentor is pleased to note that another person thought it was important for DOE to report the results of the Watts Bar Lead Test Assembly test because the commentor believes such information is critical to the EIS process.

10/24.22 The commentor asks how many TPBARs were inserted into the Advanced Test Reactor.

11/06.04 The commentor points to text in the CLWR EIS Summary document that describes DOE's dual track approach for tritium production and asks when DOE plans to exercise its option to purchase irradiation services.

12/23.01 The commentor wishes to make it clear that the ratepayers in Tennessee are ultimately responsible for the costs currently being incurred by TVA for the construction of Bellefonte (TVA issues bonds, but the bonds are the responsibility of the ratepayers). The commentor states that, as a result, the Federal Government's argument that it already owns the TVA plants is thin.

13/21.04 The commentor asks when the NRC's review of the Production Core Topical Report and its plant-specific reviews will be available to the public.

14/07.06 The commentor states that constructing the Bellefonte plant as a natural gas facility is just as viable as completing Bellefonte as some nuclear facility with tritium production, and both would create jobs.

15/07.02 The commentor doesn't believe that residents of the Tennessee Valley need this project to survive. The commentor, as a young person, doesn't want to live with this legacy in the Tennessee Valley and encourages DOE not to proceed with the decision to produce tritium in a civilian nuclear power plant.

16/23.10 The commentor is extremely uncomfortable with ratepayers in the Tennessee Valley being asked to subsidize DOE's nuclear power program.

Commentor 705 (Bill Monroe)

1/21.01 The commentor asks whether TVA would expect the operational technical specification limits to remain the same under tritium production.

Commentor 706 (Greg DeCamp)

1/06.03 The commentor requests clarification about which of the 18 CLWR tritium production alternatives remains practically viable after the expiration of TVA's irradiation services offer (i.e., how many of the 18 options are really practical at this point?). The commentor asks if TVA and DOE are in agreement that, despite TVA's withdrawal/expiration of its offer to sell/lease the irradiation services of the Watts Bar plant, all five of the TVA reactors are still being considered for tritium production.

2/23.08 The commentor asks if TVA's offer for tritium production includes a fixed price.

3/23.09 The commentor thinks the CLWR EIS would benefit from including more information about the actual costs of the various alternatives and the implications of the costs for the specific economic proposals being considered (e.g., if the project costs $1.9 billion, who will be responsible for supplying the rest of the money if the costs exceed the fixed price?).

4/23.10 The commentor asks if TVA plans to pass on the cost of an overrun on its fixed price contract with DOE to ratepayers and, if not, is TVA subsidized by some other means.

5/24.10 The commentor asks for clarification of a statement found in the CLWR Draft EIS summary that indicates no design changes would be necessary to complete Bellefonte for tritium production. The commentor suggests the clarification be added to the summary document for the CLWR Final EIS.

Commentor 707 (Michelle Caratoo)

1/06.05 The commentor asks to know if DOE's preferred choice for tritium production would involve several different sites. The commentor believes it might simplify the process if all the necessary activities were performed at one site.

2/18.07 The commentor believes the additional shipping requirements for tritium production are likely to cause accidents and traffic problems. The commentor believes the transportation accident risk found in the CLWR Draft EIS is exceedingly low—less than one fatal accident per hundred thousand years is unrealistic. The commentor wonders whether other agencies like the Tennessee Emergency Management Agency or Federal Emergency Management Agency have plans to deal with any accidents, because accidents are inevitable in any line of work.

3/02.02 The commentor asks if the new tritium produced between 2005 and 2007 would likely decay if it has to wait 20 years before it's used and, if so, wouldn't it be better to produce it only when it is actually needed. The commentor asks why new tritium production couldn't wait until 2017 if the United States does not need tritium until 2020. The commentor thinks that, if we don't need tritium until 2020, perhaps we can spend a little more time investigating different ways to make it, and maybe the accelerator or some other way would be a simpler procedure.

4/24.03 The commentor asks if the amount of tritium now possessed by the United States is losing its efficiency or is leaking somewhat and, if so, is there no way to prevent this loss.

5/01.04 The commentor considers the Nonproliferation Treaty to be something important that the country has signed and believes we need to start keeping our treaties.

6/01.09 The commentor doesn't want other countries to use their civilian nuclear facilities for military purposes, so the United States needs to set a good example and do likewise. The commentor doesn't recall any other place in the United States where new nuclear facilities to produce energy or military products are being used. The commentor wonders why TVA is opening a new facility at this time. The commentor believes this activity is contrary to the current national trend, and there is probably a good reason for that trend.

7/08.02 The commentor is concerned that there is so much left from past [weapons] projects to clean up, such as at Oak Ridge and other facilities. The commentor wonders who is responsible for doing that and whether that's something we also could be working on at the same time.

8/23.13 The commentor believes it doesn't make sense to start a new project when the previous ones haven't been completed and these would probably take a great number of brilliant engineering minds and many jobs to clean up. The commentor would like to see the U.S. Government work on that, starting now—perhaps with the use of Superfund monies The commentor would like part of the Federal budget to be spent developing more renewable energy resources for the present and the future instead of starting new nuclear projects.

9/05.24 The commentor invites DOE to do a presentation on CLWR tritium production in Nashville, Tennessee.

10/12.01 The commentor is concerned that TVA is divesting some of its recreational properties, like the Land Between the Lakes, and putting so much energy into this project. The commentor would like TVA to keep that project and maybe turn it over to the Wildlife Resources Agency or some other agency to maintain. The commentor believes it is not fair to take land from private citizens for valley uses and then just dump it to some other agency; the land should go back to the people or some other thing like that.

11/23.11 The commentor is concerned about TVA's debt—maybe TVA should take a little breather before starting another project and incurring more debt.

12/20.04 The commentor is concerned that the costs for eventually mothballing and decontaminating TVA's plants will be very high and this issue was not addressed in the CLWR Draft EIS.

13/24.02 The commentor is concerned that, whether we're producing electricity or making tritium, it seems like we pick the most complicated processes—like nuclear energy, which is a very complicated way to make steam or heat or boil water. The commentor wonders if using highly complicated processes make mistakes and failures more likely. The commentor suggests more time should be spent figuring out how to make the process (nuclear power) safe, or it should be abandoned until we can find a safer way to do this.

14/20.01 The commentor wonders who will be responsible for the cleanup of this project, because many jobs could be created by cleaning up past projects.

15/13.05 The commentor believes tritium production may not be the best way to create jobs.

16/04.04 The commentor states that burning uranium and mixed oxide fuels, as is occurring at Oak Ridge, is not an acceptable way of dealing with the waste. The commentor would like to see the development of a better way of dealing with it.

17/14.24 The commentor believes the cancer fatalities listed under environmental impacts in the EIS are exceedingly low and inaccurate, if recent newspaper stories are true.

18/20.03 The commentor thinks DOE and TVA should consider the long-term effects and the cleanup and the decontamination aspects of CLWR tritium production, which are all parts of the process, before starting such a project.

Commentor 708 (Bill Griffith)

1/07.03 The commentor and his employer have reviewed the CLWR Draft EIS and offer their compliments to DOE on its thoroughness. The commentor also agrees with the EIS conclusions concerning the public safety and environmental impacts of CLWR tritium production at the Bellefonte nuclear power station.

Commentor 709 (Fred Boggess)

1/07.03 The commentor and his labor union agree with the conclusions of the CLWR Draft EIS and support completion of the Bellefonte plant for tritium production because it is both economical and good for the taxpayers and ratepayers of the valley.

Commentor 710 (Leroy Beasley)

1/07.04 The commentor believes the Bellefonte plant is probably the safest and the best documented nuclear plant that TVA has, and that the plant would "stand head and shoulders" above most of the nuclear plants designed in America. The commentor has no concerns about the safety of TVA's other nuclear plants.

2/07.03 The commentor and his organization have reviewed the CLWR Draft EIS, and they accept and support its conclusions about the completion of the Bellefonte nuclear plant.

Commentor 711 (Louvain Edmondson)

1/07.04 The commentor and his organization are confident that TVA's nuclear plants are safe. The commentor recognizes the need for tritium to preserve the U.S. nuclear deterrent. The commentor takes issue with charges that TVA is always "over budget and over schedule," citing record performance at the Sequoyah plant. The commentor brought a petition to the last public meeting with 450 signatures of people, mostly engineers, who had read the CLWR Draft EIS summary and agreed with its conclusions. The commentor has brought an additional 69 signatures to present to this meeting and states that his organization, the engineers at the Sequoyah plant, and many people from the Bellefonte plant are in full support of CLWR tritium production. The commentor believes CLWR tritium production is the right thing for the people of the valley and of the nation because all the people can benefit from it and it will save the ratepayers a lot of money.

Commentor 712 (Linda Ewald)

1/10.03 The commentor is opposed to tritium production because of the increased risk of environmental contamination.

2/14.04 The commentor is opposed to tritium production because of human health hazards.

3/16.04 The commentor is opposed to tritium production because of nuclear waste production.

4/01.10 The commentor is opposed to tritium production because of the immorality of its use in nuclear weapons.

5/02.02 The commentor believes the United States does not need tritium by the year 2005. By DOE's calculations, the United States can maintain its current, huge arsenal without producing tritium until 2016. The commentor believes that if the [U.S. nuclear] arsenal is reduced, as experts claim it can and should be, no new tritium would be needed until 2032. The commentor believes that Federal funding to begin tritium production by 2005 would be wasted because, with tritium's decay rate, half of the tritium produced would be gone by the time it is actually used.

6/23.13 The commentor suggests the $2 billion for tritium production would be better used to create 20,000 valuable jobs.

7/01.04 The commentor believes that CLWR tritium production would be a violation of the 1970 Nuclear Nonproliferation Treaty. The commentor thinks it is hypocritical for the United States to criticize other nations for their use of commercial reactors to produce nuclear weapons material while we make plans to produce tritium in our civilian reactors. The commentor states that, as a taxpayer, a ratepayer, and a human being, she does not want to support the production of tritium or any other nuclear weapons material. The commentor thinks that weapons of mass destruction threaten all of creation, and DOE's CLWR tritium production proposal sets a precedent that will destroy the United States' national nonproliferation efforts. The commentor urges the individuals with the power to make decisions to consider the long-term consequences of tritium production and whether the short-term gain is worth the risks to our health, our home, and our future.

Commentor 713 (Steve Tanner)

1/05.20 The commentor commends DOE and TVA for the thoroughness and depth of the CLWR Draft EIS. The commentor believes that all the potential impacts have been identified and thoroughly evaluated.

2/23.15 The commentor believes the APT option is a way for some people to fund their own retirements through a pork barrel program paid for by taxpayer dollars.

3/01.02 The commentor believes that political considerations are the only reason for proposing to site the accelerator in South Carolina. The commentor is pleased that, in making decisions about tritium production, some members of Congress have kept DOE on the steady path of determining what is best for the United States and have supported basing the decision on merit, not politics.

4/01.04 The commentor believes that, until total world nuclear disarmament is achieved, the right action is for the United States to maintain a safe and reliable nuclear deterrent, which will require tritium. The commentor believes that building an accelerator as a new nuclear defense production facility that is part of the nuclear weapons complex is not the right action because: (1) the accelerator facility would be capable of producing fissile materials such as plutonium and uranium and would be controlled by the nuclear weapons complex; (2) it probably would not be subject to International Atomic Energy Agency accountability inspections; and (3) it would use technology that is not under current export controls, carries high risk and has major proliferation implications. The commentor believes that DOE's purchase of irradiation services through a financial arrangement with TVA that allows the completion of Bellefonte is consistent with the direction the United States has been taking regarding military versus civilian technology uses. The commentor thinks that DOE's dual-use technology policy recognizes that the nation can no longer afford to maintain two distinct industrial bases and allows the armed forces to exploit commercial industry's rate of innovation to meet defense needs.

5/07.01 The commentor believes the right action for tritium production is to use a CLWR because it would support the dual-use technology policy. The commentor believes tritium production would not violate any laws, treaties, or policies. The commentor believes tritium production would provide greater government control in the DOE nuclear weapons complex, which is managed by private sector companies who are in business for profit, while TVA reactors are managed and operated by government employees.

6/06.05 The commentor recommends that DOE identify the Bellefonte facility (backed up by the Watts Bar as needed) as its Preferred Alternative in the CLWR Final EIS.

7/04.01 The commentor requests DOE to move expeditiously to eliminate any further funding of the APT project or, at a minimum, rename that project the "Fund Our Retirement Production of Tritium" project.

Commentor 714 (Clyde Caldwell)

1/07.03 The commentor states that he, together with his union and the members of his local trades and labor council, favors completing the Bellefonte plant because it is a win-win situation for the country, TVA, and the citizens of this valley. The commentor informs DOE that TVA has a $4.5 million investment sitting in northern Alabama and, because of the number of construction workers required, completing and operating Bellefonte for tritium production will provide employment and associated economic benefits not only for northern Alabama, but also for eastern Tennessee and all the way to Birmingham (in central Alabama). The commentor states that completion of the Bellefonte plant would allow TVA to recoup part of its $4.5 million investment while producing badly-needed tritium to secure public safety and security. The commentor states that the Bellefonte plant is one of the highest quality plants that's ever been built in the nuclear industry. The commentor, because of the lessons learned in completing the Watts Bar plant, does not anticipate significant problems in completing the Bellefonte plant and encourages DOE to use the Bellefonte facility for tritium production. The commentor is not concerned about the safety of TVA nuclear plants. The commentor states that safety is not a major concern of the people he represents because they intend to operate the [TVA] plants and build them as safely as they can be built. The commentor believes that nuclear is a clean, safe power source. The commentor points out that, although he's heard about the danger of tritium, he has some tritium on his watch face and has seen it in nursery decorations and other things for children. The commentor believes tritium production is necessary because the United States cannot defend itself without nuclear weapons.

2/24.11 The commentor wants to make it clear that TVA will own the facility and at no time will it be sold or given to DOE.

Commentor 715 (Ronald Forster)

1/07.03 The commentor and his company have reviewed the CLWR Draft EIS and agree wholeheartedly with the safe production of tritium in a CLWR. The commentor, after investigating regional electricity rates, believes an increase in TVA's rates would be justified in return for enabling TVA to pay off some debt, change the liability of the Bellefonte plant into an electricity-producing asset, and use the revenues from Bellefonte to repay some of the tax monies used to complete the plant. The commentor, as a taxpayer, wants to see things completed sooner rather than later and believes the Bellefonte plant would be completed sooner for tritium production than the accelerator. The commentor believes the United States needs to have the availability of a tritium production source and needs to make the decision about where to produce it. The commentor believes completion of the Bellefonte plant makes sense to meet the increasing need for electricity in the area and to help stabilize rates. The commentor believes that $2 billion to complete Bellefonte for tritium production, relying on a well documented technology that works better than expected, versus $9 billion to build an accelerator for tritium production, using an untested, unknown, experimental version of the technology, should be a logical decision for taxpayers.

Commentor 716 (Jennifer Stephens)

1/07.03 The commentor favors completion of the Bellefonte plant for tritium production to “bring the jobs back home” so that area workers won’t be forced to leave their families and seek employment in other states. The commentor states that, in addition to jobs, completion of Bellefonte for tritium production would benefit the local economy because workers will spend the money they earn at home, not on the road. The commentor states that, if tritium is not produced at Bellefonte, it will be produced somewhere else and all of the socioeconomic benefits will go to some other area of the country. The commentor does not want this to happen anymore.

Commentor 717 (James Roberson)

1/07.04 The commentor supports TVA management and employees in operating a tritium-producing facility because they have proven they can handle related plants and projects for the people of the United States. The commentor states that the Tennessee Valley has expertise available [to support tritium production].

Commentor 718 (Rex Wilson)

1/07.03 The commentor and his labor union urge the completion of Bellefonte and the use of Sequoyah and Watts Bar as backup units. The commentor appreciates TVA for bringing electricity to the area. The commentor believes TVA is fair with people. The commentor urges DOE to do the right thing and select Bellefonte, finish it, use it, and then use Watts Bar and Sequoyah as backup units to bring some jobs in the area.

Commentor 719 (Mark Wheeler)

1/03.01 The commentor asks if the U.S. tritium supply is classified. The commentor wonders how persons who have access to that classified information can say we need more tritium by 2005, but others who don't have access can come up with figures like 2016 and 20 years and 30 years down the road. The commentor is not willing to make an assumption and risk national security.

2/23.15 The commentor understands the cost of the Bellefonte option is estimated at about $2 billion, and the accelerator at the Savannah River Site would cost about $9 billion. The commentor suggests the cost estimates for each option indicate which is the best.

3/07.03 The commentor believes that, as tritium production will occur somewhere, it should be done in the local area where area residents can benefit from it. The commentor and his labor union strongly support tritium production at Bellefonte because it will be safe, great for the country, and great for the Tennessee Valley.

4/05.20 The commentor thinks the CLWR Draft EIS does an excellent job covering the options and statistics.

5/07.04 The commentor, who works at the Sequoyah plant, has absolutely no safety concerns and is very impressed with the plant's redundant safety systems. The commentor, speaking as an official of his labor union, states that the workers know how safe the plant is and if they thought anything was unsafe, they would be opposed to building these plants.

Commentor 720 (Terry Johnson)

1/01.01 The commentor believes the United States' nuclear deterrence policy and program has worked, and we need to continue to make it work.

2/08.02 The commentor thinks one of the biggest problems affecting CLWR tritium production is that, because of past history, we don't trust each other.

The following commentors (800 through 835) made comments at the December 14, 1998, public meeting concerning TVA's latest proposals to DOE for use of Watts Bar, Sequoyah, and Bellefonte.

Public Hearing – Evensville, Tennessee
December 14, 1998

Commentor 800 (John Johnson)

1/24.24 The commentor asks what “point of departure” means as used in the slide presentation.

2/23.02 The commentor asks that, given the costs of $11 billion and 23 years to complete the Watts Bar Plant, why does DOE think they can complete the Bellefonte Plant for less.

3/16.01 The commentor asks what DOE will do with the nuclear waste generated by tritium production.

4/05.31 The commentor states that it is bad timing to hold the meeting during the holiday season and complains that he did not receive any personal notice of the meeting, although he is on the stakeholder mailing list.

5/01.04 The commentor states that he is opposed to tritium production because it violates the spirit of the Nonproliferation Treaty and sends a wrong message to other countries.

6/01.01 The commentor states that the Cold War is over. The commentor urges DOE to obtain tritium from existing nuclear weapons. The commentor states that tritium production will subvert the human race to the will of the national security state, serves the imperatives of technology, is all about money, greed, and death, and demands that DOE cease and desist in its tritium production plans at once.

7/24.21 The commentor asks what DOE will do if TVA is dismantled as a result of deregulation.

8/24.19 The commentor asks if DOE and TVA are in Y2K compliance.

9/08.02 The commentor states that DOE’s track record belies its promises.

Commentor 801 (Ronnie Boles)

1/06.03 The commentor asks whether TVA has a legal or contractual obligation to partner with DOE on any of the current tritium proposals.

Commentor 802 (Michelle Conlon)

1/05.27 The commentor asks whether DOE still has the option to buy a reactor.

2/23.23 The commentor asks what effect irradiation services at Watts Bar and Sequoyah Plants will have on ratepayers, and whether electric rates would change.

3/05.10 The commentor asks what will be done with the TPBARs used in the Lead Test Assembly demonstration at Watts Bar and when will it be completed. Since tritium will not be extracted from the TPBARs used in the lead test assembly demonstration, how will we know the production process works without extracting the tritium.

4/05.31 The commentor criticizes the process and states that it appears there has been a lot of discussion after the public comment period was closed. The commentor suggests DOE do things differently in the future. The commentor complains that she did not get copies of Chairman Crowell’s letter before this meeting and says this is unfair.

5/01.15 The commentor warns Vice President Gore about the damage his support for the proposed action will do to his presidential campaign in 2000.

The commentor submits the following document along with her written statement: Zerriffi, Hisham and Herbert Scoville, Jr., *Tritium: The Environmental, Health, Budgetary, and Strategic Effects of the Department of Energy's Decision to Produce Tritium*, Institute for Energy and Environmental Research, Takoma Park, Maryland, January 1996.

Commentor 803 (Steven Smith)

1/23.24 The commentor asks for clarification regarding the [cost] numbers given for the Watts Bar and Sequoyah Plants in the presentation. What is the breakdown that led to TVA's estimate of $85 million for irradiation services. The commentor further suggests that TVA is inflating the taxpayer costs to make the Bellefonte option more attractive.

2/01.07 The commentor asks why DOE cannot use off-spec blended-down HEU at Sequoyah for tritium production.

3/08.02 The commentor states that every place DOE has made tritium is now a nuclear waste site, and asks why DOE cannot be honest about it.

4/24.31 The commentor asks why TVA proposed only 25 years, noting that the Watts Bar Plant came on line in 1986-1987, and should theoretically have 30 years left for tritium production.

5/05.31 The commentor complains that there was not enough time to respond to the meeting notice.

6/01.04 The commentor states that he is opposed to the use of CLWRs for tritium production since, regardless of which option is chosen, the nonproliferation issue remains.

7/01.15 The commentor warns Vice President Gore about the damage his support for the proposed action will do to his presidential campaign in 2000.

8/23.05 The commentor states that the Bellefonte option is a risk to ratepayers because of the danger of cost overruns. The commentor warns that ratepayers will "foot the bill" if Bellefonte cannot be completed for under $2 billion, and the commentor believes it cannot be done.

9/05.05 The commentor states that TVA should submit to the record its three scenarios for Bellefonte from its completion plan.

10/07.03 The commentor states that only those persons in Alabama who will benefit directly from completion of Bellefonte support this option; a silent majority oppose it.

11/02.01 The commentor states that DOE should not commit to using Bellefonte while arms reduction efforts are moving ahead.

Commentor 804 (Cheryll Dyer)

1/05.27 The commentor asks if TVA is overseen by the state and OSHA regulations, and would this oversight cease if TVA partners with DOE to produce tritium.

Commentor 805 (Ralph Galt)

1/01.04 The commentor asks whether it is true that the United States promoted the Nonproliferation Treaty to encourage the world's weapons states to stop production and reduce their stockpiles and to persuade nonweapons states to not make nuclear weapons. The commentor asks whether the U.S. Government is violating the Nonproliferation Treaty by making new nuclear weapons. The commentor asks whether the United States is working towards further reductions or maintaining the high level of the stockpile. The commentor asks whether the United States is required to wait for the Russians to ratify the START II treaty before making the agreed-upon reductions. Does the United States have to wait for the international community to agree to arms reduction before it can reduce its nuclear weapons stockpiles. The commentor asks whether U.S. law takes precedence over the Nonproliferation Treaty.

Commentor 806 (Mike Womacks)

1/23.25 The commentor asks how TVA can reduce its estimated costs for completing the Bellefonte Plant for tritium production. The commentor asks whether ratepayers would have to pay more to make up the $.5 billion difference.

2/23.07 The commentor asks whether residents of Scottsboro, Alabama, would see their rates go up or down as a result of tritium production at Bellefonte.

3/13.05 The commentor states that citizens of Jackson County will not receive the benefit of either short- or long-term jobs.

4/01.02 The commentor states that congressional support is not universal, and the majority of local citizens are not in favor of using Bellefonte for tritium production.

5/23.22 The commentor asks why TVA did not include the negative EIS comments in their latest offer letter to DOE.

6/13.06 The commentor states that, if Bellefonte is used, local property values will go down and taxes will go up and that the local school system cannot support the extra students.

7/07.06 The commentor states that he supports Bellefonte being converted to a natural gas facility.

8/02.01 The commentor states that the United States has enough nuclear bombs, so it is not necessary to make more tritium.

9/07.07 The commentor suggests that if it is necessary to make tritium, DOE use an existing facility rather than contaminate a new area.

Commentor 807 (Linda Ewald)

1/01.13 The commentor asks what is special nuclear material, and why tritium is not a special nuclear material.

Commentor 808 (Ernie Chaput)

1/05.29 The commentor asks if the Secretary would make the technology decision before the final tritium production EISs (CLWR and APT) are completed.

2/05.32 The commentor asks how DOE can make a technology decision when the EIS has not been completed and questions on the safety analysis and environmental impacts in the CLWR Draft EIS have not been addressed. The commentor asks whether the Secretary could change his decision after the final EISs (CLWR and APT) are published. The commentor suggests that DOE is ahead of the NEPA process in making the technology decision before the safety issues are identified and publicly addressed in the final CLWR and APT EISs.

3/03.04 The commentor, citing the 2.5 kilogram requirement, says that the CLWR Draft EIS isn't clear as to how many reactors would be needed. The commentor asks whether the Bellefonte option refers to Bellefonte only, or to Bellefonte and another reactor, and would two reactors be used for tritium production in all cases. The commentor asks where in the CLWR Draft EIS does it mention a 12-month cycle for tritium production at Bellefonte? The commentor asks whether DOE submitted materials to the NRC for review and whether the NRC is reviewing the 12-month cycle option.

4/24.31 The commentor asks why TVA's irradiation services proposal is for 25 years when the original programmatic proposal was for 40 years. The commentor also asks whether the requirements had changed.

Commentor 809 (Gary Drinkard)

1/23.23 The commentor asks whether residents of Rhea County would receive a tax break for the risks associated with tritium production at Watts Bar and Sequoyah.

2/05.31 The commentor notes that the meeting was called hastily, suggesting that DOE prefers the Watts Bar and Sequoyah option and speculating whether DOE was tipping its hand.

3/05.29 The commentor asks why "input from area residents" was not included in the decision criteria shown in the presentation.

Commentor 810 (Fred Boggess)

1/21.08 The commentor asks whether the license to finish the Bellefonte unit is still in effect.

2/23.26 The commentor also asks whether TVA has begun paying back the principal on the debt.

3/23.27 The commentor asks whether DOE has determined which reactor method is the most economical way to produce tritium over the 25- or 30-year production period.

Commentor 811 (Ann Harris)

1/01.06 The commentor asks why DOE has not made it clear that the IAEA does not do any kind of evaluations – they accept the word of the U.S. reactors.

2/19.14 The commentor asks who is going to fabricate the tritium rods that DOE would use in the Watts Bar reactor. The commentor asks whether DOE will examine the fabricator's past performance specifically with regards to cladding. The commentor notes there is massive decay of the cladding in the rods that would cut down on the production of Watts Bar, and suggests that DOE would derate the plant even more. The commentor also asks whether one-cycle use would cut power production at Watts Bar.

3/24.25 The commentor notes that both EPA and the Occupational, Safety, and Health Administration say they have Memorandums of Understanding with TVA that allow an exchange of paperwork instead of onsite inspections. The commentor asks where he can obtain copies of these Memorandums of Understanding.

4/01.14 The commentor asks DOE to consider buying the 14 kilograms of tritium available from a Canadian source.

5/14.04 The commentor expresses concern that tritiated water is readily absorbed by the human body and by metal. The commentor is concerned that using Watts Bar for tritium production will turn it into a superfund site, since the Watts Bar Plant metal structures will absorb the tritium.

6/14.25 The commentor quotes statistics on the dangers of tritium and calls it “nuclear thalidomide.”

7/09.10 The commentor expresses concern about the safety of the primary coolant system at the Sequoyah and Watts Bar Plants, saying the systems are badly designed and are virtually inoperable at any given time.

8/01.15 The commentor warns Vice President Gore about the damage his support for the proposed action will do to his presidential campaign in 2000.

Commentor 812 (Jackie Kittrell)

1/05.26 The commentor asks what steps will occur once the Secretary makes his technology decision at the end of the month, and will there be opportunities for public input during this process.

2/21.07 The commentor asks what would be the NRC time line for licensing once a decision has been made to use Watts Bar for tritium production.

Commentor 813 (Jimmy Wilkey, Rhea County Executive)

1/24.27 The commentor asks if TVA was the only organization to offer a bid in response to DOE’s Request for Proposals for CLWR tritium production.

2/13.07 The commentor asks whether the economic impact of using Watts Bar or Sequoyah for tritium production would be positive or negative. The commentor also asks that the welfare of the citizens of Rhea County be included in DOE’s deliberations and notes that Bellefonte would have greater and more positive economic impact.

Commentor 814 (Ronald Forster)

1/24.26 The commentor asks whether tritium production would shorten the life span of the Watts Bar or Sequoyah units.

2/07.08 The commentor states that he favors the completion of the Bellefonte Plant for tritium production because it would produce additional electricity, provide economic benefits to the region, and enable a payback of taxpayer dollars. The commentor states that he is opposed to tritium production at Watts Bar and Sequoyah because it could reduce plant operating lifetimes and would offer no real economic benefits.

Commentor 815 (H. M. Fagan)

1/24.27 The commentor asks how many organizations are qualified to do this job that didn't want it. The commentor asks why TVA bid on DOE tritium production. The commentor asks why TVA had no competition.

2/06.03 The commentor asks whether this is a case of two government agencies (DOE and TVA) "scratching each other's back" to produce tritium. The commentor asks whether the Savannah River Site and some other utilities were considered as potential sites.

3/09.03 The commentor notes that TVA is expanding its responsibilities from power production to weapons production, and asks whether tritium production would influence TVA to move further into weapons and defense-related activities.

4/14.04 The commentor asks how tritium production would affect TVA's ability to maintain current levels of public health risk around its reactors. The commentor asks whether tritium production is going to increase the amount of radiation leakage and risk to the public from dangerous materials at Watts Bar.

Commentor 816 (Carol Womacks)

1/24.28 The commentor asks when the last environmental impact study was done using Bellefonte as a nuclear reactor without tritium production.

2/23.12 The commentor asks how the $2.9 billion will be dispersed if tritium production takes place at the Watts Bar Plant.

Commentor 817 (Chris Lugo)

1/05.21 The commentor asks whether the public has the right to say no if DOE chooses the Watts Bar and Sequoyah Plants for tritium production, and, if so, how is this done. The commentor also asks what their legal recourse would be.

2/01.09 The commentor asks whether tritium production in a CLWR would violate the Atomic Energy Act, and who decided it would be acceptable to produce tritium in a CLWR.

3/02.01: The commentor states that tritium production is about death and bombs and that the whole cycle of consequences resulting from the use of nuclear weapons should be considered in making a decision about tritium production. The commentor states that he is opposed to tritium production in general.

Commentor 818 (Patty Fagan)

1/08.03 The commentor asks where tritium has been produced before, and requests a list of these places.

2/14.04 The commentor asks how safe is tritium. The commentor expresses belief that TVA had made fishing in local waters impossible, and is concerned about the effects of tritium production on regional air and water.

Commentor 819 (Don Clark)

1/08.04 The commentor notes past tritium leaks at Brookhaven National Laboratory, and asks why the tritium was allowed to get into the groundwater. The commentor also asks why the tritium leaks were not discovered at Brookhaven National Laboratory for 20 years; what are DOE and Brookhaven National Laboratory doing about the leaks, and what can they do about it.

The commentor submits the following documents along with his written statement:

"Nuclear Regulatory Commission Public Hearing, Testimony of Donald B. Clark," Sweetwater, Tennessee, August 7, 1997.

"U.S. Department of Energy CLWR Environmental Impact Statement Public Meeting, Testimony of Donald B. Clark," Evensville, Tennessee, February 26, 1998.

Ferguson, Charles, and Frank Von Hippel, "U.S. Tritium Production Plan Lacks Strategic Rationale," *Defense News* 29 (December 7-13, 1998).

"Nation Shirks Duty to Nuclear Victims,"*The Tennessean*, September 29, 1998.

Commentor 820 (Roy Priest for U.S. Congressman Bud Cramer)

1/07.08 The commentor states that Congressman Cramer supports the Bellefonte option on the grounds that it is more cost-effective, offers economic benefits such as cost recovery over the lifetime of the contract, and is very much supported by state and local officials and area residents. The Watts Bar and Sequoyah irradiation services option would offer none of these benefits.

Commentor 821 (Charles Dotson)

1/07.03 The commentor states that the Bellefonte option is the cheapest and most effective choice over the long term, and it would create jobs and help the economy.

Commentor 822 (Calvin Underwood)

1/07.08: The commentor states that he supports the Bellefonte option because of the positive impacts it would have on ratepayers, taxpayers, and the area workforce. Only this option would increase jobs. The Bellefonte option is the only option fully compatible with the programmatic requirements. Bellefonte offers a dedicated facility with a flexible schedule that can adapt to programmatic changes in requirements. It would be difficult to deal with such changes at a nondedicated baseload plant like Watts Bar or Sequoyah. Also, cost factors favor Bellefonte—it would be the best option for DOE, TVA, the United States, and TVA ratepayers.

Commentor 823 (Steve Tanner)

1/07.08 The commentor notes that DOE has stated the selection criteria being considered. One criteria not listed, which is stated in public law, involves the "liabilities and benefits of the technologies, including benefits like revenues." They (the commentor's family) believe TVA's Watts Bar and Sequoyah option would not be the best choice for tritium production for three reasons.

First, the offer commits two baseload nuclear plants to a mission that would no longer be solely power production. This would place a liability on TVA and would increase risks to TVA's ability to produce reliable, low-cost power for its customers, the ratepayers.

Second, there are no direct benefits from the Watts Bar/Sequoyah offer to Hamilton or Rhea Counties or the State of Tennessee. The offer provides no new jobs and no increase in the tax base. It does not salvage use of an existing government asset; provides no revenue-sharing to DOE; and does not add the positive environmental benefit of new power generation without emission of greenhouse gases.

Third, the overall cost is higher than that of the Bellefonte option. Although the Watts Bar offer comes with low annual payments, the total long-term cost is higher than the Bellefonte offer and the term is shorter.

The commentors, therefore, believe that Bellefonte would be the best choice for tritium production because it meets the selection criteria; offers the lowest cost to taxpayers; does not come with the liabilities and risks of a baseload plant; and provides distinct local and national economic benefits.

The commentors point out that DOE must not forget that it has other missions in addition to national security. DOE's core mission statement begins with the words, "To foster a secure and reliable energy system that is environmentally sustainable,...." During the Fiscal Year 1999 budget process, DOE states that it had established five key goals that drive all its strategic planning and budgetary decisions. Three of these goals are directly supported by the selection of Bellefonte, but are not supported by the selection of Watts Bar and Sequoyah.

Selection of Bellefonte would:

- Promote clean, efficient energy and enhance energy security through provision of new nuclear power generation capacity.

- Stabilize and protect the environment by preventing new fossil-fueled generation that would result in greenhouse gas emissions.

- Stimulate U.S. economic productivity through job creation and multiregional economic development.

The commentors contend that the Secretary of Energy should not select merely an acceptable option, but should select the option that, using the Vice President's words, is in the "best interest of all citizens."

Commentor 824 (Joseph Imhof)

1/01.09 The commentor states that he opposes the use of commercial facilities for weapons use.

2/ 07.08 The commentor believes the best policy is one that entails the least amount of harm to the fewest humans and biological entities. Therefore, the impact of tritium production should be minimal. The commentor believes existing facilities should be used for tritium production whenever possible without impacting new areas of population and generating additional expense to U.S. taxpayers. Use of existing facilities would avoid creating new health risks and environmental concerns. The commentor believes Watts Bar should be the main unit for tritium production, with Sequoyah as a backup facility. Bellefonte should be considered for use as a natural gas electric power production facility, which would cost billions less than its completion as a nuclear power plant. Bellefonte should not be considered for use as a coal-fired plant because this would make it a source of acid rain and particulate matter, which would aggravate people with respiratory illnesses.

Commentor 825 (Ralph Hutchison)

1/01.01 The commentor is in favor of arms reduction and eventual nuclear disarmament.

2/14.05 The commentor states that, according to the CLWR Draft EIS, tritium production at Watts Bar under normal operations would increase tritium released to the air by slightly less than 300 times. Tritium released to area water sources without tritium production at Watts Bar is 639 Curies compared to 17,649 Curies from tritium production. In addition, radiation doses to area residents is 10 times higher than normal under tritium production.

3/02.01 The commentor submits a letter to the Secretary from himself and other area residents asking DOE not to produce tritium at any of the TVA plant sites or at the Savannah River Site.

Commentor 826 (Jimmy Sandlin)

1/07.08 The commentor states that the people of Jackson County, Alabama, support tritium production at Bellefonte and are opposed to tritium production at the Watts Bar/Sequoyah Plants because it would compromise the region's power supply under moderate and extreme loading conditions. Tritium production at Bellefonte would add 1,200 megawatts to the TVA power system, which would decrease the risk of sharp price increases and increase stability. Selection of the Watts Bar/Sequoyah Plants would increase price instability because the generation capacity supplied by the plants could be interrupted if DOE needs to extract tritium during extreme load conditions. If TVA nuclear generation were not available, wholesale power costs would rise, thereby jeopardizing municipal and cooperative electric distribution systems. The commentor states that the Tennessee Valley Power Distributors unanimously support completion of Bellefonte for tritium production.

Commentor 827 (Louvain Edmondson)

1/07.03 The commentor states that Bellefonte is the best choice for tritium production because there is substantial congressional, state, and local support. Also, a dedicated unit is preferable to a baseload plant that would lose power generation if put on a 12-month schedule, resulting in negative impacts to ratepayers. Bellefonte would provide additional generation capacity without greenhouse gas emissions, as well as economic benefits such as jobs and cost recovery via revenues.

Commentor 828 (Monica Blanton)

1/01.09 The commentor states that the United States should follow the nonproliferation policy it espouses to other nations by not using commercial facilities for weapons production. The commentor states that the proposed action blurs the line between civilian and military nuclear facilities.

2/23.13 The commentor states that the cost to produce tritium should not be a major factor in determining where it is produced.

3/07.04 The commentor opposes tritium production at any of the TVA plants.

Commentor 829 (Mary Lentsch)

1/02.01 The commentor states that tritium production is unnecessary because reserve inventories are available and can last until 2016. The commentor states that she trusts Secretary of Energy Bill Richardson to say “NO” to tritium production.

2/01.09 The commentor states that the United States must maintain its respect among nations by following the nonproliferation policies it has promoted, particularly the ban on the use of commercial facilities for military nuclear purposes.

3/01.04 The commentor states that the United States cannot maintain its integrity if it violates the Nonproliferation Treaty to produce tritium. The commentor states that interdependence among nations in living up to their agreements is vital.

4/01.12 The commentor does not understand why there is such urgency for tritium production at the Watts Bar/Sequoyah Plants when the United States seems to be reducing its nuclear arsenal.

5/07.07 The commentor states that, if tritium is produced at the Watts Bar/Sequoyah Plants, all she can say is “MERCY ME! OH LORD, HAVE MERCY!”

Commentor 830 (Dwight Wilhoit)

1/07.08 The commentor asks that the Secretary not do the cheap and easy thing in making his decision, but do the right thing–select Bellefonte for tritium production. Selection of Bellefonte is supported by local residents and would help a depressed area by bringing thousands of jobs, while selection of Watts Bar does nothing for the citizens of the Tennessee Valley.

Commentor 831 (Don Nelms)

1/07.03 The commentor states that he and his union support the use of the Bellefonte Plant for tritium production. The commentor states that TVA was founded to provide jobs and electricity for Americans, and DOE has the opportunity to help TVA continue to do so.

Commentor 832 (Carl Fowler)

1/06.03 The commentor states that he opposes the use of Hanford (Fast Flux Test Facility) for tritium production for cost and environmental reasons.

2/07.01 The commentor opposes building the APT for tritium production for economic and schedule reasons, and states it is an unproven technology.

3/07.08 The commentor opposes using Watts Bar and/or Sequoyah for tritium production because it would not yield any economic benefit and the option has little support among area residents. The commentor points out that tritium production would be secondary at Watts Bar and Sequoyah, but the primary mission at Bellefonte. The commentor supports the completion and use of Bellefonte for tritium production because it would bring substantial economic benefit to the region and there is significant local, state, and congressional support for this option.

Commentor 833 (Greg Wright)

1/07.08 The commentor, as a businessman, recognizes that there is little return on DOE's investment if it uses the Watts Bar and Sequoyah plants for tritium production, but there would be a high return from selecting the Bellefonte plant for this purpose. Bellefonte would be an asset to the economy in the southern region of the country; would increase TVA's electricity-generating capacity; and would stabilize rates.

Commentor 834 (Mitchell Weir)

1/07.08 The commentor is against the selection of the Watts Bar and Sequoyah plants and favors selection of the Bellefonte plant on the basis of job creation.

Commentor 835 (Leaf Myczack)

1/05.31 The commentor complains that notification about the meeting was poor.

2/05.09 The commentor charges that the Lead Test Assembly demonstration was already underway when DOE had the public meeting on that issue.

3/24.29 The commentor states that tritium is a weapons component and DOE should be honest about that fact.

4/24.30 The commentor expresses concern about the impacts of tritium production on uranium mine workers and people living in the vicinity of uranium mines.

5/07.04 The commentor opposes tritium production at any of the TVA plants.

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3. COMMENT SUMMARIES AND RESPONSES

> This chapter presents summaries and responses to comments the Department of Energy received during the public comment period on the *Draft Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*. Comments received in conjunction with the December 14, 1998, public meeting are also addressed in this chapter.

All comments received during the public comment period are addressed in this chapter. The comments have been summarized and organized under issue categories. Where possible, identical or similar comments provided by more than one commentor are grouped together into one comment summary. The comment summaries also are organized under comment summary-response codes. These codes are keyed to Table 1-7, Comments Sorted by Summary-Response Code, and are presented in numerical order. Responses have been prepared by the Department of Energy (DOE) and the Tennessee Valley Authority (TVA) for each of the comment summaries. These responses indicate whether changes were made to the *Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (CLWR EIS) and the rationale behind those changes.

The comments summarized under each issue category are listed below each summary. The first numeral in each comment number represents the document or public hearing commentor number, and the second numeral after the dash represents the comment number. These comment numbers can be used in Chapter 2 to locate the original comments. Section 1.3 further describes the organization of this Comment Response Document and discusses the tables provided in Chapter 1 to assist the reader.

CATEGORY 01: POLICY ISSUES

01.01 Several commentors assert that DOE should not produce tritium or nuclear weapons. Other commentors question why nuclear weapons require tritium. One commentor requests that the EIS be withdrawn and that DOE not make a decision to select a new tritium production option. Several commentors express the need to maintain a strong defense.

Comments Summarized: 2-4, 5-2, 7-2, 19-1, 30-2, 110-2, 112-1, 124-2, 136-11 137-2, 207-2, 212-3, 217-1, 223-2, 225-2, 232-6, 248-1, 250-6, 603-2, 702-9, 720-1, 800-6, 825-1

Response: In accordance with Section 91 of the Atomic Energy Act, DOE is required to carry out its atomic weapon activities consistent with the express consent and direction from the President. This express consent and direction is contained in the Nuclear Weapons Stockpile Plan, which is described in Volume 1, Section 1.3.1 and Chapter 2 of this EIS. The issue of whether DOE should produce tritium or nuclear weapons is beyond the scope of the CLWR EIS. Volume 1, Section 1.3.2 of the EIS discusses the tritium requirement for U.S. nuclear weapons. As described in that section, all weapons in the U.S. stockpile require tritium to function as designed. Without tritium, none of the weapons in the stockpile would be capable of functioning as designed, the Nuclear Weapons Stockpile Plan requirements would not be met, and the nuclear deterrent would degrade. Eventually the nuclear deterrent would be lost. The alternative of redesigning weapons to require less or no tritium was evaluated but dismissed from further consideration for the reasons stated in Section 3.1.3 of the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling Programmatic Environmental Impact Statement* (Final Programmatic EIS) (DOE 1995). [See also the response to Comment Summary 01.03.] DOE acknowledges the commentors' concerns that the United States maintain a strong defense.

01.02 One commentor expresses pleasure that, in making decisions about tritium production, some members of Congress have kept DOE on the steady path of determining what is best for the United States and have supported basing the decision on merit, not politics. One commentor thinks the real battle is yet to come before $2 billion is appropriated by Congress for this project. One commentor suggests that DOE would not get the support of the Alabama delegation if the area doesn't gain anything. Another commentor suggests that, while there is local political support for Bellefonte, it is by no means universal. Another commentor asks whether DOE is aware that the vote on the Markey-Graham Amendment was close and in opposition to the CLWR program.

Comments Summarized: 90-2, 232-2, 700-20, 702-7, 713-3, 806-4

Response: The actions of elected officials are beyond the scope of the CLWR EIS.

01.03 Several commentors contend that DOE does not need tritium because the nuclear weapons will work without tritium, albeit at reduced yields. Another commentor states that, with new treaties limiting multiple-warhead delivery systems to one warhead per delivery system, the additional weight capacity of the delivery systems would allow a heavier warhead that could be designed to deliver the same yield without using tritium. Another commentor suggests that a system whereby the decayed helium and hydrogen could be diverted prior to weapon detonation might be used, thereby negating the need for tritium replenishment.

Comments Summarized: 3-1, 97-1, 110-4

Response: The alternative to redesign weapons to require less or no tritium was considered in Section 3.1.3 of the Final Programmatic EIS (DOE 1995), but dismissed as unreasonable. As explained in that section, the nuclear warheads in the enduring stockpile were designed and built in an era when the tritium supply was assured, when underground testing was being conducted, and when military needs required that the warheads be optimized in terms of weight and volume. Replacing all of these warheads with new ones that would use little or no tritium for the sole purpose of reducing overall tritium demand would not be feasible. Without underground nuclear testing to verify their safety and reliability, new warhead designs could not deviate very far from existing designs, which require the use of tritium. Even with underground testing to facilitate new designs and a fully operational production complex, it would still take many years to build enough nuclear weapons to replace the entire stockpile. Furthermore, the design of a whole new weapons stockpile, the resumption of the underground nuclear testing program necessary to prove the safety and reliability of such a new stockpile, and the redesign of all delivery systems would undoubtedly have severe impacts on negotiating additional bilateral arms reductions.

In regard to the suggestion of adding a new mechanism to purge the helium and hydrogen immediately prior to detonation, nuclear weapons are designed to function using a specified amount of tritium. As explained in Volume 1, Section 1.3.2 of the CLWR EIS, the implosion of the pit along with the onset of the fissioning process heats the deuterium-tritium mixture to the point that the atoms undergo fusion. This is a very intricate and precise process and is dependent upon a specified amount of tritium which interacts with other components specifically designed for such an interaction. Either the specified amount of tritium is present to enable the weapons to be capable of functioning as designed, or it isn't. This is why the tritium reservoirs must be replenished on a regular basis.

01.04 Commentors suggest that production of tritium in a CLWR poses a nuclear proliferation risk. Several other commentors indicate that use of a CLWR to produce tritium violates the Nuclear Nonproliferation Treaty, especially Article VI's commitment to total disarmament. Another commentor indicates that, if the CLWR program were to influence just one other country to do what is being proposed by the CLWR EIS, the U.S. nuclear nonproliferation effort will be lost. Another commentor states that production of tritium in a CLWR sends a message to other countries that the U.S. intends to keep its nuclear weapons well into the future. Another commentor asks, “What moral authority does the United States have to damn Saddam Hussein for building weapons of mass destruction while we, a signer of the Nonproliferation Treaty, plan to continue production of nuclear weapons?” Another commentor refers DOE to an additional study, *Getting on With Tritium Production: A Report to Speaker Newt Gingrich*, which concluded that CLWR production of tritium does not violate any treaties, laws, or policies. Another commentor states that tritium production is necessary to keep the United States strong while we move forward toward the goal of total nuclear disarmament. One commentor says that the interagency nonproliferation review cited in Section 1.3.5 of the CLWR Draft EIS was either bound by a predetermined outcome or prepared by a group which was astonishingly inept. The same commentor also indicates that the United States is not upholding its obligations under Article VI of the Nonproliferation Treaty by maintaining a very large arsenal into the next century.

Comments Summarized: 32-2, 45-1, 46-1, 48-2, 53-1, 84-7, 89-2, 90-3, 94-6, 99-4, 100-3, 102-2, 109-4, 110-1, 115-3, 119-1, 132-3, 136-6, 137-6, 212-4, 217-2, 235-3, 239-5, 249-2, 250-4, 501-14, 503-1, 600-2, 604-2, 700-15, 702-11, 707-5, 712-7, 713-4, 800-5, 803-6 805-1, 829-3

Response: The issue of nonproliferation is addressed in Volume 1, Section 1.3.5 of the CLWR EIS. As explained in that section, in order to fully investigate the potential impacts of the CLWR proposal on nonproliferation efforts, a high-level interagency review was conducted. That effort resulted in the July 14, 1998, issuance of the *Interagency Review of the Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy, A Report to the Congress* (DOE 1998b). This report, prepared by top Administration officials from various government departments including the Department of Defense, the Department of State, and the Department of Energy, concluded that any nonproliferation issues associated with the use of a CLWR to produce tritium were manageable and that DOE should continue to pursue the CLWR option. The review further concluded that there are no legal or treaty prohibitions against tritium production in a CLWR; reactors making tritium can remain on the International Atomic Energy Agency (IAEA) Safeguards List; and no bilateral “peaceful uses” agreements would be violated so long as unrestricted fuel and components are used.

In regard to the Nuclear Nonproliferation Treaty, nowhere does it specifically refer to tritium. Under the Treaty, parties agree not to transfer nuclear weapons or other devices or control over them, and not to assist, encourage, or induce nonnuclear states to acquire nuclear weapons. Production of tritium in a CLWR by a nuclear weapons state in no way conflicts with such an agreement.

In regard to the U.S. use of CLWRs to produce tritium and the influence this action might have on enticing other countries to do the same, production of tritium in a CLWR fully supports the goals of Article VI of the Nuclear Nonproliferation Treaty, in which signatory nations agree to work toward total disarmament. Since the end of the Cold War, the United States has significantly reduced the size of its nuclear weapons stockpile and DOE has dismantled more than 12,000 nuclear weapons. At the present time, the United States is further downsizing the nuclear weapons stockpile consistent with the terms of the Strategic Arms Reduction Treaty I (START I), and DOE is continuing its dismantlement activities. The United States has ratified the START II Treaty and is hopeful Russia will do likewise. Negotiations required for further reductions will stretch well into the next century, and tritium production in a CLWR to support a reduced nuclear weapons stockpile, while the United States actively pursues further nuclear weapons reductions agreements, is consistent with the long-range goal of total nuclear disarmament.

The United States is a declared weapons state, and the purpose of nonproliferation efforts is to keep nonweapons states from acquiring nuclear weapons while weapons states work towards the longer term goal of achieving total nuclear disarmament. Other declared nuclear weapons states already produce tritium in reactors that also produce electricity for commercial use. Nonweapons states which have agreed not to manufacture nuclear weapons are not likely to be encouraged to do so as a result of the U.S. decision to produce tritium in a CLWR. As for rogue states bent on obtaining nuclear weapons at any cost, it is doubtful that U.S. production of tritium in a CLWR will have any influence on their nuclear weapons endeavors.

In regard to the commentor who referred DOE to *Getting on with Tritium Production: A Report to Speaker Newt Gingrich*, dated September 29, 1995, the Department has reviewed this document and is aware of this report's finding that production of tritium in a CLWR would not violate any treaties, laws, or policies.

01.05 The commentor wonders whether the Interagency Review Panel (on nonproliferation issues associated with CLWR tritium production), the Department of Energy, etc., have decided it is permissible for India, Iraq, and North Korea to produce tritium in their commercial reactors for use in nuclear weapons.

Comment Summarized: 702-8

Response: No. The goal of the Nuclear Nonproliferation Treaty is to prevent nations such as Iraq, North Korea, and India from having a nuclear weapons program at all, regardless of where materials might be made.

01.06 The commentor wants additional clarification concerning the statement in Section 1.3.5(3) of the CLWR Draft EIS that any reactors used to produce tritium would "remain eligible for IAEA safeguards." The commentor also asks for an explanation of the safeguards provided by the IAEA.

Comments Summarized: 94-7, 811-1

Response: The TVA reactors will remain on the U.S. list of facilities eligible for IAEA safeguards. Under the 1980 U.S./IAEA Safeguards Agreement, the United States has sole authority to decide which U.S. facilities are eligible for safeguards and the IAEA has sole authority to decide which eligible facilities will be selected for safeguards. Although the IAEA does not monitor the production of tritium, the IAEA has advised the U.S. government that the use of any CLWR to produce tritium would not preclude the IAEA from applying safeguards at such facilities. All relevant U.S. agencies have agreed that, if tritium is produced at a TVA facility, the TVA facility will be maintained on the list of installations eligible for IAEA inspection.

IAEA safeguards are designed to safeguard the flow of special nuclear and source material under the U.S./IAEA Agreement and to detect the withdrawal of significant quantities of nuclear material from activities while such material is being safeguarded. Safeguard procedures are based upon material accountancy with containment and surveillance as important complementary measures. Material control system records and design information are made available to the IAEA for examination and verification. The IAEA may make routine, ad hoc, or special inspections to verify information received. During inspections, the IAEA may make use of statistical techniques and random sampling in evaluating the flow of nuclear material.

01.07 The commentor states that the CLWR Draft EIS indicates that DOE would provide blended-down highly enriched uranium to be used for reactor fuel. The commentor believes that such a use of weapons material is inappropriate, as the Department has already acknowledged by removing such a proposal from the *Storage and Disposition of Weapons — Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE 1996). Another commentor asks why DOE cannot use "off-spec" blended-down highly enriched uranium at Sequoyah for tritium production.

Comments Summarized: 94-24, 803-2

Response: DOE has amended the language in Volume 1, Section 5.2.7 of the CLWR EIS to indicate that any highly enriched uranium provided by DOE for downblending into CLWR fuel would come from highly enriched uranium set aside for national security purposes, and would not come from highly enriched uranium that has been declared excess to weapons needs.

"Off-spec" blended-down highly enriched uranium is material that does not meet the standard specifications for commercial nuclear reactor fuel. The fuel contains higher than usual amounts of a material that inhibits the fission process. "Off-spec" fuel still can be used in nuclear fuel if the fuel is at a somewhat higher commercial fuel enrichment level. While there is no legal prohibition, using "off-spec" highly enriched uranium in a tritium production reactor could be judged to be inconsistent with U.S. commitments to refrain from using the material to manufacture nuclear weapons.

01.08 The commentor requests information on the Congressional or Presidential positions on nonproliferation at the time Atomic Energy Commission regulatory authority was given to the U.S. Nuclear Regulatory Commission (NRC) and the rest of the military support mission was given to the Energy Research and Development Administration (and then to DOE).

Comment Summarized: 4-7

Response*:* The delegation of Atomic Energy Commission regulatory authority for commercial reactors to the NRC and the delegation of the remaining Atomic Energy Commission authority to the Energy Research and Development Administration (and then to DOE) did not constitute a policy decision to separate commercial power from weapon production.

01.09 Commentors contend that it goes against long-standing national policy to produce materials for nuclear weapons at a commercial facility. Several commentors indicate that the nonproliferation study referred to in the CLWR Draft EIS only addresses military-to-civilian instances, and that this is not the same as civilian-to-military—that crossing the line from military-to-civilian use of a reactor is not remotely comparable to crossing the line the other way. Additional commentors state that it would be hypocritical for the United States to manufacture tritium in a CLWR while at the same time formally trying to prohibit other countries such as India, Pakistan, or North Korea from doing the same thing. Another commentor believes that a CLWR is not capable of serving "two masters," i.e., operating in both a civilian and military mode at the same time. Another commentor states "Use of a commercial plant to produce weapons material would set a precedent for Iraq, China, and any other country to disguise weapons development as civilian activity." Another commentor indicates that Section 57.e of the Atomic Energy Act prohibits the government from using commercial nuclear power plants to facilitate the development of nuclear weapons. Another commentor states that it is disingenuous of DOE to pretend it misunderstood the public's concern, and that it is absurd to imagine the United States would threaten another nuclear power to prevent them from converting a military installation to a peaceful purpose or would disable their efforts to use military technology for civilian purposes. This commentor states the real concern always has been that nations would be able to disguise weapons development as civilian activity, and this is precisely what DOE is proposing with the CLWR program. Another commentor states that producing tritium in a commercial reactor is "illegal and counterproductive to life on earth."

Comments Summarized: 2-1, 4-8, 6-3, 7-1, 9-1, 13-5, 14-1, 20-1, 25-4, 32-1, 41-1, 44-11, 51-1, 52-1, 95-1, 99-1, 100-4, 102-1, 110-5, 113-1, 117-1, 120-2, 124-1, 132-5, 135-1, 136-7, 206-1, 207-1, 208-3, 218-1, 235-2, 239-2, 245-1, 250-3, 501-15, 504-1, 505-1, 700-16, 707-6, 817-2, 824-1, 828-1, 829-2

Response: There is no U.S. policy, law, or treaty that prohibits the production of tritium which will ultimately be used in weapons in a commercial reactor. Although Section 57.e of the Atomic Energy Act of 1954, as amended, prohibits the use of special nuclear materials produced in an NRC-licensed facility (a commercial reactor), tritium is not considered a special nuclear material as defined by Section 11.aa of the Atomic Energy Act.

Additionally, production of tritium in a U.S. commercial reactor is not inconsistent with U.S. opposition to such production by India, Pakistan, or North Korea. The United States is a declared weapons state, and the purpose of the nonproliferation efforts is to keep nonweapons states from acquiring nuclear weapons while weapons states work toward the longer-term goal of achieving total nuclear disarmament. In addition, several other nations operate dual-purpose reactors which serve both civilian and military needs.

The commentors are correct in that the CLWR Draft EIS only gives examples of military-to-civilian joint uses of reactors. The CLWR Final EIS has been amended to include examples of civilian-to-military joint uses of reactors. These additional examples of civilian-to-military uses may be found in Volume 1, Section 1.3.5 of the CLWR EIS.

In regard to the ability of a CLWR to operate in both a civilian and military capacity at the same time, the tritium-producing burnable absorber rods (TPBARs), as described in Volume 1, Section 3.1.2, replace the existing burnable neutron absorber rods of a normal reactor operation. They absorb excess neutrons and extend fuel life in the same way as the burnable absorber rods they replace. TPBARs do not affect the normal operation of the reactor, but they produce tritium, all of which is internally captured in the TPBAR getter.

01.10 Commentors allege that tritium should not be produced in a CLWR because the use of nuclear weapons is morally and ethically wrong. Another commentor alleges that moral and ethical issues are already present in abundance in the CLWR Draft EIS and, while uncomfortable to contemplate and difficult to quantify, they deserve full consideration throughout this decisionmaking process. Another commentor states that security will be generated not by nuclear energy and nuclear weapons, but by developing a reverence for life.

Comments Summarized: 84-5, 94-27, 136-8, 223-3, 248-5, 501-16, 603-3, 702-17, 712-4

Response: The CLWR EIS assesses the potential environmental impacts associated with tritium production at one or more CLWRs. While one could opine that moral and ethical issues are integral to every issue addressed in an EIS, the focus of an EIS is on potential environmental impacts. Strictly moral and ethical issues are outside the scope of the CLWR EIS.

01.11 The commentor expresses disappointment that the Senate approved CLWRs for tritium production, but is pleased that DOE will not receive funding for it in Fiscal Year 1999. The commentor also expresses hope that DOE will be more thorough in considering the CLWR Program's impact on national and international obligations, human health, and the environment.

Comment Summarized: 102-5

Response: The commentor is referred to Volume 1, Chapter 1 for a discussion of a number of national and international concerns, and to Chapter 5 for a thorough evaluation of the environmental consequences of the proposed action.

01.12 The commentor asks why DOE and the Federal Government are moving so quickly on tritium production, and why Secretary Richardson believes he has to make the technology decision before the end of the calendar year.

Comments Summarized: 212-2, 235-4, 704-6, 829-4

Response: All nuclear weapons in the United States stockpile must contain tritium to be capable of performing as designed. Because it decays, the tritium contained in nuclear weapons must be replenished periodically. The United States has not produced new tritium since 1988. International arms control agreements in recent years have led to reductions in the size of the nuclear weapons stockpile. This, in turn, has allowed DOE to recycle tritium from dismantled weapons for use in the remaining stockpile. However, due to the decay of tritium, the current inventory of tritium will not be sufficient to meet national defense requirements past approximately 2005. The most recent Presidential direction, which is contained in the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive, mandates that new tritium must be available by approximately 2005 if a CLWR is the selected option for tritium production. In order for DOE to obtain tritium from a CLWR by that date, it is necessary first to make the CLWR tritium technology decision by December 1998, as mandated by the Fiscal Year 1998 Authorization Act. Subsequent to the tritium technology decision, the following events would need to occur before approximately 2005: (1) TPBARs must be fabricated; (2) an NRC license amendment to allow irradiation of the TPBARs in a CLWR must be obtained; (3) TPBARs must be irradiated in a CLWR, removed, and cooled; (4) irradiated TPBARs must be transported to the Savannah River Site; and (5) tritium must be extracted at the proposed Tritium Extraction Facility at Savannah River.

01.13 The commentor asks for a definition of special nuclear material and wants to know why tritium is not a special nuclear material.

Comments Summarized: 212-5, 807-1

Response: As indicated in Volume 1, Chapter 10, the Glossary, "special nuclear material" is defined in Section 11 of the Atomic Energy Act of 1954. Accordingly, special nuclear material means: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the NRC determines to be special nuclear material; or (2) any material artificially enriched by any of the foregoing. Section 51 of the Atomic Energy Act further states that, "The Commission [i.e., NRC] may determine from time to time that other material is special nuclear material in addition to that specified in the definition as special nuclear material. Before making such determination, the Commission must find that the determination that such material is special nuclear material is in the interest of the common defense and security, and the President must have expressly assented in writing to the determination."

The NRC has not classified tritium as special nuclear material. Tritium, therefore, is not legally classified or regulated as special nuclear material under the Atomic Energy Act.

01.14 The commentors suggest that DOE could buy tritium from either Russia or Canada. One commentor notes that, if money alone is the issue, DOE could buy tritium from Russia; however, this commentor felt that such a move would leave our weapons program vulnerable to a foreign power. Another commentor points out that 14 kilograms of tritium have been extracted in Canada since 1988 and suggests that DOE should acquire it at $30,000 per gram rather than produce it.

Comments Summarized: 240-2, 241-1, 253-1, 811-4

Response: In the Final Programmatic EIS (DOE 1995), DOE considered the purchase of tritium from other sources, including foreign nations. Conceptually, the purchase of tritium from foreign governments could fulfill the tritium requirement. However, while there is no national policy against purchase of defense materials from foreign sources, DOE determined that the uncertainties associated with obtaining tritium from foreign sources rendered this alternative unreasonable for an assured long-term supply. Consequently, in this tiered CLWR EIS, the purchase of tritium from foreign sources is still considered an unreasonable alternative.

01.15 Several commentors feel that the Vice President's office has influenced this decision and has been too involved in moving TVA's agenda. They believe that this will compromise the Vice President's ability to stand before the world community in the future and argue against weapons of mass destruction if he is elected to a higher office. Another commentor suggests that the Vice President's support of the proposed action will damage his chances in the 2000 presidential election.

Comments Summarized: 249-3, 802-5, 803-7, 811-8

Response: Energy Secretary Bill Richardson announced that the CLWR will be the primary technology for tritium production because it is a proven technology; it has the flexibility to meet a range of future needs; and it is the best deal for the taxpayer. He also explained that the Watts Bar and Sequoyah plants are the Preferred Alternative because they would provide tritium when needed, at cost, without a large capital expense. The political aspirations of the Vice President are beyond the scope of the CLWR EIS.

CATEGORY 02: PURPOSE AND NEED FOR TRITIUM

02.01 Several commentors question the need for tritium. One commentor asserts that, "DOE claimed in 1988 that national security would be jeopardized if tritium production did not resume swiftly, however, no crisis has resulted." Several commentors state that the United States should shift away from a dependency on nuclear weapons. Other commentors question the need for nuclear weapons and whether the United States needs as many nuclear weapons as it has. Several commentors assert that the United States should be reducing its nuclear weapons stockpile, rather than producing more tritium.

Comments Summarized: 2-2, 5-1, 6-1, 9-2, 13-3, 20-2, 21-1, 47-1, 48-1, 53-2, 94-5, 108-3, 109-2, 111-1, 112-4, 119-2, 122-1, 125-1, 137-4, 208-2, 235-1, 239-3, 248-3, 249-1, 507-1, 700-13, 803-11, 806-8, 817-3, 825-3, 829-1

Response: Since the end of the Cold War, the United States has significantly reduced the size of its nuclear weapons stockpile and DOE has dismantled more than 12,000 nuclear weapons. At the present time, the United States is further downsizing its nuclear weapons stockpile, consistent with the terms of the START I Treaty, and DOE is continuing dismantlement. The United States ratified the START II Treaty and is hopeful that Russia will do likewise. Additionally, the United States is committed to further weapons reduction in accordance with the Nonproliferation Treaty. As stated in Volume 1, Section 1.3.3 of the CLWR EIS, reductions in the size of the nuclear weapons stockpile, brought on by international arms control agreements, have enabled DOE to fulfill its tritium requirements by recycling tritium removed from weapons. This source of tritium is presently being utilized and already has been factored into the tritium requirement projections, which indicate a need for a new supply of tritium by approximately 2005. While future arms control reductions may change the requirements, DOE is responsible for meeting the current requirements set forth by the President. The need for nuclear weapons and the issue of how many nuclear weapons the United States should maintain in its nuclear deterrent are beyond the scope of the CLWR EIS. The need for a new tritium supply is explained in Volume 1, Chapter 2 of the CLWR EIS. [See also the response to Comment Summary 02.02 for additional information.]

02.02 Several commentors question the need for tritium by 2005. One commentor specifically questions whether the 2005 date comes from the Presidential directive or from DOE's extrapolation from the Presidential directive. Several commentors assert that DOE does not need tritium until 2016 to maintain START II levels and, by then, the United States likely will need less tritium due to additional multilateral stockpile reductions. Several commentors also opine that a scenario of 1,000 warheads would be more than enough for national defense and this scenario would not require additional tritium until 2032. One commentor questions how it is possible that tritium is needed by 2005 for the CLWR alternative, but not until 2007 for the accelerator alternative. The commentor asserts that the need date for tritium should be independent of the tritium supply source.

Comments Summarized: 84-6, 94-2, 99-2, 100-2, 110-3, 115-4, 116-9, 132-4, 136-9, 137-5, 250-2, 604-1, 700-11, 704-8, 707-3, 712-5

Response: As discussed in Volume 1, Chapter 2 of the CLWR EIS, the need for a new tritium supply is based on the 1996 Nuclear Weapons Stockpile Plan and an accompanying Presidential Decision Directive. The approximate 2005 date comes directly from the Presidential Decision Directive, not from DOE's extrapolation from the Presidential Decision Directive. The 1996 Nuclear Weapons Stockpile Plan, which represents the latest official guidance for tritium requirements, is based on a START I-level stockpile size of approximately 6,000 accountable weapons. A Nuclear Weapons Stockpile Plan for 1997 and 1998 was not issued. The potential impacts of future arms control agreements were accounted for in the development of the 1996 Nuclear Weapons Stockpile Plan. Commentors' assertions that new tritium is not needed until 2016 are erroneous and are not based on the current Nuclear Weapons Stockpile Plan requirements. The issue of whether a stockpile of 1,000 warheads would be more than enough to secure national defense is beyond the scope of the CLWR EIS. The purpose of the CLWR EIS is to evaluate the environmental impacts of the reasonable CLWR alternatives for providing the tritium necessary to support the enduring stockpile, as defined by the President in the Nuclear Weapons Stockpile Plan. Concerning whether the need for tritium is independent of the supply source, the reason the year 2007 was mandated for accelerator tritium production is that is the earliest date by which the accelerator could be built and begin operation. In such a case, tritium requirements from approximately 2005 until 2007 would have been met by withdrawals from the tritium reserve. The tritium reserve then would have been replenished by producing tritium quantities greater than the decay requirements. The Secretary's December 22, 1998, announcement that the CLWR would be the primary supply tritium technology means that DOE will not have to withdraw from the tritium reserve.

CATEGORY 03: TRITIUM REQUIREMENTS

03.01 Several commentors opine that the classified tritium requirements should be declassified. One commentor states that a meaningful review of the CLWR EIS is not possible due to the classification issues. Another commentor asserts that DOE is hiding behind classifications and that the citizenry should be entitled to the same information as DOE. Lastly, one commentor opines that, if the tritium requirements were declassified, they would show that tritium is not needed as soon as DOE claims. Another commentor is not willing to risk national security to declassify tritium requirements.

Comments Summarized: 700-12, 704-4, 719-1

Response: Tritium requirements are classified to protect national security. While DOE's philosophy is to disclose as much information to the public as possible, this does not include classified information. Volume 1, Chapter 2 of the CLWR EIS provides unclassified information regarding the tritium requirements. As discussed in that chapter, the President directed DOE to provide a new tritium supply source by approximately 2005 in order to meet the requirements set forth in the most recent Nuclear Weapons Stockpile Plan. The unclassified tritium requirements information presented in Chapter 2 is consistent with the classified tritium requirements.

03.02 Commentors question whether the Bellefonte plant could meet tritium requirements by approximately 2005. Commentors further question what would happen if Bellefonte were not on line in time to support the tritium requirements.

Comments Summarized: 500-2, 502-2

Response: If TVA were not able to provide the necessary tritium by approximately 2005 using Bellefonte Unit 1, then TVA would produce tritium in Watts Bar 1 and/or Sequoyah 1 and/or 2 to meet the tritium requirements.

03.03 Several commentors state that the CLWR Draft EIS is unclear about the number of TPBARs and the number of reactors required to meet tritium demands. One commentor states that the CLWR EIS should explain that 3 kilograms of tritium is the surge goal and that the "day-in, day-out goal is something lower." One commentor questions why DOE needs 40 years of tritium production at 3 kilograms per year.

Comments Summarized: 44-7, 45-7, 86-13, 116-10, 501-9, 503-11, 504-4, 700-6, 703-3

Response: As described in Volume 1, Section 3.2.1 of the EIS, the CLWR program is being designed to produce up to 3 kilograms of tritium per year. The text in Section 3.2.1 has been modified to clarify that 3 kilograms of tritium represents an unclassified maximum requirement that only would be required if the tritium reserve were ever lost/used. Producing up to 3 kilograms of tritium would involve the irradiation of up to 6,000 TPBARs in an 18-month cycle. The maximum number of TPBARs that could be irradiated in a single reactor without significantly disrupting the normal electricity-producing mode of operation is approximately 3,400 TPBARs per each 18-month cycle. Consequently, producing 3 kilograms of tritium without significantly disrupting the normal electricity-producing mode of operation would require more than one reactor. It should be noted, however, that producing 3 kilograms of tritium per year likely would be a short-term requirement to reconstitute the tritium reserve. In such a case it is technically feasible to produce larger quantities of tritium in a single reactor by changing some of the design parameters of the TPBARs and/or some of the technical parameters of the host reactor, including shortening the operating cycle. Volume 1, Section 5.2.9 of the EIS addresses the environmental impacts associated with such a case. However, DOE does not foresee the implementation of this mode of production in any of the reactor units considered in the CLWR EIS. Regarding why the EIS evaluates a 40-year period, this represents the operational life of the new tritium production source (as presented in Volume 1, Chapter 2 and Section 3.2.1 of the EIS). Forty years was selected for several reasons: (1) it is consistent with the period of analysis analyzed in the Accelerator Production of Tritium (APT) EIS (DOE 1997b, DOE 1999a) (thus facilitating a common basis comparison between the two technologies); (2) it is the length of time for the NRC's initial operating license for nuclear power plant operation; and (3) it represents a bounding period of time to ensure that the CLWR EIS assesses all reasonably foreseeable impacts. However, because the Nuclear Weapons Stockpile Plan requirements do not extend beyond an 11-year period (see Volume 1, Section 1.3.1 of the EIS), the 40-year time period for analysis does not purport to translate into national security requirements beyond the Plan's requirements.

03.04 The commentor, citing the 2.5 kilogram requirement, asks how many reactors would be needed. The commentor asks whether the Bellefonte option refers to Bellefonte only, or Bellefonte and another reactor, and whether two reactors would be used for tritium production in all cases. The commentor asks where in the CLWR Draft EIS does it mention a 12-month cycle for tritium production at Bellefonte. The commentor also asks whether DOE submitted materials to the NRC for review, and whether the NRC is reviewing the 12-month cycle option.

Comment Summarized: 808-3

Response: As discussed in Volume 1, Section 3.2.1 of the CLWR EIS, for the purposes of the analysis DOE assumed that the CLWR program would be designed to produce up to 3 kilograms of tritium per year. Steady-state tritium requirements, which are classified and would vary depending upon the specific requirements of the Nuclear Weapons Stockpile Plan, are less than 3 kilograms of tritium per year. Considering the current design of the TPBARs and the efficiency of the tritium extraction process, the analysis assumption of 3 kilograms of tritium per year would involve the irradiation of up to 6,000 TPBARs in an 18-month refueling cycle. Since the maximum number of TPBARs that could be irradiated at each reactor unit without significantly disturbing the electricity-producing mode is 3,400 TPBARs, more than one reactor unit would be needed to satisfy the analysis assumption. The combinations of reactor units that could be used for tritium production form the reasonable alternatives discussed in Section 3.2.3 of the CLWR EIS. It is technically feasible to produce larger quantities of tritium by changing some of the design parameters of the TPBARs and some technical parameters of the host reactor, including shortening the refueling cycle. Volume 1, Section 5.2.9 addresses the environmental impacts associated with such a case.

The NRC is currently reviewing a topical report titled, *Tritium Production Core Topical Report*, (WEC 1998). The NRC is not reviewing anything regarding the length of the operating cycle.

CATEGORY 04: OTHER TRITIUM PRODUCTION OPTIONS

04.01 Several commentors express support for the APT at the Savannah River Site and opine several advantages of the APT over CLWR production of tritium. One commentor questions whether DOE thinks that tritium production in an accelerator is straightforward and safe. Commentors also request a comparison of the technical risks associated with the CLWR and APT options. The commentor asks whether the technical risks for the two options will be included in the CLWR Final EIS or only in the final decision. Commentors also express opposition to an APT at the Savannah River Site.

Comments Summarized: 1-1, 6-2, 16-1, 18-1, 43-1, 45-4, 90-6, 135-2, 139-2, 501-1, 503-7, 701-1, 713-7

Response: DOE acknowledges that there is both support for and opposition to the APT at the Savannah River Site, which is the programmatic No Action Alternative to the CLWR program. The purpose of the CLWR EIS is to evaluate the environmental impacts of the reasonable CLWR alternatives for providing the tritium necessary to support the enduring stockpile, as defined by the President in the Nuclear Weapons Stockpile Plan. For completeness, Volume 1, Section 5.2.11 and Table 3-14 of the CLWR EIS provide a summary of the environmental impacts associated with tritium production at an APT at the Savannah River Site. Specific questions about APT safety and technology challenges are addressed in the APT EIS (DOE 1997b, DOE 1999a).

04.02 One commentor expresses support for a small advanced heavy water reactor for tritium production that could be built at the Savannah River Site. The commentor opines that such a device would be the least costly tritium production alternative, as well as the safest, most efficient, and most environmentally-sound.

Comments Summarized: 14-3, 504-3

Response: As discussed in Volume 1, Section 1.1.3, the CLWR EIS is a tiered document which follows the Record of Decision for the Final Programmatic EIS (60 FR 63878). As such, the scope of the CLWR EIS is limited to evaluating the environmental impacts of the reasonable CLWR alternatives for providing the tritium necessary to support the enduring stockpile. Reactor alternatives that are not CLWRs are not reasonable alternatives for the CLWR EIS. The Final Programmatic EIS evaluates the full range of reasonable technology alternatives for tritium supply. A heavy water reactor was one of the reasonable alternatives evaluated. In addition, Section A.3.1 of the Final Programmatic EIS described the potential technology innovations that might be incorporated into any of the reactor alternatives. For the heavy water reactor, the Final Programmatic EIS described the potential technology innovations associated with a small advanced heavy water reactor. As explained in the Comment Response Document (Volume III of the Final Programmatic EIS), if the heavy water reactor were chosen in the Record of Decision, "site-specific analysis would consider these types of improvements." However, in the Record of Decision, DOE did not choose to build any new reactors and did not choose the heavy water reactor technology. Consequently, no site-specific analysis of a small advanced heavy water reactor has been done.

04.03 Commentors request DOE to provide tables comparing the environmental impacts of the CLWR and APT options and the Tritium Extraction Facility. Another commentor questions how much of the APT costs would be for design and how much would be for construction.

Comments Summarized: 4-9, 44-2, 501-4

Response: An environmental impact comparison table comparing the CLWR and APT options was provided to the individual who made this comment at the Savannah River Site public hearing, and the CLWR Final EIS has added a comparison of impacts table as suggested (see Volume 1, Chapter 3, Table 3-14). The costs associated with the APT are contained in the official cost estimates which DOE made available at the public hearings (DOE 1998c). Costs of the APT and the Tritium Extraction Facility are beyond the scope of the CLWR EIS.

04.04 One commentor questions why the option of simultaneously burning mixed oxide fuel and producing tritium in the same reactor was not discussed in the CLWR Draft EIS. Another commentor opines that burning uranium and mixed oxide fuels is not an acceptable way to deal with the waste. Another commentor asks TVA and DOE to guarantee that mixed oxide fuel will never be used at Bellefonte.

Comments Summarized: 127-2, 623-1, 707-16

Response: As explained in Volume 1, Appendix F, Table F-3 of the CLWR EIS, TVA officials stated at the public scoping meeting in Evensville, Tennessee, on February 26, 1998, that TVA has no intention of pursuing the use of mixed oxide fuel at any TVA reactor that would be utilized for tritium production. Consequently, the potential impacts associated with producing tritium while also burning mixed oxide fuel are not reasonably foreseeable. The issue of burning uranium and mixed oxide fuels is not within the scope of the CLWR EIS.

04.05 The commentor states that he does not believe the summary of the APT Draft EIS (CLWR Draft EIS, Section 5.2.11) captures the most significant impacts regarding dewatering and the presence of radium and tritium contamination, as described in the APT Draft EIS, Section 3.3.2.2. The commentor also references a previous EIS from DOE that resulted in the U.S. Environmental Protection Agency (EPA) expressing concern about the lack of assurance that proposed operations would not lead to further adverse impacts. Volume 1, Section 5.2.11 of the CLWR Draft EIS states that the APT would produce neutrons that have the potential to penetrate shielding and be absorbed by the soil and groundwater. This indicates that there would be an adverse impact from operation of the facility and, based on the EPA's previous concern, DOE should address the impacts from the APT in the CLWR Final EIS.

Comment Summarized: 89-3

Response: As stated in the CLWR EIS, Section 5.2.11 presents a summary of the environmental impacts of the APT. For a more detailed analysis of these potential impacts, the reader is referred to the APT EIS (DOE 1997b, DOE 1999a). The APT EIS has been incorporated into the CLWR EIS by reference. DOE has included in the CLWR EIS a summary of the most significant potential impacts from the APT. It is beyond the scope of the CLWR EIS explicitly to address the impacts or the mitigation actions resulting from the programmatic No Action Alternative, which is the construction and operation of the APT at the Savannah River Site.

CATEGORY 05: NEPA PROCESS

05.01 One commentor questions the reason for the linkage between the CLWR EIS, the APT EIS, and the Tritium Extraction Facility EIS.

Comments Summarized: 4-5, 44-1

Response: The Preface to the CLWR EIS clarifies the relationship between the CLWR EIS, the APT EIS, and the Tritium Extraction Facility EIS. The Preface also includes the announcement Secretary Richardson made on December 22, 1998 (DOE 1998d). Based on that announcement, DOE now intends to produce tritium in CLWRs. The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. A new tritium extraction capability would be sited at the Savannah River Site to extract tritium from CLWR TPBARs. The December 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) provides the programmatic umbrella for the site-specific actions assessed in the CLWR, APT, and Tritium Extraction Facility EISs. As tiered National Environmental Policy Act (NEPA) documents, these EISs analyze the site-specific environmental impacts of implementing the actions proposed in each. In the Final Programmatic EIS, the environmental impacts of all three of these projects were analyzed collectively. In addition, this CLWR EIS presents a summary of the environmental impacts of the APT at the Savannah River Site (see Volume 1, Section 5.2.11 and Table 3-14) and the impacts of the tritium extraction facility at the Savannah River Site (see Section 5.3.4). The APT and Tritium Extraction Facility EISs have been incorporated into the CLWR EIS by reference.

05.02 Two commentors question whether there is a "real no action alternative" for either the CLWR EIS or the APT EIS. Another commentor states that it is very difficult to understand the decisions that DOE is talking about, particularly when the EIS does not provide the reader with the no-action effects and merely tiers them off to some other document.

Comments Summarized: 4-6, 501-5, 700-14

Response: The No Action Alternatives for the CLWR EIS and the APT EIS tier from the original December 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878). As explained in Volume 1, Section 3.2.4 of the CLWR EIS, based on that Record of Decision, if tritium is not produced in a CLWR, it will be produced in an accelerator. This approach is consistent with guidance from the Council on Environmental Quality, which states that, "the no action alternative may be thought of in terms of continuing with the present course of action until that action is changed," (see 46 FR 18026). In the December 1995 Record of Decision for the Final Programmatic EIS, the Secretary determined that DOE would produce tritium either in a CLWR or in an APT at the Savannah River Site. The CLWR EIS No Action Alternative is not to produce tritium in any of the TVA reactors. However, the alternative of not producing tritium (which DOE has interpreted the commentor's question of a "true no action alternative" to mean) was analyzed in Section 3.2.1 of the Final Programmatic EIS. Neither the Record of Decision for the Final Programmatic EIS nor the Secretary's announcement on December 22, 1998, selected this No Action Alternative.

05.03 The commentor suggests that the 1995 Record of Decision for the Final Programmatic EIS be re-opened and re-evaluated based on information available today. The commentor advocates that DOE design, construct, and operate two different tritium facilities at different sites to ensure redundancy, with one of the facilities designed for electricity production.

Comment Summarized: 41-7

Response: On December 22, 1998, Energy Secretary Richardson announced that DOE now intends to produce tritium in CLWRs (DOE 1998d). The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site. The Secretary considered issues such as cost, technical realities, environmental impacts, policy, and statutory requirements in making that announcement. DOE intends to issue a consolidated Record of Decision in April 1999 (see also the Preface to the CLWR EIS).

05.04 One commentor states that the information on the primary and backup tritium sources is difficult to understand—particularly the elements DOE requires as a facility and a backup and what that really means to public citizens. Another commentor questions when DOE will select either of the tritium supply dual tracks described in the CLWR EIS.

Comments Summarized: 44-3, 501-2, 702-3

Response: On December 22, 1998, Energy Secretary Richardson announced that DOE now intends to produce tritium in CLWRs (DOE 1998d). The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site. Volume 1, Section 1.5.1.1 of the CLWR EIS has been revised to clarify the issue of the primary and backup tritium source in accordance with the Secretary's announcement (see also the Preface).

05.05 Several commentors ask why the preparation of this EIS should impact the Bellefonte Conversion EIS. One commentor opines that it would make more sense to complete the Conversion EIS so that the people living near the sites can make a decision about what they would like to see in their community. The commentor suggests the CLWR EIS should incorporate the Conversion EIS in its entirety since they are connected actions. The commentor points out that in Section 3.2.6.1, the CLWR Draft EIS states, "Such conversion [of Bellefonte to fossil fuel] would be independent of this EIS and would not occur until after a decision were made regarding the role of Bellefonte 1 and 2 in tritium production." This sentence asserts that the consideration of the conversion to fossil fuel at Bellefonte is independent of the CLWR EIS at the same time that it states explicitly that it is dependent on the outcome of this EIS. The commentor suggests that a comparison be made between Bellefonte as a nuclear plant making tritium and Bellefonte as a fossil fuel plant. Other commentors question why the CLWR Draft EIS did not include an alternative to complete the Bellefonte plant as a fossil fuel electricity plant. One commentor specifically questions the validity of the CLWR EIS because this alternative is not included. This commentor asserts that the EIS needs to compare the eventual decommissioning and decontamination costs of Bellefonte as a nuclear site with the costs of Bellefonte as a fossil-fuel electricity generation plant.

Comments Summarized: 94-11, 503-10, 702-14, 803-9

Response: It is a well-established principle under NEPA that the purpose and need of a proposed action should delineate the limits of the reasonable alternatives to that action. That is, an alternative that does not accomplish the agency's goals is not a reasonable alternative.

As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy the national security requirements directed by the President. DOE believes that the CLWR EIS discusses all of the reasonable alternatives for producing tritium in one or more CLWRs to satisfy such national security requirements.

Converting the Bellefonte plant to a fossil fuel electricity-generating plant is discussed in the CLWR EIS (see Volume 1, Section 1.5.2.4). As discussed in that section, TVA has completed a Final EIS for the Bellefonte Conversion Project (TVA 1997) that analyzes the reasonably foreseeable environmental impacts associated with converting the Bellefonte plant to a fossil fuel plant. However, with respect to the CLWR EIS, conversion of the Bellefonte plant to a fossil fuel electricity-generating plant would not accomplish DOE's purpose and need as stated in the CLWR EIS. As such, conversion of the Bellefonte plant to a fossil fuel plant is not a reasonable alternative for the CLWR EIS and, thus, is not analyzed in the CLWR EIS.

05.06 The commentor expresses the opinion that the completion of the Bellefonte Nuclear Plant be analyzed in a separate EIS. Unless solely used for tritium production, this EIS should not suffice both for the completion and commercial operation of the Bellefonte Plant.

Comment Summarized: 143-2

Response: TVA is a cooperating agency with DOE on the CLWR EIS. TVA plans to adopt the CLWR EIS and issue a TVA Record of Decision. Upon adoption, the CLWR EIS would effectively update TVA's Bellefonte environmental statement, which was revised in 1993. All remaining construction impacts, as well as all operational impacts that relate to operation as a nuclear power plant, are addressed in this EIS. Additional impacts peculiar to tritium production also are addressed. TVA has worked closely with DOE to ensure that all aspects of completing and operating Bellefonte have been considered. Although DOE's purpose for completing Bellefonte is tritium production, the CLWR EIS also discusses TVA's need for power and concludes that power generation from Bellefonte could be used in lieu of other options analyzed in TVA's *Energy Vision 2020, Integrated Resource Plan and Environmental Impact Statement* (TVA 1995).

05.07 One commentor asserts that DOE has not addressed the full range of expected safety and environmental impacts and, therefore, is deficient with respect to NEPA and implementation of Council on Environmental Quality regulations. The commentor says that the CLWR EIS has not identified and assessed the worldwide environmental impacts that would result from a Federal action to approve the CLWR option. The commentor also opines that, "Adoption of the CLWR option would undermine international nonproliferation objectives and result in a higher probability that some nations will initiate or continue production of materials for nuclear weapons in commercial reactors."

Comments Summarized: 45-5, 503-8

Response: The CLWR EIS has been prepared in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. To the extent that potential environmental impacts could be identified for the alternatives analyzed, they are included in the CLWR EIS. This analysis includes the direct, indirect, and cumulative environmental consequences of the production of tritium in three operating CLWRs and the completion and operation of two partially completed CLWRs. The proposed action does not have any worldwide impacts. The proposed action is not expected to have any impact upon the nuclear weapons endeavors of other nations; would not violate or impact any international treaties or agreements; would not have any impact on ongoing negotiations to further reduce nuclear weapons stockpiles; and would not promote nuclear proliferation. [See also the response to Comment Summary 01.04 for additional information.]

05.08 The commentor states that in the CLWR Draft EIS, Section 1.4, NEPA Strategy, DOE proposes an action that may prove to be unwise and untenable—that tritium will be produced in one of two ways even if other EISs (i.e., APT and Tritium Extraction Facility) demonstrate the impacts to be drastic or prohibitive. The commentor says that DOE apparently leaves itself no room to back out of a position that runs counter to the intent of NEPA. The commentor also asks whether the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) stands regardless of the outcome of the EISs which tier [sic] from it.

Comment Summarized: 94-9

Response: On December 22, 1998, Secretary Richardson announced that DOE intends to produce tritium in CLWRs (DOE 1998d). The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site. The CLWR EIS assesses the environmental impact of tritium production at each of the TVA sites and the transportation impacts associated with transferring TPBARs to the Savannah River Site. In accordance with the Secretary's announcement, Volume 1, Section 3.2.7 of the CLWR EIS has been revised to indicate DOE's Preferred Alternative for tritium production. In preparing both the Programmatic EIS and the project-specific EISs (CLWR EIS, APT EIS, Tritium Extraction Facility EIS), no drastic or prohibitive environmental impacts were identified. Moreover, the NEPA regulations do not mandate that an agency select the most environmentally beneficial alternative. See also the Preface to the CLWR EIS for a discussion of DOE's intent to issue a consolidated Record of Decision.

05.09 The commentor notes that opportunities did not exist for the public to participate in the development of the NRC's environmental assessment of the Watts Bar Lead Test Assembly. Another commentor charges that the Lead Test Assembly tests were already underway when the public meeting was held.

Comments Summarized: 94-10, 835-2

Response: The public had several opportunities to state their concerns to the NRC prior to the start of the Lead Test Assembly demonstration in September 1997. On December 23, 1996 (62 FR 67584), the NRC announced it would hold a public hearing for public comment regarding a topical report entitled, "Report on the Evaluation of Tritium-Producing Burnable Absorber Rod Lead Test Assembly." The time and place of the public hearing was announced on January 27, 1997, and the public hearing was held in Washington, D.C., on February 25, 1997.

On July 23, 1997 (62 FR 39557), NRC announced another public hearing in Sweetwater, Tennessee, on August 7, 1997, regarding TVA's proposal to insert lead test assemblies containing TPBARs at the Watts Bar Nuclear Plant. The purpose of the hearing was to provide an opportunity for public comment on the technical issues and to ensure that the public is aware of the NRC staff's review activities and has an opportunity to provide comments on them.

Also, on June 11, 1997 (62 FR 31853), the NRC announced that the "Report on the Evaluation of the Tritium-Producing Burnable Absorber Rod Lead Test Assembly" (NRC 1997) was available from the NRC for public inspection. Any member of the public could request and obtain a copy of the document and provide comments. Finally, on September 11, 1997, the NRC issued its "Environmental Assessment and Finding of No Significant Impact" (62 FR 47835) for the license amendment to allow the insertion of the lead test assemblies into the Watts Bar Nuclear Plant for testing. In addition, as part of the license amendment process for the lead test assembly demonstration, NRC issued a Notice of Opportunity for Hearing (62 FR 30644). No comments were received and the amendment was issued on September 15, 1997 (62 FR 52596). Each of these actions by the NRC involved the public.

05.10 One commentor requests DOE to provide information on the benefits DOE or TVA have obtained from the Watts Bar Lead Test Assembly demonstration. Another commentor suggests that data from the Lead Test

Assembly demonstration should be reviewed and analyzed before the CLWR Final EIS is completed. Commentors question whether it is reasonable to make a tritium technology decision before concluding the Lead Test Assembly demonstration at Watts Bar. Another commentor requests that DOE delay reissuing another Draft EIS until such time as complete tests have been run on the TPBARs currently at Watts Bar. Another commentor asks what will be done with the TPBARs used in the Lead Test Assembly tests at Watts Bar and when will it be done. This commentor also asks how DOE will know that the production process works if tritium is not extracted from the TPBARs used in the Lead Test Assembly tests. Another commentor asks whether there is any incremental release of tritium from the TPBARs being tested in the Lead Test Assembly demonstration. Another commentor asks how many TPBARs were inserted into the Watts Bar reactor.

Comments Summarized: 4-4, 116-4, 128-1, 143-3, 702-6, 704-9, 802-3

Response: As described in Volume 1, Section 1.5.1.2 of the CLWR EIS, DOE and TVA are currently conducting a Lead Test Assembly demonstration to confirm and provide confidence to regulators and the public that tritium production in a CLWR is technically straightforward and safe. This confirmatory demonstration, which involves irradiating 32 TPBARs in Watts Bar Unit 1, began in September 1997. Once irradiation is completed (approximately March 1999), the TPBARs will be removed and undergo post-irradiation examination. The TPBARs will be examined extensively, both in a nondestructive and destructive manner, including some extraction testing. The benefits received to date from the Lead Test Assembly demonstration are: (1) the design and fabrication of the TPBARs were successfully completed to meet all requirements; (2) Watts Bar was successfully licensed by the NRC for the irradiation demonstration; (3) the CLWR program has demonstrated all aspects of the program, from TPBAR design through actual insertion and irradiation in a CLWR; and (4) routine monitoring shows that TPBARs are performing as intended (i.e., tritium effluents in the reactor coolant system are as expected and neutron flux levels in the reactor core are as expected).

The confirmatory tests of the Lead Test Assembly demonstration at Watts Bar are not required prior to the completion of this EIS. DOE has over 10 years of extensive development and testing, including the irradiation of tritium-producing rods at the Advanced Test Reactor at the Idaho National Engineering Laboratory. Examination of these rods proved that the rods make and retain tritium. The Lead Test Assembly demonstration is confirmatory and is not being done for technical reasons, but to provide confidence to the NRC and the public that tritium production in a light water reactor is technically straightforward and safe. Based on over 10 years of experience utilizing this design of TPBARs in the Advanced Test Reactor and extensive post-irradiation examinations conducted at Argonne National Laboratory-West and Pacific Northwest National Laboratory, DOE is confident that placement of up to 3,400 TPBARs in a CLWR would have minimal impact on normal reactor operations and on factors such as TPBAR burnup and reactor physics (see Volume 1, Appendix A of the CLWR EIS).

05.11 The commentor cites the Council on Environmental Quality's regulations and a number of court cases and states that: (1) the EIS is woefully inadequate and incomplete and DOE did not consider a broad-enough range of alternatives; (2) an alternative not considered is the production of tritium for fewer years or in smaller amounts; the commentor requests consideration only of lower rates or fewer years of tritium production, not more; and (3) DOE failed to identify alternatives that were dropped from consideration and explain why they were dropped. The commentor also asks why the Preferred Alternative was not identified.

Comment Summarized: 116-2

Response: (1) It is a well-established principle under NEPA that the purpose and need of a proposed action should delineate the limits of the reasonable alternatives to that action. That is, an alternative that does not accomplish the agency's goals is not a reasonable alternative. As explained in Volume 1, Chapter 3 of the

CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy the national security requirements directed by the President. DOE believes that the CLWR EIS addresses all of the reasonable alternatives for producing tritium to meet national security requirements. Even if it were reasonable to consider the alternatives suggested by the commentor, their impacts would be less than, and subsumed within, those presented in the CLWR EIS. The CLWR EIS also contains a sensitivity analysis that addresses the effects of a reduced production cycle (Volume 1, Section 5.2.9).

(2) The 1996 Nuclear Weapons Stockpile Plan, which represents the latest official guidance for tritium requirements, is based on a START I-level stockpile size of approximately 6,000 accountable weapons. To support such a stockpile, a new tritium supply is required by approximately 2005, not 2010 as the commentor states. As described in Volume 1, Section 3.2.1 of the CLWR EIS, the CLWR program is being designed to produce up to 3 kilograms of tritium per year and has been revised to explain that this amount represents an unclassified maximum requirement, and only would be required if the tritium reserve, which is maintained for emergencies and contingencies, were ever lost or used. To ensure that the EIS assessment of potential environmental impacts is conservative, the EIS presents the environmental impacts of maximum tritium production at each of the five TVA reactor alternatives. In reality, DOE intends to produce only as much tritium as actually required, which would be significantly less than the amount presented in the CLWR EIS (e.g., maximum tritium production at each of five TVA reactors). NEPA does not require an agency to consider alternatives that are infeasible, ineffective, or inconsistent with the basic policy objectives for the action at issue. The case cited by the commentor, *Friends of the Bitterroot, Inc., v. Forest Service 25 E.L.R 21186 (D.Mt. 1994),* is not inconsistent with this principle. The court noted (in the excerpt quoted by the commentor) that the additional alternative required to be considered (preservation of a roadless area) was within the discretion of the agency.

In the present action, DOE does not have discretion to consider the underlying basis of the Presidential Decision Directive, let alone to consider changes to the tritium production levels and schedules which the President mandates. The requested alternative to consider such changes is, therefore, not within the "reasonable alternatives" which NEPA requires to be considered (40 CFR 1502.14).

(3) Volume 1, Section 3.2.2 of the CLWR EIS identifies the alternatives that were dropped from consideration, (specifically other CLWRs considered for tritium production) and the rationale for their elimination. Programmatic alternatives for the production of tritium were discussed in the Final Programmatic EIS (DOE 1995).

(4) In Section 3.2.7 of the CLWR Draft EIS, DOE stated that a Preferred Alternative was not known at the time of the publication. The Preferred Alternative for the CLWR EIS was announced by Secretary Richardson on December 22, 1998, and is identified in Volume 1, Section 3.2.7 of the CLWR Final EIS. Question 4b. of "40 Most Asked Questions" concerning the Council on Environmental Quality's NEPA regulations addresses the issue of whether the Preferred Alternative has to be identified in the CLWR Draft EIS. The Council's response is as follows: "Section 1502.14(e) requires the section of the EIS on alternatives to identify the agency's Preferred Alternative if one or more exists, in the draft statement, and identify such alternative in the final statement . . . ." This means that if the agency has a Preferred Alternative at the Draft EIS stage, that alternative must be labeled or identified as such in the Draft EIS. If the responsible Federal official in fact has no Preferred Alternative at the Draft EIS stage, a Preferred Alternative need not be identified there. By the time the Final EIS is filed, Section 1502.14(e) presumes the existence of a Preferred Alternative and requires its identification in the Final EIS ". . . unless another law prohibits the expression of such a preference."

05.12 The commentor is concerned that DOE is vague and noncommittal in its discussion of impacts to the environment.

Comment Summarized: 116-6

Response: DOE believes that it has adequately addressed impacts to the environment that could result from implementing the various alternatives. Volume 1, Chapter 5 of the CLWR EIS addresses specific site and regional impacts to 12 resource areas from the proposed alternatives, and Appendices C, D, E, and G provide further detailed analysis related to human health effects from normal operation, human health effects from facility accidents, human health effects of overland transportation, and environmental justice, respectively.

05.13 The commentor asserts that, since the operation of Bellefonte represents the most significant impacts of any of the alternatives, it should not be a viable alternative.

Comment Summarized: 116-15

Response: NEPA requires the preparation of an EIS for major Federal actions that may significantly affect the quality of the environment. The analysis for the CLWR EIS was conducted in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. These regulations do not mandate that an agency select the most environmentally beneficial alternative. The purpose of the NEPA process is to ensure that accurate environmental studies are performed; that they are done with public involvement; and that public officials, like those at DOE, make decisions based on an understanding of the environmental consequences.

As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy the national security requirements directed by the President. DOE believes that the CLWR EIS addresses all of the reasonable alternatives for producing tritium to meet national security requirements.

05.14 The commentor states that: (1) DOE has not properly addressed the cumulative impacts in the CLWR EIS. The commentor asserts that (2) Section 5.3.2 of the CLWR EIS addresses only indirect impacts and not cumulative impacts as defined by the Council on Environmental Quality regulations. The commentor suggests that the EIS should address the combined effects of the proposed action; for example, minor noise impacts on wildlife and small impacts to aquatic life could be combined to result in significant impacts on the ecosystem. The commentor also asserts that there is a very limited discussion of other projects in the area. The commentor also asks, (3) where is the cumulative analysis on Bellefonte's impact in conjunction with the Widow's Creek Fossil Plant? The commentor also refers to (4) an increase in the diversion of water from the Tennessee River for public use.

Comment Summarized: 116-16

Response: (1) DOE feels that Volume 1, Section 5.3 of the CLWR EIS adequately addresses cumulative impacts. Council on Environmental Quality/NEPA regulations define "cumulative impacts" as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

(2) In Volume 1, Section 5.3.2, the CLWR EIS states that for Watts Bar and Sequoyah there are no known Federal or nonfederal facilities that could contribute to a change in the radiological environment of the region of influence. In addition, the CLWR Final EIS Tables 5-59 and 5-60 address land use, air quality, and groundwater requirements at the Watts Bar and Sequoyah Nuclear Plants.

For the Bellefonte plant, DOE acknowledges that there will be future growth in Jackson County, and this is indicated in Volume 1, Chapter 5, Table 5-61. The cumulative impacts from tritium production at the Bellefonte Nuclear Plant are presented in Table 5-62.

No causal relationships were found between resource consumption, effluent emissions, and health of surrounding ecosystems.

(3) The contributory effect of the Widow's Creek Fossil Plant is accounted for in the ambient air and water quality and background radiological conditions described for the region around Bellefonte in Volume 1, Chapter 4 of the CLWR EIS. These conditions have been combined with the incremental impacts associated with the completion and operation of Bellefonte for tritium production and have been presented for each resource area in Chapter 5 of the EIS.

(4) DOE and TVA are aware of increases in water diversions from the Tennessee River for public use and have considered both demand and discharge impacts in the CLWR EIS analysis on water quality.

05.15 The commentor provides various citations to regulations relating to "significance" of environmental impacts and requests that the CLWR EIS adequately identify how the proposed project will impact the environment as "a whole." The commentor also asserts that the EIS glosses over environmental issues and dismisses the significant impacts the project will have on the "surrounding ecosystem, humans and all." The commentor criticizes DOE for concluding that the operation at Bellefonte would have no significant adverse impacts.

Comment Summarized: 116-18

Response: NEPA requires the preparation of an EIS for major Federal actions that may significantly affect the quality of the environment. The analysis for the CLWR EIS is conducted in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. The purpose of the NEPA process is to ensure that accurate environmental studies are performed; that they are done with public involvement; and that public officials, like those at DOE, make decisions based on an understanding of the environmental consequences.

Volume 1, Chapter 5 of the CLWR EIS provides a detailed description of impacts associated with land resources, noise, air quality, water resources, geology and soils, ecological resources, archaeological and historic resources, socioeconomic aspects, public and occupational health and safety, and waste management. Chapter 3 summarizes the impacts. In addition, the CLWR EIS has three Appendices (C, D, and E) that discuss in detail the health impacts associated with each of the alternatives. The EIS addresses all of the elements of significance required by Council on Environmental Quality regulations and case law associated with NEPA.

DOE believes that the environmental impacts at Bellefonte have been adequately addressed in the CLWR EIS.

05.16 Two commentors find the EIS to be deficient and inadequate as a NEPA document. One commentor feels that DOE sloughs off the difficult issues raised by tritium production at Bellefonte and that its use of classified information does not satisfy the open process of NEPA. The other commentor states that the EIS is substantially deficient as a NEPA document in its analysis of the environmental impacts, in addition to not discussing all reasonable alternatives.

Comments Summarized: 116-24, 137-3

Response: DOE believes that the EIS is adequate and fully complies with NEPA with respect to the analysis of impacts at the proposed sites. The EIS evaluates all reasonably foreseeable impacts for all reasonable alternatives.

With respect to addressing all reasonable alternatives, it is a well-established principle under NEPA that the purpose and need of a proposed action delineate the limits of the reasonable alternatives to that action. That is, an alternative that does not accomplish the agency's goals is not a reasonable alternative. As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. DOE believes that the CLWR EIS addresses all of the reasonable alternatives for producing tritium to meet national security requirements. A discussion of the development of alternatives is given in Section 3.2.

With respect to the use of classified information, tritium requirements are classified to protect national security. While DOE's philosophy is to disclose as much information to the public as possible, this does not include classified information. Chapter 2 of the CLWR EIS provides unclassified information regarding tritium requirements. As discussed in that chapter, the President has directed DOE to provide a new tritium supply source by approximately 2005 in order to meet the requirements set forth in the most recent Nuclear Weapons Stockpile Plan. The unclassified tritium requirement information presented in Chapter 2 is consistent with the classified tritium requirements.

05.17 The commentor suggests that DOE should not use five- and six-year old documentation for the CLWR EIS.

Comment Summarized: 703-9

Response: The CLWR EIS was prepared using the most current information available. In addition to existing EISs, those persons preparing the document reviewed all recent available documents and consulted with TVA personnel to obtain accurate and timely information (TVA 1998a). Further, prior to publication of the Draft EIS and the Final EIS, it underwent internal review within TVA to ensure that the latest information was used in its preparation (TVA 1998c, TVA 1999).

05.18 The commentor believes the EIS process is very one-sided and thinks DOE and other Federal agencies may need to review it.

Comment Summarized: 704-1

Response: DOE has made every effort to ensure that the preparation of this EIS has not been one-sided. DOE has encouraged public participation in the process beginning with the initial scoping meetings and continues it with incorporation of public comments in the CLWR Final EIS. Further, DOE has consulted with a number of other Federal and state agencies during its preparation of the CLWR EIS. In addition, the EIS has been reviewed by other state and Federal agencies. The NEPA process is established through Council on Environmental Quality regulations (40 CFR 1500-1508). In addition, DOE has developed its own implementing regulations for NEPA (10 CFR 1021). This EIS was prepared in accordance with both sets of regulations, as well as NEPA itself (42 U.S.C. 4321 *et seq.*).

05.19 The commentor would like to see DOE's presentation of the EIS information to the public accompanied by a presentation from an independent reviewer.

Comment Summarized: 704-2

Response: In addition to its own review of the CLWR EIS, DOE has provided copies to numerous Federal and state agencies, including the EPA, for review and comment. The EPA has an obligation under Section 309 of the Clean Air Act to review and comment in writing on the environmental impact of any matter relating to the authority of the Administrator. In addition, the public comment period provides opportunity for all interested parties to provide their own independent review of the document. DOE welcomes these independent reviews and feels that they lead to both a better document and, ultimately, a better decision.

05.20 Two commentors commend DOE and TVA for the thoroughness and depth of the CLWR Draft EIS. One commentor states that all the potential impacts have been identified and thoroughly evaluated. Another commentor thinks the CLWR Draft EIS does an excellent job covering the options and statistics.

Comments Summarized: 713-1, 719-4

Response: DOE acknowledges the commentors' recognition of the quality of the CLWR Draft EIS.

05.21 The commentor asks why the Government is not listening to the people. Another commentor asks by what means can citizens prevent the making of tritium.

Comments Summarized: 2-5, 222-2, 817-1

Response: The CLWR program has undertaken an aggressive public outreach program and has made an effort to listen to all members of the public who have views on what the U.S. Government should do with respect to tritium production alternatives. DOE has reviewed and responded to all comments received during the public comment period.

DOE's role in the production of tritium and all nuclear materials required for the defense of the United States is mandated by Congress through its enactment of the Atomic Energy Act of 1954, and the President in the Nuclear Weapons Stockpile Plan. Further, any decision to produce tritium at a CLWR would have to be funded by Congress. Thus, those citizens wishing to prevent the making of tritium should express their views by writing to their congressional representatives and the President.

05.22 The commentor asks for a copy of the *Final Environmental Impact Statement for the Bellefonte Conversion Project* and a copy of the Record of Decision associated with this EIS.

Comment Summarized: 4-1

Response: TVA provided the commentor a copy of the *Final Environmental Impact Statement for the Bellefonte Conversion Project*. The Record of Decision for this EIS will not be issued until the outcome of the current TVA effort with DOE to produce tritium at Bellefonte is completed.

05.23 The commentor asks DOE not to intimidate or dismiss the public and to give the public adequate information to evaluate DOE's actions.

Comment Summarized: 702-1

Response: The NEPA process is one of the most successful and effective ways that DOE has to both inform and receive input from the public. Every effort is made to prepare an EIS that is complete and understandable. Further, supporting documentation is referenced and all referenced material is made available to the public in reading rooms. It is not DOE's intention to intimidate or dismiss the public at any stage in the NEPA process. All public comments received during the public comment period will be reviewed and responded to before DOE decides on a course of action.

05.24 The commentor would like DOE to hold an additional hearing on tritium production in Nashville, Tennessee.

Comment Summarized: 707-9

Response: Prior to the beginning of the public comment period, DOE evaluated potential locations for public hearings. An effort was made to ensure that all geographic areas were represented. Thus, it was decided to hold hearings in North Augusta, South Carolina; Rainsville, Alabama; and Evensville, Tennessee. These hearings were held on October 1, 6, and 8, 1998, respectively, and were well attended. DOE believes that the geographic distribution of these hearings was adequate to provide an opportunity for those residents in closest proximity to the TVA reactors being considered and the site of the new extraction capability to attend.

05.25 The commentor questions the definition of “previous impact statements” that “serve to a great extent as the basis for this EIS.” The span of time for these documents ranges from three years to fifteen years or more, and the commentor questions how DOE selected its data.

Comment Summarized: 86-4

Response: Section 1.5.1.3 summarizes the relationship between the CLWR EIS and other relevant NEPA documents, including EISs for the operation of the Watts Bar and Sequoyah Nuclear Plants and the construction of the Bellefonte Nuclear Plant. The documents have been completed and serve as a baseline on which the environmental impacts associated with tritium production can be assessed. The information has been updated through communications with TVA staff, along with current TVA documents. DOE used the most current sources of information available in compiling data to assess the impacts of tritium production. Volume 1, Chapter 7 and each of the appendices in the CLWR EIS provide a detailed list of the references that were the basis of this analysis.

05.26 The commentor is concerned that DOE will focus too heavily on the potential economic benefits from the Bellefonte site and will not weigh these benefits against decreases in land resources, air quality, water quality, ecosystem quality, and quality of life issues. Another commentor expresses concern that politics would influence the decision.

Comments Summarized: 116-23, 231-2, 812-1

Response: DOE has undertaken the preparation of the CLWR EIS to evaluate the environmental impacts of producing tritium at a CLWR at Bellefonte, as well as Watts Bar and Sequoyah. DOE will fairly and completely consider environmental issues, along with other pertinent issues such as economic, policy, and statutory requirements, when arriving at a decision. The decision will be made after the CLWR Final EIS has been published. Council on Environmental Quality Regulation 1505.2, Record of Decision, states that each agency shall prepare a concise public record of decision.

The Record of Decision must identify all alternatives considered by the agency in reaching its decision, specifying the alternative or alternatives considered to be environmentally preferable. An agency may discuss preferences among alternatives based on relevant factors, including economic and technical considerations and agency statutory missions. An agency shall identify and discuss all such factors, including any essential considerations of national policy balanced by the agency in making its decision and how those considerations entered into its decision.

The Record of Decision must state whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted and, if not, why. A monitoring and enforcement program is to be adopted and summarized where applicable for any mitigation.

This EIS has been undertaken to evaluate the environmental impacts of tritium production in a CLWR. The decision resulting from the NEPA process will be announced in a Record of Decision following publication of the Final EIS. That decision will be based on the evaluation of impacts presented in the EIS, as well as other pertinent factors such as economic considerations.

05.27 One commentor asks whether DOE is considering purchasing a TVA reactor or its irradiation services. The commentor refers to the December 1995 Record of Decision, which contains the option of DOE purchasing a reactor. The commentor expresses concern that external, peer, regulatory, and fiscal reviews of operations at the tritium-producing nuclear plants would disappear because DOE nuclear defense facilities are not licensed by the NRC, nor is DOE obligated to adhere to the Institute of Nuclear Power Operations' industrial standards of excellence. However, the commentor believes the tax payers and rate payers should realize a return on the $4.5 billion already spent on Bellefonte. The commentor recommends that, if Bellefonte comes on line, it must never be allowed to become a government-owned, contractor-operated defense facility that will go unchecked by the mechanisms designed to ensure it is managed with the safety of the citizens and the environment as its primary concern. Another commentor asks if oversight by state and Occupational Safety and Health Administration regulators would continue if TVA partners with DOE to produce tritium.

Comments Summarized: 58-3, 506-2, 610-2, 802-1, 804-1

Response: The 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) considered the possibility of purchasing a reactor before the Request for Proposals process began. As events unfolded, the purchase option became irrelevant because only TVA nuclear plants were proposed for tritium production. As stated in Volume 1, Section 1.1.1, DOE considered only the purchase of irradiation services, not the purchase of a reactor. As TVA is a U.S. Government agency, the Watts Bar, Sequoyah, and Bellefonte Nuclear Plants are already government-owned. If chosen for tritium production, the Bellefonte plant will be completed as a nuclear power plant and would continue to be regulated by the NRC. Therefore, use of the TPBARs in one of Bellefonte's reactors would be governed by NRC regulations, and NRC approval would be required before the use of the TPBARs could begin. After this approval, the Bellefonte plant would be subject to periodic NRC safety inspections and evaluations throughout its planned lifetime (40 years).

The TVA plants would continue to comply with all applicable Federal and state regulations. Regulatory oversight will not be affected by tritium production in a CLWR.

05.28 The commentor requests clarification on how DOE and NRC define the word "significance."

Comment Summarized: 86-5

Response: Although the word significant is used in the CLWR EIS, there is not one meaning of this term (see 40 CFR 1508.27). When possible, the EIS defines what is meant by "significant." For example, in Volume 1, Section 5.2.3.2, the EIS defines significant as noise impacts greater than 65 decibels A-weighted [dBA]. In Section 3.2.6.2, the transportation risks for Bellefonte 1 or 2 would be significantly lower than one fatality per year, which is then defined as less than one fatality per 100,000 years. Therefore, it is important to look at the word "significant" in the context of its usage.

The commentor may be referring to Section 1.5.1.2, DOE's Lead Test Assembly Environmental Assessment, and the TPBAR confirmatory demonstration at Watts Bar 1. The NRC prepared a separate environmental assessment and issued its own Finding of No Significant Impact for the Environmental Assessments. According to Council on Environmental Quality NEPA regulations, a Finding of No Significant Impact is a document which briefly explains the reasons why a proposed action addressed in an environmental assessment will not have a significant effect on the human environment and, therefore, why an EIS will not be necessary (40 CFR 1508.13).

The NRC Finding of No Significant Impact (62 FR 47835) indicates that they evaluated the impacts relative to the requirements set forth in 10 CFR Part 51. Specifically, they evaluated the possibility of accidents, changes in types or amounts of effluents, offsite population doses, and worker doses attributable to the demonstration. For example, they found that if the entire amount of tritium was released in a year's discharge of cooling water, the maximum annual dose to a member of the public would be less than 1 percent of the NRC criterion for effluents and only about 0.007 percent of the average annual dose resulting from naturally occurring radionuclides. Based on its environmental assessment, the NRC staff concluded that there are no significant radiological or nonradiological impacts associated with the proposed action and that the proposed license amendment will not have a significant effect on the quality of the human environment. The commentor is referred to the NRC document (62 FR 47835) for further details on this decision.

05.29 One commentor questions whether the tritium technology decision will be made prior to completing the CLWR EIS and the APT EIS. The commentor opines that DOE should use the comments received on these EISs in the decisionmaking process. Another commentor questions whether a technology decision prior to completion of the project-specific EISs (i.e., the APT EIS and the CLWR EIS) would be premature. Another commentor asks whether the Secretary would make a decision before the final tritium production EISs (CLWR and APT) are completed. Another commentor suggests that the Final APT, Tritium Extraction Facility, and CLWR EISs not be prepared or should be combined. Another commentor asks why input from area residents was not included in the decision criteria shown in DOE's December 14, 1998, presentation.

Comments Summarized: 44-4, 501-6, 808-1, 809-3

Response: On December 22, 1998, the Secretary announced that DOE intends to produce tritium in CLWRs (DOE 1998d). The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site. That announcement was made based on all available information, the Final Programmatic EIS, and any comments that were received related to the CLWR EIS and the APT EIS. DOE intends to complete these EISs to support proposed project-specific actions that could be implemented by the Secretary's announcement. The express intent of the December 14, 1998, public meeting was to solicit input from area residents prior to the Secretary's announcement on December 22, 1998. See also the Preface to the CLWR EIS for a discussion of DOE's intent to issue a consolidated Record of Decision.

05.30 The commentor, observing that the analysis of DOE's most likely scenario (2,000 TPBARs) is not in the CLWR Draft EIS, expresses frustration that the public can't comment on a scenario unless it is presented in the EIS.

Comment Summarized: 702-2

Response: The EIS presents the environmental impacts associated with the maximum loading of TPBARs in a reactor (3,400 TPBARs) and also addresses lesser amounts.

05.31 Several commentors stated that notification of the December 14, 1998, meeting was too short. Other commentors stated that the December meeting was scheduled at a bad time—during the holidays. Yet other commentors stated that the mailing of the notification for the December meeting was too late; did not reach all interested parties; and did not provide sufficient time to prepare for such an important meeting.

Comments Summarized: 202-2, 207-1, 212-1, 247-1, 800-4, 802-4, 803-5, 809-2, 835-1

Response: Prior to fulfilling his requirement to reach a technology decision by the end of 1998, the Secretary of Energy asked TVA to resubmit a proposal for the Watts Bar and Sequoyah reactors, as well as final proposals for completion of TVA's Bellefonte reactor in order to provide DOE with a comprehensive set of options. Such proposals were provided to DOE the first week of December 1998. In order for the public to have an opportunity to provide DOE with input on these proposals prior to the Secretary's decision at the end of 1998, it was necessary to hold the December 14, 1998, meeting with a minimum of notice to the public. To maximize public participation on such short notice, DOE sent more than a thousand individual notices of the meeting to interested parties on December 10, 1998; advertised notice of the meeting in local newspapers; and provided the local media with a December 8, 1998, press release giving notice of the time and place of the meeting.

DOE recognizes that the December 14, 1998, meeting was scheduled, announced, and conducted in a relatively short time frame. As stated in the introductory comments by Mr. Barry Lawson, the public meeting facilitator, this December 14, 1998, meeting was not for the purpose of discussing the EIS, but to provide DOE with public input on the resubmitted TVA proposal to utilize the Watts Bar and Sequoyah plants for tritium production.

In compliance with NEPA requirements, DOE held scoping meetings related to the CLWR EIS proposal in February 1998, and subsequently held public hearings in October 1998 to receive comments on the CLWR Draft EIS. The option of utilizing the Watts Bar and Sequoyah reactors was included in the CLWR Draft EIS. As such, the public was notified of this option through the normal NEPA process and was provided ample time to review and comment on the proposal to utilize the Watts Bar and Sequoyah plants for tritium production.

Participants at the December 14, 1998, meeting were encouraged to provide comments to DOE on the latest TVA proposal. Although these comments are not part of the formal comment process for the CLWR Draft EIS, they are included in the CLWR Final EIS.

05.32 A commentor wants to know if the Secretary of Energy could change his decision after the EISs are published, and states his opinion that the technology decision should not come before the NEPA process and before the safety issues are identified and addressed in the CLWR Final EIS.

Comment Summarized: 808-2

Response: The announcement made by Secretary Richardson on December 22, 1998 (DOE 1998d), which designated the CLWR as the primary tritium production technology, fulfilled DOE's 1995 commitment to select between a CLWR and a linear accelerator. The CLWR option was designated because it is a proven technology; it is the best deal for the taxpayer; and it has the flexibility to meet a range of future needs. DOE will complete key research and development milestones for the accelerator as a backup option, but will not initiate construction. Such a dual track strategy would allow the Secretary of Energy to change his decision at a later date should the CLWRs prove unable to supply the nation's future need for tritium.

05.33 A commentor feels that DOE and TVA have already struck a deal to produce tritium regardless of the concerns of community members.

Comment Summarized: 208-4

Response: As described in Volume 1, Section 1.1.1, the CLWR EIS evaluates the environmental impacts associated with tritium production for all TVA reactor plants offered by TVA during the open procurement process. That procurement process is ongoing, and negotiations are continuing between DOE and TVA. As discussed in Section 1.1.4, because both TVA and DOE are Federal agencies, an agreement between them could be reached through either a contract (per the full and open Federal procurement process) or through an interagency agreement via the Economy Act. The Economy Act is a Federal law that allows two government agencies to enter into an interagency agreement similar to the contractual agreement that a Federal agency would enter into with a nonfederal party through the competitive procurement process.

During preparation of the CLWR EIS the community had several opportunities to provide input through the NEPA process. This participation occurred during the scoping and public comment periods for the CLWR Draft EIS. The public's input is reflected in the CLWR Final EIS.

CATEGORY 06: REASONABLE ALTERNATIVES SELECTION

06.01 The commentor disagrees with DOE's assertion that tritium must be produced. The commentor asserts that this provides "no options; no alternatives." The commentor further states that, "the purpose of an EIS is to present all possible, viable alternatives. Instead, the documents provided interested parties contain nothing more than bureaucratic filler for foregone conclusions. The fact that you provide a chart with 18 reactor combinations does not give the vulnerable public the 'alternatives' required by NEPA; nor does the consideration of producing tritium in an accelerator provide an alternative."

Comment Summarized: 116-1

Response: As described in Volume 1, Section 1.1.3 of the CLWR EIS, the CLWR EIS tiers from the Final Programmatic EIS (DOE 1995) and Record of Decision (60 FR 63878). As such, the CLWR EIS evaluates the reasonable alternatives for tritium production in one or more CLWRs to satisfy national security requirements as directed by the President. These national security requirements, which are set forth in Section 91 of the Atomic Energy Act, are not discretionary. The specific CLWRs that are assessed in the CLWR EIS were determined through a competitive procurement process described in Volume 1, Section 1.1.4 of the CLWR EIS. It is a well established principle under NEPA that the purpose and need of a proposed action should delineate the limits of the reasonable alternatives to that action. That is, an alternative which does not accomplish the agency's goals is not a reasonable alternative. As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. DOE believes that the CLWR EIS discusses all of the reasonable alternatives for producing tritium in one or more CLWRs to satisfy these national security requirements. The commentor does not identify any other reasonable alternatives, nor does the commentor provide any reasons why the alternatives evaluated are not reasonable. With respect to the commentor's implication that the EIS should evaluate an alternative that would not produce tritium (e.g., "a real no action alternative"), the response to Comment Summary 05.02 discusses this issue.

06.02 The commentor asserts that DOE will not reach 1996 Nuclear Weapons Stockpile Memorandum stockpile levels (tritium requirements) until 2010 and that DOE should evaluate the alternative of a delayed startup. The commentor further asserts that, "all of the DOE alternatives result in the same amount of tritium in the same amount of time." The commentor opines that this is not legally sufficient and that DOE should evaluate alternative production scenarios.

Comment Summarized: 116-8

Response: The 1996 Nuclear Weapons Stockpile Plan, which represents the latest official guidance for tritium requirements, is based on a START I-level stockpile size of approximately 6,000 accountable weapons. To support such a stockpile, a new tritium supply is required by approximately 2005, not 2010 as the commentor states. As described in Volume 1, Section 3.2.1 of the CLWR EIS, the CLWR program is being designed to produce up to 3 kilograms of tritium per year. Section 3.2.1 has been revised in the CLWR EIS to explain that 3 kilograms of tritium represents an unclassified maximum requirement, and would only be required if the tritium reserve, which is maintained for emergencies and contingencies, were ever lost or used. To ensure that the EIS assessment of potential environmental impacts is conservative, the CLWR EIS presents the environmental impacts of the maximum tritium production at each of the five TVA reactor alternatives. In reality, DOE intends to produce only as much tritium as actually required, which will be significantly less than what is presented in the EIS (e.g., maximum tritium production at each of five TVA reactors). [See the response to Comment Summary 03.03 for more detail on tritium requirements.]

06.03 Several commentors ask questions regarding the fact that TVA has allowed one of its two procurement proposals (the irradiation services proposal) to expire. The commentors question whether this affects the alternatives in the CLWR EIS, and whether there are really alternatives for tritium production at TVA reactors other than Bellefonte Unit 1. One commentor specifically requests that DOE explicitly state the criteria used to define reasonable alternatives and also questions why the Fast Flux Test Facility Reactor and any number of commercial reactors operated by public utilities were not included as reasonable alternatives. One commentor expresses their opposition to using a Hanford reactor (the Fast Flux Test Facility) for the production of tritium.

Comments Summarized: 26-1, 44-6, 94-4, 242-1, 501-7, 502-1, 506-1, 700-1, 706-1, 801-1, 815-2, 832-1

Response: As described in Volume 1, Section 1.1.1, the CLWR EIS evaluates the environmental impacts associated with tritium production for all TVA reactor plants offered during the procurement process. That procurement process is ongoing, and negotiations are continuing between DOE and TVA. Because both TVA and DOE are Federal agencies, an agreement could be reached through an interagency agreement via the Economy Act. The Economy Act is a Federal law that allows two government agencies to enter into an interagency agreement similar to the contractual agreement that a Federal agency would enter into with a nonfederal party through the competitive procurement process. The Federal procurement process for the CLWR program explicitly allows for an interagency agreement via the Economy Act. As such, TVA's action to allow the irradiation services proposal (made in response to the procurement request) to expire, has no bearing on the negotiations that might result in an interagency agreement via the Economy Act. Consequently, all of the TVA reactors that were initially identified during the procurement process as reasonable alternatives for tritium production remain reasonable alternatives. In December 1998, TVA resubmitted a radiation services proposal for the Watts Bar and Sequoyah reactors. Volume 1, Section 1.1.4 of the CLWR EIS was revised to clarify the procurement process.

In response to the commentor who requests the criteria used to define reasonable alternatives, Volume 1, Section 3.2.2 of the CLWR EIS describes the process that DOE employed to receive proposals from owners/operators of CLWRs for tritium production. As explained in that section, DOE issued a request for proposals for the CLWR production of tritium (while the specific requirements are too voluminous for inclusion, the request for proposals is available by contacting the DOE CLWR Program Office). As stated in Volume 1, Section 1.1.4 of the CLWR EIS, the only proposals determined to be responsive to the requirements of the procurement request were from TVA. Through the procurement process, the five TVA reactors evaluated in the CLWR EIS were identified. No other commercial CLWRs were offered by owner/operators and, consequently, the CLWR EIS does not evaluate them. With respect to the Fast Flux Test Facility Reactor, that research reactor is a DOE reactor, not a CLWR. The option of using DOE's existing reactors (such as the

Fast Flux Test Facility at Hanford and the K-reactor at the Savannah River Site) was evaluated but dismissed from further consideration for the reasons stated in Section 3.1.3 of the Final Programmatic EIS (DOE 1995). DOE announced in the December 1995 Record of Decision (60 FR 63878) that it would evaluate whether the Fast Flux Test Facility Reactor might play a role in tritium production. The Secretary of Energy, on December 22, 1998, announced that the Fast Flux Test Reactor would play no role in tritium production (DOE 1998d).

06.04 One commentor asks whether the CLWR Final EIS will include information about the contractual agreements between TVA and DOE and the potential impacts of TVA's contract obligations. Another commentor asks when DOE plans to exercise its option to purchase irradiation services.

Comments Summarized: 700-19, 704-11

Response: Contractual agreements are not a part of the EIS and involve sensitive negotiations that are ongoing and have not been finalized. For these reasons, any contractual agreements made between TVA and DOE regarding production of tritium are not presented in the CLWR EIS. TVA would produce tritium for DOE only if and when necessary.

06.05 One commentor asks if DOE's preferred choice for tritium production would involve several different sites. The commentor believes it might simplify the process if all the necessary activities were performed at one site. Another commentor asks when DOE would use two or more facilities to avoid exceeding the Bellefonte plant's spent fuel generation limit. The commentor believes that analyses that will determine DOE's choice to use one or more reactors for tritium production should be made public because of the implications for TVA ratepayers and U.S. taxpayers. Another commentor asks if the 1995 Record of Decision can be deleted or amended to remove language that would allow DOE to purchase the Bellefonte plant and convert it to a defense facility. Another commentor recommends that DOE identify the Bellefonte facility (backed up by Watts Bar as needed) as its Preferred Alternative in the CLWR Final EIS.

Comments Summarized: 58-7, 90-5, 610-3, 700-8, 707-1, 713-6

Response: On December 22, 1998, Secretary of Energy Bill Richardson announced that DOE now intends to produce tritium in CLWRs (DOE 1998d). The APT would not be constructed at the Savannah River Site, but would be a backup option to CLWRs. The Secretary's announcement that the CLWR would be the primary tritium supply technology reaffirms the 1995 Record of Decision for the Final Programmatic EIS (60 FR 63878) to construct and operate a new tritium extraction capability at the Savannah River Site. The CLWR EIS assesses the environmental impact of tritium production at each of the TVA sites and the transportation impacts associated with transferring TPBARs to the Savannah River Site. In accordance with the Secretary's announcement, Volume 1, Section 3.2.7 of the CLWR EIS has been revised to indicate DOE's Preferred Alternative of using Watts Bar and Sequoyah for tritium production. As stated in Volume 1, Section 1.1.1 of the CLWR EIS, DOE is considering only the purchase of irradiation services, not the purchase of a reactor.

06.06 Several commentors do not understand Table 3-2 in the Draft EIS. One commentor specifically requests that the actual environmental impacts for the various alternatives be displayed in Table 3-2, rather than "dots."

Comments Summarized: 44-5, 700-9

Response: As described in Volume 1, Section 3.2.3 of the CLWR EIS, Table 3-2 presents the various reactor alternative combinations that constitute the reasonable alternatives evaluated in the CLWR EIS. The "dots" in that table depict the combination alternatives. As stated in this section, "the impacts for each of the

18 irradiation alternatives would be the sum of each of the impacts at each of the sites involved." The impacts at each of the sites involved are described in detail in Volume 1, Chapter 5 of the CLWR EIS.

06.07 The commentor requests a comparison between the completed and uncompleted reactors. The commentor asserts that, "the purpose of NEPA is to compel the Government to choose from among reasonable alternatives that which has the least adverse impact on the environment."

Comment Summarized: 94-15

Response: In Volume 1, Chapter 3 of the CLWR EIS, Table 3-13 provides the comparison between the completed and uncompleted reactors.

NEPA requires the preparation of an EIS for major Federal actions that may significantly affect the quality of the environment. The analysis for the CLWR EIS was conducted in accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. These regulations do not mandate that an agency select the most environmentally beneficial alternative. The purpose of the NEPA process is to ensure that accurate environmental studies are performed; that they are done with public involvement; and that public officials, like those at DOE, make decisions based on an understanding of the environmental consequences.

CATEGORY 07: GENERAL SUPPORT/OPPOSITION

07.01 Several commentors express support for the CLWR option and cite several advantages of the CLWR over accelerator production of tritium.

Comments Summarized: 8-1, 59-1, 73-1, 81-1, 88-1, 90-4, 225-3, 233-3, 242-2, 604-3, 624-1, 628-2, 713-5, 832-2

Response: DOE acknowledges that there is both support and opposition for the CLWR program, which is the programmatic No Action Alternative to the APT program. The purpose of the CLWR EIS is to evaluate the environmental impacts of the reasonable CLWR alternatives for providing the tritium necessary to support the enduring stockpile, as defined by the President in the Nuclear Weapons Stockpile Plan. For completeness, Volume 1, Section 5.2.11 and Table 3-14 of the CLWR EIS summarizes the environmental impacts associated with accelerator tritium production at the Savannah River Site.

07.02 Several commentors express their support for the CLWR program in general, citing reasons of national defense, cost-effectiveness, and low environmental impacts, as described in the CLWR EIS. Several other commentors also express their opposition to the CLWR program in general, citing the policy of separation between military and civilian programs, public health and safety, effects to the environment, and cost.

Comments Summarized: 23-3, 28-1, 91-1, 92-1, 93-1, 109-1, 120-1, 121-1, 123-1, 130-1, 202-1, 222-1, 225-1, 227-1, 239-1, 248-2, 250-1, 704-15

Response: DOE acknowledges that there is both support for and opposition to the CLWR program in general. The reasons cited by supporters and opponents have been the subject of specific comments and responses elsewhere in this document. The need for tritium and national defense are discussed in Volume 1, Chapter 2 of the CLWR EIS and in the response to Comment Summary 02.01. Cost is discussed in the response to Comment Summary 23.16. The issue of separation between military and civilian programs is discussed in the response to Comment Summary 01.09. Public health and safety is discussed in Volume 1, Chapter 5 of the CLWR EIS and in response to Comment Summaries 14.04 and 15.03.

07.03 Several commentors express their support for the Bellefonte option, citing numerous reasons including safety; cost-effectiveness; boost to the regional economy; electricity as a byproduct; TVA's good track record; jobs; use of an existing resource; national defense; proven technology; small environmental impacts; compatibility with the program needs; the right thing to do; a win-win situation; and it is good for the nation, DOE, TVA, and Jackson County.

Several other commentors express their opposition to the Bellefonte option, citing numerous reasons including the dangers of radioactivity, public health and safety, significant impacts to the environment, the policy of separation between military and civilian programs, and nonproliferation.

Comments Summarized: 10-1, 12-1, 15-1, 17-1, 23-1, 24-1, 26-3, 33-1, 34-1, 35-1, 38-1, 42-1, 47-2, 54-1, 55-1, 56-1, 57-1, 58-1, 60-1, 61-1, 62-1, 63-1, 64-1, 65-1, 66-1, 67-1, 68-1, 69-1, 70-1, 71-1, 72-1, 74-1, 75-1, 76-1, 77-1, 78-1, 79-1, 82-1, 83-1, 85-1, 87-1, 96-1, 104-1, 107-1, 118-1, 131-1, 133-1, 134-1, 136-12, 140-1, 144-1, 147-1, 203-1, 204-1, 205-1, 209-1, 210-1, 211-2, 215-1, 224-1, 225-4, 228-1, 231-1, 254-1, 604-4, 607-1, 608-1, 609-1, 610-1, 611-1, 612-1, 613-1, 614-1, 615-1, 616-1, 617-1, 618-1, 619-1, 620-1, 621-1, 622-2, 625-1, 626-1, 627-5, 628-3, 629-1, 708-1, 709-1, 710-2, 714-1, 715-1, 716-1, 718-1, 719-3, 803-10, 821-1, 827-1, 831-1

Response: DOE acknowledges that there is both support for and opposition to the Bellefonte option. The reasons cited by supporters and opponents have been discussed in the CLWR EIS and also have been the subject of specific comments and responses elsewhere in this document. Specifically: The need for tritium and national defense are discussed in Volume 1, Chapter 2 of the EIS and in response to Comment Summary 02.01. Cost is discussed in the response to Comment Summary 23.16. The issue of separation between military and civilian programs is discussed in the response to Comment Summary 01.09. The issue of nonproliferation is discussed in response to Comment Summary 01.04. Issues related to public health and safety from radiological releases are discussed in responses to Comment Summaries 14.04 and 15.03. Socioeconomic issues are discussed in Chapter 5 of the EIS and in response to comment summaries in Category 13.

07.04 Several commentors support the use of the TVA plants in general and Bellefonte in particular for implementing the proposed action. The commentors express several reasons for their support including safety; small environmental effects; efficiency; less risk that other everyday activities; design superiority (Bellefonte) over other plants; nuclear energy's advantages as a clean and safe power source; safe practices on the part of TVA and its employees; advantages for Jackson County (Bellefonte), Alabama, and surrounding areas in Tennessee and Georgia; and the safety record of the nuclear industry. Several commentors oppose the use of TVA facilities for the production of tritium.

Comments Summarized: 141-1, 245-3, 610-6, 622-1, 627-1, 628-1, 710-1, 711-1, 717-1, 719-5, 828-3, 835-5

Response: DOE assesses the environmental impacts of the proposed action at each of the TVA reactor units in Volume 1, Chapter 5 of the CLWR EIS. The commentors' support for the proposed action and the specific support of some of the commentors for Bellefonte is noted. DOE acknowledges that there is both support and opposition to the use of TVA facilities for the production of tritium.

07.05 Commentors oppose the proposed action on the basis of an “increased likelihood of environmental contamination” and “adverse effects” even at low levels of radiation exposure. One of the commentors suggests that DOE should not further develop nuclear energy.

Comments Summarized: 32-3, 102-3

Response: As discussed in Volume 1, Chapter 5 of the CLWR EIS, the environmental impacts and potential doses to the public from the proposed action are well within limits considered acceptable by regulatory authorities. Sections 5.2.1.9, 5.2.2.9, and 5.2.3.9 of the EIS provide the results of the analyses of the incremental risk resulting from normal operation and hypothetical accident scenarios during tritium production. These analyses are performed using a generally accepted method for design-basis and beyond design-basis accident analyses in support of the reactor operations promulgated by the NRC. The analyses use special models for the evaluation of consequences of accidental releases of tritium (both in elemental and tritiated water vapor) to the environment. Volume 1, Appendix C, Section C.2.2, of the EIS summarizes the characteristics and biological health effects of tritium. This appendix also provides the health effect standards that were used to estimate the potential lifetime cancer mortalities resulting from the exposure to tritium and other radioactive materials. Health effects were calculated using a linear extrapolation from the nominal risk estimated for lifetime total cancer mortality at a dose of 10 rad to a very low dose level, i.e., a zero dose. The impact from the application of this model is considered to be an upper-bound estimate. There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiologic observation, and the possibility of no risk, or even a health benefit, cannot be excluded. The low-dose region is defined as a dose level (~0.01 rad) where DNA repair can occur in a short period (a few hours) after irradiation-induced damage. DOE considers the use of CLWRs to produce tritium to be a viable, cost-effective, safe, and environmentally-sound alternative, and not necessarily a promotion of nuclear energy.

07.06 Several commentors express their preference that the Bellefonte plant be converted into a fossil fuel plant.

Comments Summarized: 11-1, 12-3, 98-2, 232-5, 704-14, 806-7

Response: Volume 1, Section 1.5.2.4 of the CLWR EIS discusses the Bellefonte Conversion Project EIS. As stated in that section, if these reactors will not be utilized in the CLWR program, one of the five alternatives addressed in the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997) could be selected in the Record of Decision for that EIS.

07.07 Several commentors express support for the Watts Bar/Sequoyah option, stating it would permit the Tennessee Valley area to receive benefits in addition to the production of electricity; it is the least environmentally destructive option; and it provides greater flexibility at the least cost.

Several other commentors express opposition to the Watts Bar/Sequoyah option, citing numerous reasons including: increased risk to local residents, no economic benefit, adverse effects on the region’s power supply, and no increase in jobs.

Comments Summarized: 201-1, 226-1, 229-1, 230-1, 232-7, 233-1, 235-5, 246-1, 251-1, 252-1, 255-1, 806-9, 829-5

Response: DOE acknowledges that there is both support for and opposition to the Watts Bar/Sequoyah alternative, which is the Preferred Alternative in the CLWR EIS. The reasons cited by supporters and opponents are discussed in the EIS and also are the subject of specific comments and responses elsewhere in the document. Public health and safety issues are discussed in Chapter 5 of the EIS, and also in response to Comment Summaries 14.04 and 15.03. Socioeconomic issues, such as jobs, are both discussed in Chapter 5, as well as in response to Comment Summaries in Category 13. Cost issues are discussed in response to Comment Summary 23.16. The commentors are also referred to the responses to Comment Summaries 7.03 and 7.04.

07.08 During the December 14, 1998, meeting a number of commentors compared the Bellefonte alternative to the Watts Bar/Sequoyah alternative. Those in favor of Bellefonte feel that it would: (1) provide more electricity, not less, as would happen at Watts Bar and Sequoyah during shutdowns needed to produce tritium; (2) help stabilize electrical costs, since TVA would not have to buy power during periods of high demand; (3) be cheaper, since the sale of electricity would pay back the tax dollars spent to build the plant; (4) provide economic benefits, including jobs, to the region; (5) produce tritium for a longer period of time; (6) benefit area ratepayers and taxpayers; (7) salvage an existing government asset; (8) provide national benefits, such as the lowest cost to the taxpayer; and (9) generate power without greenhouse gases. Some commentors also point out that, compared to Watts Bar/Sequoyah, Bellefonte is strongly supported by the local population (including politicians, businessmen, labor unions, and educators) and many supporters have worked hard to promote tritium production at the site.

Some commentors, after comparing the alternatives, favor the Watts Bar/Sequoyah alternative over the Bellefonte alternative since it would: (1) use an existing facility; (2) avoid creating new health risks and environmental concerns; (3) not impact new population areas; (4) cost less; (5) cause the least harm to biological entities; and (6) offer the greatest flexibility at the least cost, given the future likelihood of additional weapons reductions.

Comments Summarized: 214-1, 216-1, 219-1, 220-1, 221-1, 227-2, 233-2, 234-1, 236-1, 237-1, 238-1, 240-1, 242-3, 243-1, 244-1, 249-4, 814-2, 820-1, 822-1, 823-1, 824-2, 826-1, 830-1, 832-3, 833-1, 834-1

Response: DOE recognizes that there are advantages and disadvantages to both the Bellefonte alternative and the Watts Bar/Sequoyah alternative. In designating the Preferred Alternative, the Secretary of Energy considered a variety of factors including cost, schedule, flexibility, environmental impacts, and the ability to meet statutory requirements. Based upon these factors, the Secretary judged the Watts Bar/Sequoyah alternative preferable to Bellefonte. A final decision will not be made until at least 30 days after the EPA Notice of Availability for the CLWR Final EIS is issued.

CATEGORY 08: DOE PAST PRACTICES

08.01 One commentor opposes transportation of TPBARs to the Savannah River Site for extraction because the Savannah River Site cleanup "doesn't seem to be accomplishing its goal," and the commentor doesn't want South Carolina to become a dump or storage site for nuclear and radioactive waste.

Comment Summarized: 18-2

Response: DOE has a very aggressive cleanup program and has worked with the EPA, states, stakeholders, and the general public to develop long-range programs and commitments to clean up its facilities to acceptable levels. While the commentor's opinion that DOE's clean-up actions are not accomplishing its goal are noted, this comment is beyond the scope of the CLWR EIS. The impacts of low-level wastes associated with the proposed action to produce tritium at one or more CLWRs are addressed in Volume 1, Sections 5.2.1.11, 5.2.2.11, and 5.2.3.11 of the CLWR EIS. Impacts associated with wastes from tritium extraction are addressed in the Tritium Extraction Facility EIS (DOE/EIS-0271) (DOE 1998a, DOE 1999b).

08.02 Commentors suggest that DOE has a record of polluting and contaminating every site they have operated and that the CLWR program will be no different. One commentor contends that the K-Reactor should be utilized so that other sites will not be polluted by DOE. Another commentor contends that, since the K-Reactor at the Savannah River Site has been contaminated beyond reasonable or economical expectation for clean-up, it is difficult to see why the need for environmental upgrades are a reasonable excuse for this facility not to be considered as a reasonable alternative. One commentor indicates that among other deficiencies in cleanup activities, DOE has failed to site a nuclear repository and, therefore, its ability to operate a CLWR program is in serious question. Another commentor indicates that in December 1991, coolant contaminated with tritium leaked into the Savannah River from a DOE reactor. Another commentor states that the CLWR EIS does not give the history of environmental and health problems around DOE tritium facilities.

Comments Summarized: 36-1, 41-4, 58-2, 103-3, 132-2, 136-3, 137-1, 211-3, 217-3, 252-3, 507-2, 707-7, 720-2, 800-9, 803-3

Response: DOE recognizes that it has facilities which require some level of environmental cleanup. Similar to other industries, most of the DOE facilities were designed and constructed in the 1940s and 1950s, prior to today's environmental requirements, when the understanding of waste management principles was not what it is today. Over the past several years, DOE has had a very aggressive facility modernization and cleanup program and has worked with the EPA, states, Tribal Nations, stakeholders, and the general public to develop long-range programs and commitments to cleanup its facilities to acceptable levels. To date, the Department has completed numerous cleanup activities and is aggressively working toward the cleanup of its remaining environmental problems. Actions taken to implement the CLWR tritium program would not be inconsistent with nor impact these ongoing cleanup activities, since the cleanup activities of the DOE are funded and managed separately.

In regard to the use of the K-Reactor at the Savannah River Site, this option was evaluated by the Final Programmatic EIS (DOE 1995), but dismissed from further consideration for the reasons stated in Section 3.1.3 of that document and summarized here. The K-Reactor was designed in the 1940s and was utilized for the production of tritium and other nuclear materials until 1988. At that time, the facility was shut down for major environmental, safety, and health upgrades to comply with today's stringent standards. The commentor is correct in that, during the effort to restart the K-Reactor, tritium-contaminated coolant was released into the Savannah River. Despite a great number of improvements, it was finally decided that the facility was too old and that the additional cost of upgrades sufficient to enable it to comply with the Department's existing standards were too great. If the K-Reactor were to be used, the environmental problems associated with the past use of this facility must be remedied in accordance with the Federal Facilities Act and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

In regard to DOE's ability to carry out the CLWR program, the Department has demonstrated a competency in leading the industry in the use of nuclear energy and in the protection of human health and safety. DOE has pioneered the development of energy-efficient products, space exploration technology, medical treatment procedures, and a long list of other noted accomplishments. The focus of the CLWR EIS is to assess the potential environmental impacts associated with the production of tritium at each of the five TVA reactors being considered. A history of environmental and health issues associated with DOE facilities, as well as other DOE programs such as the nuclear repository, does not fall within the scope of this EIS.

DOE is committed to improving its environmental management, to operating its facilities in a manner that meets or exceeds all applicable environmental, safety, and health requirements, and to the cleanup of its environmental problems. The alternatives being considered for the production of tritium in a CLWR all propose the utilization of state-of-the-art TVA reactors. These reactors have excellent environmental compliance records and exemplary environmental, health, and safety programs to assure continued compliance.

In addition, as discussed in response to Comment Summary 05.10, DOE has confidence that the use of TPBARs in a CLWR is safe and technically straightforward.

08.03 A commentor would like to know where tritium has been produced and what studies have been conducted that show its effect on the environment.

Comments Summarized: 213-1, 818-1

Response: Volume 1, Section 1.3.3 of the CLWR EIS presents a brief discussion of the history of tritium production. Appendix C discusses the properties of tritium and its effects on the environment. Section C.2.1.2 presents a discussion of health effects including references to the National Research Council's Committee on the Biological Effects of Ionizing Radiation (BEIR) reports. Section C.2.2 presents a discussion of tritium characteristics and biological properties including references to International Commission on Radiological Protection (ICRP) publications.

08.04 A commentor mentions a 12-year tritium leak to groundwater from a spent fuel holding tank at Brookhaven National Laboratory and notes that public trust of the management of any nuclear reactor or research laboratory anywhere in the world is slim. Further, the commentor questions the faith that industry and the NRC put in nuclear science to find answers to industry problems.

Comments Summarized: 248-6, 819-1

Response: The tritium leak at Brookhaven National Laboratory involved material that leaked from an unlined spent fuel pool. All the TVA reactor facilities include linings in the design of their spent fuel pools.

CATEGORY 09: TVA PAST PRACTICES

09.01 One commentor states that he lives about 2 miles from Watts Bar and feels quite safe and confident that the plant is being operated safely. Another commentor expresses confidence in TVA's track record.

Comments Summarized: 26-2, 58-5

Response: As discussed in Volume 1, Section 6.5 of the CLWR EIS, TVA operates all its reactor facilities within all state and Federal regulations.

09.02 The commentor expresses a serious concern regarding the ability of DOE and TVA to carry out this project successfully. The commentor suggests that the EIS needs to point out changes in these organizations that have or will be taking place to give assurance that the project will be handled properly and in accordance with this EIS. The commentor also suggests that the EIS perform an evaluation on the "specified candidates" capabilities to carry out the project. Referring to Section 6.5.3.1, the commentor cites various examples of past TVA experiences which, according to the commentor, point to TVA's inability to manage the program in an environmentally acceptable manner.

Comment Summarized: 41-5

Response: TVA's capability to successfully carry out the project is inherently a major consideration in DOE's decision process. In 1985, TVA made the decision to voluntarily shut down its nuclear units because of technical deficiencies and the absence of an effective management system in the nuclear program. In response to this situation, TVA restructured its nuclear organization, strengthened its management system, and successfully implemented a comprehensive recovery plan to address the identified deficiencies and regulatory concerns. This strengthened management system demonstrated TVA's ability to recover the nuclear program, and the agency continues to successfully manage the program as one of the leading performers in the industry. TVA's management takes very seriously any identified problems and violations of any level. Corrective actions are taken as soon as possible, and recurrence controls are put in place. While Sequoyah had a number of violations identified during the mentioned time frame, the overall trend of violations continues to decrease and the majority of those received recently have been characterized as having low safety significance. Watts Bar Unit 1 was designed, built, and is operated to high standards and adheres to strict regulations to ensure the health and safety of the public and TVA employees. Since successfully completing startup activities and beginning commercial operation in May 1996, Watts Bar has demonstrated excellent performance and set world records during its first-cycle operation and refueling outage. Two years in a row, the plant received from the NRC's Systematic Assessment of Licensee Performance evaluation a "superior" rating in three of four performance categories and a "good" in the remaining category. Volume 1, Sections 6.5.2 and 6.5.3 of the CLWR EIS present a discussion of Institute of Nuclear Power Operations reports for the Watts Bar and Sequoyah plants.

09.03 The commentor, referring to Section S.1.5.5 (Summary) of the CLWR Draft EIS remarks that producing tritium in a TVA reactor is not consistent with the Congressional purposes that established TVA. The commentor notes that its establishment in 1933 had no bearing whatsoever to "national defense," although later it was further developed to ensure a reliable supply of electricity for Oak Ridge. The commentor recommends that the insinuation be removed. Another commentor suggests that tritium production is an expansion of TVA's responsibilities from power production to weapons production, and asks whether tritium production would influence TVA to move further into weapons and defense-related activities.

Comments Summarized: 41-6, 815-3

Response: The commentor is correct that TVA has provided electricity to the defense mission at Oak Ridge. One of the key reasons for constructing TVA's Shawnee Fossil Plant near Paducah, Kentucky, was to provide electricity to DOE's uranium enrichment plant at that location. The CLWR EIS Summary, Section S.1.5.5, and Volume 1, Section 1.3.6, provide an accurate summary of the TVA Act, so a revision of the text is unnecessary. The preamble to the TVA Act identifies national defense as one of the purposes for TVA's creation. Further, the TVA Act in Sections 15(h) and 31 indicates that the Act should be liberally construed to aid TVA in discharging its responsibilities for the advancement of national defense and other statutory purposes. In compliance with that Congressional mandate, TVA has supported the nation's defense efforts on numerous occasions since its creation in 1933. TVA produced phosphorus and ammonium nitrate for explosives and munitions during World War II and the Korean Conflict. From 1952 to 1957, TVA, under an agreement with the Department of the Army, operated and maintained the Phosphate Development Works complex, at which various phosphorus-based chemical agents were produced. From 1985 to 1998, under a contract with the Department of Defense, the Phosphate Development Works was refurbished and reactivated to process and purify the United States' remaining stock of a nerve agent component (methyl phosphoric dichloride). TVA continues to support defense missions today with the cleanup of chemical and munitions production and storage sites, as well as stabilization or disposal of surplus chemical weapons stockpiles. Thus, tritium production is not an expansion of TVA's defense role nor would it influence TVA with regard to any future defense-related activities. The text referred to by the commentor in the CLWR EIS Summary, Section S.2, and Volume 1, Chapter 2, is accurate.

09.04 The commentor asserts that the Bellefonte plant would put radiation into the water and the air. The commentor further remarks that, according to his understanding, the plant was stopped before because of the high cost of meeting the environmental requirements and wonders how the requirements would be met now. The commentor is interested in receiving documentation on the plan for this action.

Comment Summarized: 49-2

Response: Radioactive effluents from nuclear facilities are strictly controlled and regulated in the United States by state and Federal regulations for the protection of the environment and the health and welfare of the public. Although the operation of Bellefonte, as analyzed in Volume 1, Section 5.2.3.9 of the CLWR EIS, would result in radioactive discharges, resultant air and water concentrations would be well below established regulatory limits. As stated in the CLWR EIS, Bellefonte was initially deferred in 1988 because of diminished growth in TVA's customer power needs. In 1994, the TVA Board of Directors decided that the Bellefonte Nuclear Plant would not be completed unless financial partners could be found. The cost of environmental controls was not a factor in this decision.

09.05 The commentor asks, "What is the basis for using Institute of Nuclear Power Operations reports to defend using TVA's CLWRs when the public does not have access to those reports and cannot get them?" The commentor suggests that the public is at a vast disadvantage responding to this EIS on that basis alone.

Comment Summarized: 86-7

Response: As stated in Volume 1, Section 6.5.1 of the CLWR EIS, the purpose of the section that describes compliance indicators is not for DOE to assess the adequacy of TVA's operation of its CLWRs, but to provide a basis to assess whether there are any compliance issues that would interfere with the production of tritium. The Institute of Nuclear Power Operations performance indicators are appropriately mentioned in this section, as they are used by individual nuclear plants to help them improve their operations by measuring them against established standards of excellence that apply across the industry. The Institute of Nuclear Power Operations restricts distribution on all plant-specific performance reports, and no one in the industry releases their complete reports to other utilities or to the public. Distribution is restricted to encourage candor in communications between the Institute of Nuclear Power Operations (the auditor) and the nuclear plant being audited. While the Institute of Nuclear Power Operations reports are confidential, NRC Systematic Assessment of Licensee Performance reports are made available to the public, including all input material such as data from the Institute of Nuclear Power Operations. All regulatory violations, whether they are self-identified or not, are described in the NRC Systematic Assessment of Licensee Performance reports and are made available to the public.

09.06 The commentor remarks that the CLWR Draft EIS reports very small numbers of abused employees that have been harmed as a result of raising safety issues. The commentor inquires about the source of these numbers. The commentor also inquires as to how TVA, the NRC, and DOE will ensure a safety-conscious work environment where employees feel free to raise safety issues without damage to them, their families, or their careers.

Comments Summarized: 86-11, 703-13

Response: Over the past several years, TVA has developed several means to monitor the safety consciousness of its workforce. Periodic surveys of employee attitudes regarding employee/management communication of safety concerns are conducted by TVA's Office of Inspector General. TVA's Nuclear Concerns Resolution Staff is a separate organization outside the normal nuclear management chain that provides an alternative path for employees to communicate any safety or quality concerns. Through a standard exit interview process, the Concerns Resolution Staff also provides employees and contractors leaving employment an opportunity to raise any concerns and voice their opinions about employee/management communication. TVA management tracks and trends employee grievances and U.S. Department of Labor complaints arising from allegations of intimidation and harassment in order to gauge the effectiveness of its safety-conscious work environment efforts. In the early 1990s, dozens of Department of Labor cases were filed within TVA Nuclear. No Department of Labor cases were filed in 1998. Employee surveys in recent years indicate that approximately

98-99 percent of the employees and contractors feel free to raise safety concerns with their direct management without reprisal. The CLWR EIS does not include a discussion on the numbers of abused TVA employees that have been harmed as a result of raising safety issues. Volume 1, Sections 6.5.2.1 and 6.5.3.1 of the CLWR EIS discuss Notices of Violation which imposed civil penalties regarding alleged acts of discrimination. The source of this information is the NRC.

09.07 The commentor remarks that, in attempting to discuss current projections for future energy demands in Section 1.3.6, the CLWR Draft EIS does not make clear whether TVA's projections include conservation measures to reduce demand and/or development of renewable energy resources.

Comment Summarized: 94-8

Response: TVA's projected customer power needs will be met using new generation resources, as well as efficiency improvements to TVA's existing generation resources. Additionally, changes in customer end-use (demand-side) efficiencies, such as conservation, are a factor in power need projections. Some of these end-use efficiencies result from programs carried out by TVA and the distributors of TVA power. TVA's *Energy Vision 2020, Integrated Resource Plan Environmental Impact Statement* (TVA 1995) presents both short-term and long-term TVA plans for demand-side management and customer service programs. A program is now in the planning stages that would add additional renewable energy resources such as wind energy and solar energy to TVA's generation system.

09.08 A commentor, referring to Section 3.2.l of the CLWR Draft EIS where the assumption is made that the Bellefonte plant would be completed by 2005, states that the CLWR EIS should be subjected to a reality check, and more reasonable projections should be used based on progress thus far on Bellefonte and the schedule of Watts Bar 1. Another commentor asks whether the schedule for completing Bellefonte 1 is hypothetical or real. The commentors also recommend that the CLWR EIS, in determining the reasonableness of completing Bellefonte for tritium production by 2005, should provide information on how complete Bellefonte currently is, how realistic the 2005 date is, and what size of spent nuclear fuel cooling pool is being (or has been) designed and constructed.

Comments Summarized: 94-17, 500-1

Response: The schedule for completing Bellefonte Nuclear Plant Unit 1 is consistent with DOE's tritium requirement. The schedule for the completion is based on sound assumptions and experience gained through prior operation. It has been reviewed extensively by outside experts, such as Bechtel, Ebasco, and Fluor Daniel. In Volume 1, Section 3.2.2, the CLWR EIS states that Bellefonte Unit 1 is 90 percent complete while Unit 2 is 57 percent complete. The reasonableness of the 2005 completion date has been reviewed. Irrespective of the completion schedule for Bellefonte, it is likely that the first core load of TPBARs would be irradiated in the Watts Bar plant. As discussed in Volume 1, Section 4.2.3.11, the spent fuel pool for Unit 1 is constructed and will be able to store 1,058 spent fuel assemblies. This capacity would be sufficient to store 20 years of operation without alternate storage means.

09.09 The commentor states that, as someone who grew up in the shadows of Watts Bar and remembers reading the newspaper articles and what it took to bring that facility on line, he is appalled that DOE would even discuss Watts Bar.

Comment Summarized: 503-5

Response: Watts Bar Unit 1 was designed, built, and is operated to high standards and adheres to strict regulations to ensure the health and safety of the public and TVA employees. Since successfully completing startup activities and beginning commercial operation in May 1996, Watts Bar has demonstrated excellent performance (see Volume 1, Section 6.5.2.1). Its first operating cycle was the best first cycle for the first unit of any plant in the United States. For Fiscal Year 1998, Watts Bar set a new site generation record and had the best first-cycle refueling outage for U.S. plants in the past decade. For the second time in a row, the plant received from the NRC's Systematic Assessment of Licensee Performance evaluation a "superior" rating in three of four performance categories and a "good" in the remaining category.

09.10 A commentor points out that the primary coolant systems at Sequoyah and Watts Bar are of a recognized bad design and are virtually inoperable at any given time. The commentor expresses concern that this has received little or no attention by TVA or DOE, and that ratepayers should not be responsible for their mismanagement.

Comments Summarized: 241-4, 811-7

Response: The design of the Watts Bar and Sequoyah reactors has been thoroughly reviewed and licensed by the NRC. TVA operates its plants in compliance with all NRC requirements and all other applicable regulations. Volume 1, Chapter 6 of the CLWR EIS describes the regulatory compliance history of both Watts Bar and Sequoyah.

CATEGORY 10: LAND, AESTHETICS, NOISE, SOILS, GENERAL ENVIRONMENT

10.01 The commentor expresses concern that the plume from operation of the cooling tower would result in odors in the valley.

Comment Summarized: 12-4

Response: The cooling tower plume associated with operation of a nuclear reactor is a water vapor plume and would not result in any detectable odor.

10.02 The commentor expresses concern that DOE has not provided adequate information on soils and geology with which to evaluate storage options, other future structures, and the protection of groundwater from wastes at Bellefonte.

Comment Summarized: 116-20

Response: DOE believes that the information provided on geology and soils for Bellefonte in Volume 1, Section 4.2.3.5 of the CLWR EIS is adequate for the level of impacts anticipated and discussed in Section 5.2.3.5. Extensive evaluations of soils and bedrock on the Bellefonte site were conducted prior to the construction of Bellefonte Units 1 and 2. These evaluations are discussed in the *Bellefonte Nuclear Plant Final Safety Analysis Report* (TVA 1991) and in the *Final Environmental Statement, Bellefonte Nuclear Plant Units 1 and 2* (TVA 1974). The *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997) also summarizes geological and soil conditions at the site. The last two documents serve as a baseline on which the environmental impacts associated with tritium production are assessed. Although the characteristics of soils can play a role in controlling spills of fuels, oils, solvents, or other chemicals, the primary controls are engineered controls and mitigation measures as provided in the site Spill Prevention, Control, and Countermeasures Plan. The environmental impacts from the construction and operation of the dry cask Independent Spent Fuel Storage Installation (ISFSI) are addressed in Volume 1, Section 5.2.6 of the CLWR EIS. However, no decision will be made to either construct or operate a dry cask ISFSI as a result of this EIS. Appropriate NEPA documentation would be prepared prior to the construction of such a facility.

10.03 Commentors are opposed to tritium production in general or at Bellefonte in particular because of the increased risk of environmental contamination.

Comments Summarized: 29-1, 37-1, 84-1, 98-1, 139-1, 212-7, 712-1

Response: The radiological releases to the environment that could result from the proposed action under normal operating conditions and various hypothetical accident scenarios are conservatively estimated in Chapter 5 of the EIS for each candidate reactor site. The potential impacts to the environment and the radiological doses and risks to the public from these releases also are assessed and discussed in Chapter 5. The assumptions and methodology used for the assessment are discussed in detail in Volume 1, Appendix C and D of the CLWR EIS for normal operation and accident conditions, respectively. The methodology used is based on scientific standards accepted in the industry and dictated by Federal and state regulatory authorities. As discussed in Volume 1, Chapter 5 of the CLWR EIS, the environmental impacts and the potential doses to the public are well within limits considered acceptable by the regulatory authorities. The potential environmental impacts resulting from the operation of Bellefonte specifically are addressed in Section 5.2.3 of the CLWR EIS.

10.04 One commentor states that any pollution problem would not be greater than that which already exists for the TVA area. Other commentors suggest that the East Tennessee region is already overflowing with toxic materials from both local industry and DOE operations and cannot handle any more toxic wastes.

Comments Summarized: 103-1, 211-1, 248-7

Response: Volume 1, Chapter 5 of the CLWR EIS analyzes the range of potential impacts which could occur at each of the three TVA plants. These impacts were determined to be within regulatory limits for each of the alternatives. Existing environmental conditions within the TVA area as they relate to the operation of the TVA reactors as tritium-producing plants are described in Volume 1, Section 4.2, Affected Environment.

CATEGORY 11: AIR, WATER RESOURCES

11.01 The commentor asks the following: What is the current wastewater program that the TVA nuclear programs use to clean up the reactor coolant waste water prior to release into the Tennessee River? Where is the procedure for that and how often is that program tested to support its reliability? What are the criteria that the NRC will use to monitor that program? Where are those criteria located now?

Comments Summarized: 86-9, 703-1

Response: As described in Volume 1, Sections 4.2.1.4 and 4.2.2.4 of the CLWR EIS, the radionuclide contaminants in the primary coolant are the source of liquid radioactive waste at the Watts Bar and Sequoyah plants. Each source of liquid waste receives an individual type of treatment before discharge to the environment under the National Pollutants Discharge Elimination System (NPDES) permit. The CLWR EIS presents the amount of radioactive liquid effluent to the Tennessee River in Volume 1, Tables 5-2, 5-12, and 5-30, and presents potential tritium concentration in the river in Tables 5-3, 5-13, and 5-31. TVA Nuclear contracts with a vendor to process the reactor coolant wastewater and to ensure any radioactivity is well within the established regulated limits prior to release to the Tennessee River. The vendor is responsible for supplying and operating the liquid waste processing system. Prior to system use, the vendor supplies to TVA for review a "Process Control Program" that describes the available processing vessels, operating parameters, and suggested removal criteria for the various media utilized in the vessels. Vendor operating procedures also are submitted for TVA's review. Prior to each batch of processed water being released to the Tennessee River, an analysis is performed to identify the radioactive species present. This analysis also determines each pollutant's rate of discharge and the total activity to be released to the Tennessee River and compares these estimates to the regulatory limits for each pollutant. These releases are well below the allowable activity limits presented in 10 CFR 20. The NRC monitors and inspects conformance to the 10 CFR 20 release limits.

11.02 The commentor states that the document should explain whether the operational limits for a plant would be changed to produce tritium and whether those changes might affect the NPDES permits under which that plant now operates.

Comment Summarized: 126-3

Response: Volume 1, Sections 5.2.1.4 and 5.2.2.4 have been revised to clarify that TVA does not envision any changes to the operational limits that might affect the NPDES permits for the Watts Bar and Sequoyah plants.

11.03 Two commentors recommend that DOE should consider background and downstream monitoring of the facilities.

Comments Summarized: 126-4, 129-1

Response: TVA presently monitors downstream of the release point at Watts Bar and Sequoyah, and will monitor downstream of the Bellefonte release point (once Bellefonte begins operation) in accordance with regulatory requirements. The NRC requires that the monitoring for tritium detects at a level of 2,000 picocuries per liter. TVA monitors more conservatively than the NRC requirement and can detect at levels of 300 picocuries per liter. In addition to monitoring liquid effluent pathways, TVA also monitors releases via air pathways. In accordance with regulatory requirements, TVA routinely files environmental reports with the NRC and state agencies that identify and quantify scheduled and unscheduled liquid and air pathway releases to the environment. These reports also identify the consequences of these releases (i.e., doses) on the general population.

11.04 The commentor asks: (1) who is ultimately accountable for determining how much tritium can be released into the Tennessee River; (2) who has the authority to determine whether the procedures for the current wastewater program are correct; and (3) whether the current program is capable of providing complete and accurate numbers for the amounts of tritium that would be released into the river.

Comment Summarized: 703-2

Response: All commercial power reactors discharge liquid and gaseous tritium during operation. The NRC and EPA are statutorily responsible for setting discharge limits for radionuclides (including tritium) and enforcing those limits. TVA is responsible for meeting those limits and demonstrating compliance with them. All nuclear plant discharges are sampled and/or monitored to verify that they are within applicable limits. The instrumentation involved is periodically calibrated to ensure accuracy. In addition, TVA has a comprehensive radiological monitoring program which samples airborne and terrestrial pathways between the plant and the surrounding population to verify that all human exposure limits are met. All samples are analyzed at TVA's Western Area Radiological Laboratory in Muscle Shoals, Alabama. All analyses are conducted in accordance with written and approved procedures and are based on accepted methods. The Radiological Laboratory employs a comprehensive quality assurance/quality control program to monitor laboratory performance throughout the year. The program includes equipment checks to ensure that the radiation detection instruments are working properly and analysis of the quality control samples are included alongside routine environmental samples. The laboratory participates in the EPA Interlaboratory Comparison Program. In addition, samples are split with the EPA National Air and Radiation Environmental Laboratory, and applicable state agencies provide an independent verification of the overall performance of the laboratory.

The answer to the commentor's three points are: (1) the NRC regulates how much tritium can be released, (2) the NRC establishes the wastewater program requirements, and (3) the current program is considered to provide an accurate assessment of any tritium released into the Tennessee River.

11.05 The commentor asks whether a National Emission Standard for Hazardous Air Pollutants for radionuclides is applicable to tritium production.

Comment Summarized: 143-4

Response: As discussed in Volume 1, Section 6.2.2, National Emission Standards for Hazardous Air Pollutants for radionuclides (40 CFR 61, Subparts H and I) are not applicable to NRC-licensed facilities such as the TVA reactors. [See National Emission Standards for Radionuclide Emissions from Facilities Licensed by the Nuclear Regulatory Commission and Federal Facilities Not Covered by Subpart H, Final Rule, 60 FR 46206 (September 5, 1995).] Radioactive emissions, including tritium, are regulated by the NRC (10 CFR 50, Appendix I, 40 CFR 190, and 10 CFR 20). Furthermore, as indicated in Volume 1, Sections 5.2.1.9.1 and 5.2.2.9.1, impacts from radioactive emissions from tritium production at Watts Bar or Sequoyah would be small. Section 5.2.3.9.1 presents the expected impacts from radioactive emissions from tritium production at the Bellefonte Nuclear Plant. The EPA decided that compliance with NRC regulations constitutes compliance with 40 CFR 61.

11.06 The commentor suggests that the statement on page 5-39 of the CLWR Draft EIS, which says that studies of natural draft cooling towers in England approximate the performance of natural draft cooling towers in the southern United States, needs amplification. The commentor asserts that there are significant climate differences between these two areas.

Comment Summarized: 146-12

Response: The commentor is concerned that the cooling tower solids deposition rate presented in the CLWR Draft EIS may not be representative of the Bellefonte cooling towers. The text has been revised in the CLWR Final EIS to present the estimated solids deposition rate near the Bellefonte cooling towers.

11.07 One commentor suggests that adverse impacts to water quality have not been analyzed properly in the EIS and that there is a lack of data on impacts from previous diversions. Specifically, a commentor suggests that data presented in Tables 5-22 and 5-23 are outdated and that concentrations of pollutants from Bellefonte during operation need to be presented. The commentor states that the following statement does nothing to ease one's mind: "Water required from the Guntersville Reservoir would be a small fraction of the river flow, and most of it would be returned to the reservoir after use." (CLWR Draft EIS p. 5-42).

Comment Summarized: 116-21

Response: The CLWR EIS also analyzed the potential radiological water quality impacts associated with operation of Bellefonte 1 or Bellefonte 1 and 2 for tritium production. The results of these analyses, presented in Volume 1, Section 5.2.3.4 of the CLWR EIS, indicate that concentrations of tritium in the Tennessee River resulting from the operation of the plant would be well below limits established by the EPA for drinking water. Discharges and concentrations in the reservoir would meet the limitations of the NPDES Permit and Alabama Department of Environmental Management drinking water standards, which have been set to protect the public drinking water supply.

Water use by other users withdrawing water from the Guntersville Reservoir is discussed in Volume 1, Section 4.2.3.4 of the CLWR Final EIS. Tables 5-28 and 5-29 (formerly Tables 5-22 and 5-23) have been revised to agree with the more recent water quality monitoring data for Guntersville Reservoir presented in Table 4-26. Revised concentrations in the reservoir after effluent mixing have been included in the tables.

11.08 The commentor notes that, on page 5-33 of the CLWR Draft EIS, the Watts Bar 1 radioactive effluent is given as 14,850 Curies per year. The commentor asks whether this effluent impacts the surface water and, if so, why there is no change to water quality conditions.

Comment Summarized: 22-2

Response: The CLWR EIS analyzes the potential water quality impacts associated with operation of Watts Bar 1 for tritium production. The results of these analyses, presented in the revised Volume 1, Section 5.2.1.4 of the CLWR EIS, indicate that concentrations of tritium in the Tennessee River resulting from tritium production at the plant would be well below limits established by the EPA for drinking water. It should be noted that the radioactive effluent from each of the reactors has been modified to eliminate the contribution from two failed TPBARs. TPBAR failure is considered an abnormal event and the resulting release of radioactive materials from this event would not occur on an annual basis.

11.09 The commentor asks the distance between the Bellefonte plant's point of discharge into the river and the point where the Jackson County Water Department draws water from the river for public use. Further, upon hearing the answer is 4.5 miles, the commentor asks if the public water source that was measured is the one for Fort Payne. The commentor also asks the location of the other public water sources in Jackson County and their distance from the Bellefonte plant's discharge point.

Comment Summarized: 606-1

Response: The nearest municipal water intake is for Fort Payne at Tennessee River Mile 387.6, 2.7 miles downstream of the TVA Bellefonte effluent diffuser. The next nearest municipal water intake is for Scottsboro at Tennessee River Mile 385.8, 4.5 miles downstream of Bellefonte, at the Comer Bridge (Alabama Route 35). Scottsboro provides water to Jackson County from this intake. Other water supply intakes near Bellefonte are listed in Volume 1, Section 4.2.3.4, and Table 4-27 of the CLWR Final EIS.

11.10 The commentor claims that DOE failed to discuss the impacts of the proposed action on surface and groundwater. The commentor further opines that, although the Department concedes that there will be an impact to the water quality, it did not address monitoring. The commentor suggests that, since tritium oxide is chemically identical to water, it cannot be filtered out of the water, implying that monitoring for tritium after it has been released is too late.

Comment Summarized: 116-17

Response: Volume 1, revised Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4 of the CLWR Final EIS discuss potential releases of tritium to surface waters around each site and address potential tritium concentrations. As discussed in these sections, the resulting tritium concentration in these waters would be well within the drinking water limit established in the Safe Drinking Water Act. Plant procedures associated with any tritium monitoring would be approved by the NRC. With respect to groundwater, the EIS concludes that groundwater quality would not be affected by the operation of the reactors in a tritium-producing mode.

11.11 The commentor, referring to a statement made in the CLWR Draft EIS that, "Operational impacts on threatened or endangered species could occur through the release of thermal, chemical, or radioactive discharges to the atmosphere or the river," asks why it is necessary to discharge radioactive materials into the river and whether there is an alternative.

Comment Summarized: 602-1

Response: The statement the commentor refers to is a general statement that thermal, chemical, or radioactive discharges potentially could occur. Further on in the text, the CLWR EIS states that the impact of such radiological releases should not have a detrimental effect on endangered species. Modern nuclear plants, however, do discharge some extremely small amounts of thermal, chemical, and radioactive materials during normal operations. This is because trace amounts of these materials find their way into the makeup water that feeds into and out of the reactor coolant system. When the coolant water leaves the reactor, it is piped into large "hold-up" tanks. Most of the water is recycled back into the reactor; but when the hold-up tank fills, the water is sampled and tested to make sure it is within the regulated radiological limits, and then discharged to the river. Such discharges are regulated by the NRC and by state environmental protection agencies. The state agencies issue NPDES permits that allow the plants to discharge certain chemicals and radiological constituents within legally specified limits. There are limits on how much of these materials a plant can discharge and when it can discharge them. The analyses presented in the CLWR EIS show that the incremental risk associated with such normal discharges would be very small. Even if a plant's safety systems failed and all the tritium released to the reactor coolant system during normal operation were discharged into the river, the resulting radiological doses would be small. [In estimating the radiological doses and risks to the public from such a tritium release, the CLWR EIS assumed the public was drinking water directly from the river, eating fish from the river, and swimming in the river.] Radiation dose limits for protecting human health are much lower than any dose that would be expected to have any adverse effects on other organisms. For this reason, such radiological releases should not affect endangered species or any other wildlife that includes the river as part of its habitat.

11.12 The commentor asks whether the small amounts of radiological and chemical materials normally discharged into a river by a nuclear power plant are processed before being discharged.

Comment Summarized: 602-2

Response: The liquid discharges from a nuclear plant are processed prior to release via controlled pathway to the river to reduce the quantities of radiological and chemical materials to well below the acceptable level established by the Federal and state regulatory authorities. However, it should be noted that this processing does not reduce the quantity of tritium before it is released to the environment. Tritium concentrations are monitored to ensure compliance with limits established by the NRC.

11.13 In response to an inquiry by another commentor regarding meteorological data collection, the commentor states that a device that measures wind velocities to gather data on prevailing winds in the region near the Watts Bar site already is available at the plant.

Comment Summarized: 701-2

Response: Each nuclear plant site is required to maintain an operable meteorological tower to supply weather information as needed to direct survey operations during a radiological emergency. From these and other facilities, TVA has accumulated detailed, thorough sets of meteorological data at each site, which were used in analyzing environmental impacts for air pathway pollutant releases in this EIS. Volume 1, Section 4.2.1.3 of the CLWR EIS describes the meteorology and climatology in the region of the Watts Bar site, including the prevailing winds, which are from the south-southwest.

CATEGORY 12: ECOLOGICAL RESOURCES

12.01 The commentor is concerned that TVA is divesting some of its recreational properties, such as the Land Between the Lakes, and putting so much energy into this project. The commentor would like TVA to keep that project and maybe turn it over to the Wildlife Resources Agency or some other agency to maintain. The commentor expresses a belief that it is not fair to take land from private citizens for TVA uses and then just dump it to some other agency; the land should go back to the people or some other appropriate community use.

Comment Summarized: 707-10

Response: TVA received appropriated funding to continue to manage the Land Between The Lakes in Fiscal Year 1999 as a National Recreation Area. TVA is committed to continue operating this area to provide outdoor recreation and environmental education opportunities for the American people. For more information concerning this project, the commentor is encouraged to call 1-800-525-7077.

12.02 The commentor states agreement with the information presented in the CLWR Draft EIS that there would be only a minimal impact on the Guntersville Reservoir—less than 0.2 percent of the flow—and only minor impacts to other aquatic resources.

Comment Summarized: 627-2

Response: Impacts to Guntersville Reservoir from the production of tritium at Bellefonte are discussed in Volume 1, Section 5.2.3.4 of the CLWR EIS; impacts to aquatic resources are discussed in Section 5.2.3.6.

12.03 The commentor expresses concern that ecosystem and economical considerations were not thoroughly examined and that activities such as diversions of water and dam construction have affected the viability of aquatic wildlife. The commentor asks what is to be gained environmentally and economically by choosing a CLWR for tritium production.

Comment Summarized: 116-11

Response: The CLWR EIS summarizes the existing ecological environment at each of the three CLWR sites. These discussions may be found in Volume 1, Sections 4.2.1.6 (Watts Bar Nuclear Plant Unit 1), 4.2.2.6 (Sequoyah Nuclear Plant Units 1 and 2), and 4.2.3.6 (Bellefonte Nuclear Plant Units 1 and 2). The EIS further addresses the environmental consequences of the alternatives at each site in Sections 5.2.1.6, 5.2.2.6, and 5.2.3.6. DOE is confident that discussions presented in these sections adequately address ecological issues related to the proposed action. Impacts from water diversions and dam construction on the Tennessee River are beyond the scope of the present document. Economical benefits from the proposed action are addressed under the socioeconomic sections of Chapter 5.

12.04 The commentor cites a number of court cases and expresses concern that the CLWR EIS did not adequately address potential impacts to threatened and endangered species, especially the Indiana bat, and that DOE, although it notified the U.S. Fish and Wildlife Service, did not consult with that agency concerning threatened and endangered species.

Comment Summarized: 116-13

Response: The U.S. Fish and Wildlife Service has been consulted concerning potential threatened and endangered species that could occur at each CLWR site. Two letters were received (July 10, 1998, Lee Barclay, Field Supervisor, to Jon Loney, Manager, Environmental Management, TVA, [DOI 1998a] and

July 21, 1998, Larry E. Goldman, Field Supervisor, to Jon Loney, Manager Environmental Management, TVA [DOI 1998b]) providing information on threatened and endangered species that should be evaluated at the three proposed sites. On September 29, 1998 (letter from James H. Lee, Regional Environmental Officer, to Stephen Sohinki, Director, Commercial Light Water Reactor Project Office, DOE [DOI 1998c]), the U.S. Fish and Wildlife Service commented on the CLWR Draft EIS and noted that: "The Fish and Wildlife Service previously provided a current list of Federally threatened and endangered species [including the Indiana bat] which occur in the area. The CLWR EIS incorporated consideration of impacts to those species and concluded the operation would not adversely impact those species. The Fish and Wildlife Service does not anticipate adverse effects to listed species from the proposal." If TVA's operational monitoring program finds an adverse impact on any listed species, TVA will initiate further consultation with the U.S. Fish and Wildlife Service.

12.05 The commentor states that the EIS lacks site-specific ecological data and analysis concerning sensitive species. The commentor states that site-specific analysis should include the number of individuals of a species and how many will be killed or displaced by the proposed action.

Comment Summarized: 116-19

Response: DOE believes that the analyses of ecological resources, including sensitive species, provided in Volume 1, Sections 5.2.1.6, 5.2.2.6, and 5.2.3.6 of the CLWR EIS adequately address potential impacts from the proposed action at each of the three sites under consideration. Where the potential exists to affect ecological resources, the analyses demonstrate that impacts would be minor and/or of short duration. These results do not warrant the collection and analysis of detailed population data for each species potentially affected. The collection of detailed data and its analysis would only provide meaningful results if other than minor and/or short-term impacts were postulated. Council on Environmental Quality Regulations 1502.2 (a) and (b) state that EISs should be analytic rather than encyclopedic and that impacts should be discussed in proportion to their significance. The regulations go on to state, "There shall be only brief discussion of other than significant issues. As in finding of no significant impact, there should be only enough discussion to show why more study is not warranted."

With regard to sensitive species, the U.S. Fish and Wildlife Service, after reviewing the CLWR Draft EIS, found the analysis adequate to conclude that adverse impacts to listed species are not anticipated (letter dated September 29, 1998, James H. Lee, Regional Environmental Officer, to Stephen Sohinki, Director, Commercial Light Water Reactor Project Office [DOI 1998c]).

12.06 The commentor notes that Section 4.2.2.6, Aquatic Resources, mentions a decline in native mussel populations near the Sequoyah Nuclear Plant; but the reason for the decline was not addressed.

Comment Summarized: 146-6

Response: The referenced section states that few native mussels persist in the impounded portions of the Tennessee River adjacent to the Sequoyah Nuclear Plant site. The paragraph also states that mussels are present in the portions of the river below both the Chickamauga and Watts Bar Dams. While not directly stated, the intent of the paragraph is to point out that mussels do not occur in the impounded portions of the river and do occur in the more free-flowing portions of the river below the dams. Volume 1, Section 4.2.2.6 was revised in the CLWR Final EIS to clarify this point.

CATEGORY 13: SOCIOECONOMICS, ENVIRONMENTAL JUSTICE

13.01 The commentor states that people that live near Bellefonte are not educated enough to operate nuclear power plants and that bringing in employees to run the plant is not a good idea. Another commentor expresses concern that there is not enough housing for people to move into the area around Bellefonte.

Comments Summarized: 106-2, 200-1

Response: Approximately 800 people would be needed at Bellefonte for its efficient and safe operation. These 800 individuals would possess different skills and have various levels of education and training commensurate with their duties and responsibilities at the nuclear plant. Any individuals hired from the area or elsewhere to work at Bellefonte would be well trained in accordance with NRC requirements, applicable laws, good business practices, and nuclear industry guidelines. Internal and external audits, inspections, and assessments would ensure that these persons remain adequately trained to safely perform their jobs at the plant. While the initial economic effect of bringing in workers to operate Bellefonte may strain local infrastructure, the overall impact is expected to result in economic growth for the region.

Demand for housing by construction and operations workers in the vicinity of Bellefonte would increase during the completion and operation of the plant. Data indicate that vacant permanent housing for sale and rent in the vicinity of Bellefonte would not meet this demand. It is anticipated, however, that the completion and operation of Bellefonte would stimulate the construction of additional permanent housing, the opening of new trailer parks, and the expansion of existing parks to meet this demand. The construction of new housing units during the completion of Bellefonte would have a positive effect on the regional economy. It is expected that these new units also would meet permanent housing requirements for plant operations workers and their families. The impacts on housing from the completion and operation of Bellefonte are discussed in greater detail in Volume 1, Section 5.2.3.8 of the CLWR EIS.

13.02 The commentor asks the following question, "Since TVA has been planning on converting Bellefonte to a fossil fuel plant, how will the destruction of that plan affect the economics of the surrounding area?"

Comment Summarized: 116-12

Response: The economic impacts of converting Bellefonte to a fossil fuel plant are described in Section 4.2.12 of the *Final Environmental Impact Statement for the Bellefonte Conversion Project* (TVA 1997). As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. DOE believes that the CLWR EIS discusses all of the reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. Conversion of the Bellefonte plant to a fossil fuel electricity-generating plant would not accomplish DOE's purpose and need as stated in the CLWR EIS. As such, conversion of the Bellefonte plant to a fossil fuel plant is not a reasonable alternative for the CLWR EIS and, therefore, the comparison of tritium production with a fossil fuel plant is not presented in the CLWR EIS.

13.03 The commentor suggests that DOE avoids discussing in the CLWR EIS the economic impacts to recreation in general and, specifically, the Guntersville State Park and Reservoir. The EIS did not discuss the economics of fishing, hunting, hiking, wildflower viewing, bird watching, horseback riding or other recreational uses of these areas.

Comment Summarized: 116-22

Response: As the commentor points out, it is indeed true that the economic impacts to recreation are somewhat "intangible" and difficult to quantify. Impacts to recreation, however, may be evaluated by reviewing the number of fishing and boating licenses, for example, on other reservoirs with nuclear power plants experiencing similar conditions to that which would be experienced on the Guntersville Reservoir if the Bellefonte plant became operational.

TVA constructed and operates two nuclear power plants, Sequoyah and Watts Bar, on Chickamauga Reservoir near Chattanooga. TVA has seen no evidence of diminished recreational use on this reservoir due to the presence of these plants. Water-based recreation including fishing, boating, and water skiing is very popular on Chickamauga Reservoir. Other types of recreation, such as hunting and wildlife observation on adjoining lands, also are popular. Based on TVA's experience on Chickamauga Reservoir, there is no reason to believe that these recreational resources on Guntersville Reservoir would be impacted. The following information has been gathered in response to this comment.

There has been no decrease in fishing activities since Watts Bar went on line in May 1996.[1]

There were no appreciable changes in use patterns at TVA camping and park facilities in the area around Watts Bar. The Meigs County Arts and Crafts Festival has increased in size each year for the past several years.[2]

Creel survey data collected for Watts Bar before plant operations (1982-1985) and since the plant began operations (1996-1998) report that, since the plant began operations, harvest rates have exceeded those from before plant operations for all species compared.[3]

Tennessee Wildlife Resources Agency boat registration and hunting/fishing licenses sold in Meigs and Rhea counties are listed below. Hunting and fishing licenses are sold as a combined license. These data suggest that the startup of Watts Bar in 1996 had no effect on these common recreation outlets.

	1995	***1996***	***1997***
Hunting/Fishing Licenses[4]			
Meigs County	12,687	10,699	11,521
Rhea County	13,802	12,563	13,466
Boating Registration[5]			
Meigs County	927	NA	1,119
Rhea County	2,182	NA	2,435

13.04 The commentor suggests that the socioeconomic discussions in the EIS need to be at the same level of detail for each site.

Comment Summarized: 146-7

[1]Telephone interview with Tim Churchill, State of Tennessee Wildlife Resources Agency, Nashville, December 4, 1998.

[2]Telephone interview with Charlie Ellenburg, Tennessee Valley Authority Land Use Specialist, Melton Hill, December 4, 1998.

[3]Baxter, D.S., et al, *Aquatic Environmental Conditions in the Vicinity of Watts Bar Nuclear Plant During Two Years of Operation, 1996-1997* (Tennessee Valley Authority, Resource Group, Water Management, Norris, Tennessee, June 1998) 102.

[4]Telephone interview with Nellie Mann, State of Tennessee Wildlife Resources Agency, Nashville, December 7, 1998.

[5]Telephone interview with Becky Tomlin, State of Tennessee Wildlife Resources Agency, Nashville, December 7, 1998.

Response: Only the incremental socioeconomic impacts of tritium production were considered at the Watts Bar and Sequoyah Nuclear Power Plants. It was determined that the small regional costs and benefits associated with tritium production at these plants would have no measurable socioeconomic impacts. Less than 10 additional full-time equivalent workers would be required per unit. Because neither Bellefonte 1 nor Bellefonte 2 are currently operating, the EIS assessed the impacts of completing and operating these plants for tritium production. The socioeconomic impacts of this action at Bellefonte are far greater than at either Watts Bar or Sequoyah. The additional socioeconomic detail provided on Bellefonte in this instance is warranted, while additional socioeconomic detail on Watts Bar and Sequoyah is not necessary. This approach is consistent with Council on Environmental Quality Regulations 1502.2 (a) and (b). These regulations state that EISs should be analytic rather than encyclopedic, and that impacts should be discussed in proportion to their significance. These regulations also state, "There shall be only brief discussion of other than significant issues. As in finding of no significant impact, there should be only enough discussion to show why more study is not warranted."

13.05 Several commentors recommend that Bellefonte be selected by DOE as its primary tritium production source because it would create 800 permanent jobs and hundreds more indirect jobs, and this would have a significant economic impact on northeast Alabama because American workers would fill these jobs and retain them. However, one commentor also states that tritium production may not be the best way to create jobs. Other commentors state that the citizens of Jackson County would not receive the benefit of either short- or long-term jobs.

Comments Summarized: 232-1, 625-2, 627-3, 707-15, 806-3

Response: DOE acknowledges that there is both support for and opposition to the CLWR program and the selection of Bellefonte as the preferred tritium production site. The purpose of the CLWR EIS is to evaluate the environmental impacts of the reasonable CLWR alternatives for providing the tritium necessary to support the enduring stockpile as defined by the President in the Nuclear Weapons Stockpile Plan.

Tritium production at Bellefonte would have a significant economic impact on the region. These impacts are described in Volume 1, Section 5.2.3.8 of the CLWR EIS. Approximately 800 people would be needed at Bellefonte for its efficient and safe operation. These 800 individuals would possess different skills and have various levels of education and training commensurate with their duties and responsibilities at the nuclear plant. Local workers would be hired to the greatest extent possible which, as discussed in Section 5.2.3.8, would result in a lower unemployment rate, especially during construction. Any individuals hired from the area or elsewhere to work at Bellefonte would be well trained in accordance with NRC requirements, applicable laws, good business practices, and nuclear industry guidelines. Internal and external audits, inspections, and assessments would ensure that these persons remained adequately trained to safely perform their jobs at the plant. While the initial economic effect of bringing in workers to operate Bellefonte might strain local infrastructure, the overall impact would be expected to result in economic growth for the region.

13.06 A commentor expresses concern that there is no economic benefit [from tritium production at Bellefonte] to the residents of Scottsboro because local property values will be reduced, and local taxes will rise as a result of the completion of Bellefonte.

Comment Summarized: 232-4, 806-6

Response: As discussed in Volume 1, Section 5.2.3.8 of the CLWR EIS, DOE expects a positive socioeconomic impact associated with the completion of the Bellefonte plant. A significant number of new jobs would be added during construction and operation, along with significant new revenues and taxes to the local economy. Demand for housing would increase. It is speculative to expect property values to decrease as a result of completing Bellefonte.

13.07 A commentor asks whether the economic impact of using Watts Bar or Sequoyah for tritium production would be positive and negative. The commentor also asks that the welfare of the citizens of Rhea County be included in DOE's deliberations, and notes that Bellefonte would have greater and more positive economic impact.

Comment Summarized: 813-2

Response: As indicated in Volume 1, Sections 5.2.1.8 and 5.2.2.8 of the CLWR EIS, only the incremental socioeconomic impacts of tritium production were considered at Watts Bar and Sequoyah, which are operating nuclear power plants. It was determined that the small regional costs and benefits associated with tritium production at these plants would have no measurable socioeconomic impacts. Less than 10 additional full-time equivalent workers would be required per unit. The socioeconomic impacts, therefore, would not be noticeable. The socioeconomic impacts of completing Bellefonte would be far greater than those for either Watts Bar or Sequoyah. The socioeconomic impacts from tritium production at Watts Bar, described in Volume 1, Section 5.2.1.8 of the CLWR EIS, were determined based on the socioeconomic baseline conditions described for Rhea County in Section 4.2.1.8.

13.08 Several commentors express concern that DOE has not adequately determined whether minority and low-income populations living closest to the plants are experiencing disproportionate impacts and has not presented this information in the EIS. One commentor suggests that environmental impacts might be diluted by the usage of a 50-mile radius in the environmental justice analysis, when water and air contamination problems could be concentrated in areas of proximity to reactor sites.

Comments Summarized: 94-21, 137-10, 702-15

Response: DOE is committed to full compliance with all provisions of Executive Order 12898. The environmental justice analysis was prepared in compliance with the Council on Environmental Quality's guidelines for inclusion of environmental justice under NEPA. The CLWR EIS addresses the issue of whether implementation of the proposed action or alternatives would result in disproportionately high and adverse environmental effects on minority populations or low-income populations. The Council's guidance further states that an environmental effect must be significant to qualify as disproportionately high and adverse, where significant is defined by the Council's implementation regulations (see § 1508.27 and Volume 1, Appendix G, Section G.2 of this EIS). As discussed in Volume 1, Chapter 5 of the CLWR EIS, implementation of the alternatives for production of tritium in CLWRs would pose no significant radiological or nonradiological health risks to the public. The estimated incremental dose to an average individual from the production of tritium would be approximately one-ten-thousandth of the natural background radiation. The risks would not be significant regardless of the racial, ethnic, and economic composition of potentially affected populations.

As discussed in Volume 1, Chapter 5 and Appendix G of the CLWR EIS, implementation of the proposed action or alternatives would pose no significant risks to the entire population residing within 80 kilometers (50 miles) of candidate sites, or to maximally exposed individuals within 80 kilometers of the candidate sites. As shown in Figures G-1 through G-15 of Appendix G of the CLWR EIS, low-income populations reside throughout some of the potentially affected areas. However, implementation of the proposed action or alternatives would pose no significant risks to the potentially affected population regardless of the economic status of individuals that comprise the population.

Volume 1, Chapter 5 of the CLWR EIS describes radiological health impacts on the entire population residing within 50 miles of the candidate sites. Radiological health impacts are not diluted by selection of a 50-mile radius-of-effects zone, because the total population dose within the 50-mile distance is the sum of estimated doses received by each member of the potentially exposed population. For example, the total population dose described in Chapter 5 of the CLWR EIS is the sum of estimated doses to persons within 15 miles of the site added to the sum of estimated doses to persons at a distance larger than 15 miles, but no more than 50 miles from the site. The 50-mile radius-of-effects zone is used because potential impacts due to air and water contamination would not be limited to the area immediately surrounding the candidate sites, nor would potentially affected minority and low-income populations necessarily be concentrated near the sites. Consequently, the environmental justice analysis described in Volume 1, Appendix G of the CLWR EIS considers minority populations and low-income populations residing throughout the potentially affected area.

Figures in Appendix G have been revised and new figures added showing the location of minority and low-income populations residing within 10 miles of the candidate sites. In addition, for each of the 16 principal directions, a representative average individual dose at 5 miles and 25 miles has been overlaid onto the 10-mile and 50-mile radii, respectively, to show the potential dose to minority and low-income populations.

CATEGORY 14: OCCUPATIONAL & PUBLIC HEALTH & SAFETY - NORMAL CONDITIONS

14.01 The commentor recommends that historical exposures to workers in similar processes, with administrative controls in place, be reviewed and the risks then extrapolated and included in Table 5-30.

Comment Summarized: 146-13

Response: Volume 1, Table 5-39 (formerly Table 5-30) is mainly intended to address the impacts of airborne trace releases of hazardous chemicals to the public and workers. These chemical compound releases are derived exclusively from processes and operations considered to be point sources and, therefore, are emitted through exhaust stacks above the level where they would affect workers in the immediate vicinity of the emission source. The vast majority of the chemicals are released from the auxiliary boilers and emergency diesel generators when operated to provide heat and backup power. These processes do not operate continuously. The emergency diesel generators, for example, operate only when being tested during inactive periods to ensure reliability or demanded upon loss of normal electrical power. Additional language has been added to the text in Volume 1, Section 5.2.3.9.1 of the CLWR EIS to clarify the nature of the emissions and the risk they pose to workers.

14.02 The commentor reports that, according to the International Geological Society and the National Geology Group, it is improper to use a 50-mile radius around each of the TVA plants for impact analyses in this particular region. The commentor believes the maximum meteorological impact assumed in the CLWR EIS is understated. The commentor suggests shaping these areas more like an oblong than a circle to account for the narrow corridor in which the prevailing winds move.

Comment Summarized: 703-10

Response: Chapter 5 of the CLWR EIS describes the radiological health impacts on the entire population residing within a 50-mile radius of the candidate sites. Radiological health impacts are not diluted by selection of a 50-mile radius-of-effects because the total population dose within the 50-mile distance is the sum of estimated doses received by each member of the potentially exposed population. For example, the total population dose described in Volume 1, Chapter 5 of the EIS is the sum of the estimated doses to persons within 15 miles of the site added to the sum of estimated doses to persons at a distance larger than 15 miles, but no more than 50 miles, from the site. The 50-mile radius-of-effects is used because potential impacts due to air and water contamination would not be limited to the area immediately surrounding the candidate sites. The meteorological data used in the calculations are discussed in Volume 1, Appendix C, Section C.3.2 of the CLWR EIS.

The meteorological data used to analyze radiological impacts under normal operations at each of the sites are in the form of joint frequency distribution files from each site. These data are representative of the historical meteorological conditions at the specific plants. A joint frequency distribution is a table listing the fractions of time the wind blows in a certain direction, at a certain speed, and within a certain atmospheric stability class. Contributions to dose from other TVA plants along the Tennessee River Valley are considered in the doses to the general public shown in Volume 1, Tables 4-9, 4-21, and 4-37. These doses are used in the assessment of cumulative impacts in Volume 1, Section 5.3.2 of the CLWR EIS. The dose contribution from other nuclear plants along the Tennessee River to doses to the public in the vicinity of any one plant is a very small part of the overall dose.

DOE believes the 50-mile radius provides a valid basis for assessing CLWR impacts and for comparing alternatives considered in the CLWR EIS.

14.03 The commentor asks whether DOE's analyses of the impacts of tritium production on the affected environment are based on current prevailing winds. The commentor points out that, according to the National Weather Service, 90 percent of the prevailing winds in the local area come straight up from Alabama to the [Tennessee] state line and do not expand widely. The commentor states that the graphics in the CLWR EIS used to illustrate the area should be corrected because the lines run 50 miles in any one direction and do not reflect the national average for these valleys.

Comment Summarized: 703-8

Response: The meteorological data used to analyze the radiological impacts of normal operations at each of the sites are in the form of joint frequency distributions from each site. These data are representative of the historical meteorological conditions at the specific plants. These data are considered to be more representative of dispersion conditions at these sites than data taken from more remote meteorological stations operated by the National Oceanographic and Atmospheric Administration. A joint frequency distribution is a table listing the fractions of time the wind blows in a certain direction, at a certain speed, and within a certain atmospheric stability class. Contributions to dose from other TVA plants along the Tennessee River Valley are considered in the background doses to the general public shown in Volume 1, Tables 4-9, 4-21, and 4-37. These background doses are used in the assessment of cumulative impacts in Volume 1, Section 5.3 of the CLWR EIS. The dose contribution from other nuclear plants along the Tennessee River to doses to the public in the vicinity of any one plant is a very small part of the overall dose.

14.04 Several commentors express opposition to the proposed action because of concerns about safety, cancer incidence, health problems and other harmful effects on people, and environmental pollution to air and water. One of the commentors expresses opposition to both CLWR and accelerator production of tritium.

Comments Summarized: 11-2, 12-2, 13-1, 17-2, 30-1, 33-2, 39-1, 48-3, 51-2, 52-2, 53-4, 80-1, 84-2, 99-5, 100-1, 105-1, 106-1, 108-1, 109-3, 112-3, 113-2, 115-2, 116-26, 122-2, 132-1, 136-10, 138-2, 208-1, 212-6, 213-2, 241-2, 610-5, 712-2, 811-5, 815-4, 818-2

Response: The radiological releases to the environment that could result from the proposed action under normal operating conditions and various hypothetical accident scenarios are conservatively estimated in Volume 1, Chapter 5 of the CLWR EIS for each candidate reactor site. The potential impacts to the environment and the radiological doses and risks to the public from these releases are assessed and discussed in Chapter 5. The assumptions and methodology used for the assessment are described in detail in Volume 1, Appendix C and D of the CLWR EIS for normal operation and accident conditions, respectively. The methodology used is based on scientific standards accepted in the nuclear industry and dictated by Federal and state regulatory authorities. As discussed in Chapter 5 of the EIS, the environmental impacts and the potential radiological doses to the public are well within the limits considered acceptable by the regulatory authorities.

Before tritium is produced at any of the reactor sites considered in this EIS, the NRC will review all aspects of the design and operation of the plant(s) related to tritium production. The NRC will then issue a license amendment only upon finding that the operation is not expected to endanger the health and safety of the public. The commentor's additional opposition to the accelerator production of tritium is noted.

14.05 One commentor refers to tables and sections in the CLWR Draft EIS where tritium releases and resulting potential exposures with and without TPBARs are presented. The commentor suggests that the EIS highlight the fact that releases of tritium to the air and water at Watts Bar and Sequoyah, as well as radiological doses from normal operation and potential accidents, would be multiple times those of operation without TPBARs. The commentor suggests that this is not immediately apparent in the tables in the CLWR Draft EIS and is important in light of the fact that DOE, in previous meetings, assured the public that the TPBARs were virtually leakproof.

Comments Summarized: 94-25, 702-10, 825-2

Response: DOE maintains that the performance of the "getter" is such that there is virtually no tritium in the TPBARs available in a form that could permeate through the TPBAR cladding. In assessing the potential release of tritium, the CLWR EIS assumes that annually about 1 Curie of tritium could permeate through a TPBAR cladding and be released to the environment; and that two TPBARs fail in each core load of TPBARs and release their entire tritium inventory to the reactor coolant and then to the environment. As discussed in the CLWR Draft EIS, these assumptions are extremely conservative, but they were made to provide a bounding estimate for environmental and human health effect analyses. Because of the relatively low actual radioactive releases at both Watts Bar and Sequoyah reported in Chapter 4 of the CLWR Draft EIS, the ratio of the conservatively estimated releases and doses with tritium production to the actual releases and doses without tritium production tends to be exaggerated. Even with the conservative assumptions, the incremental tritium production doses estimated in the CLWR EIS are a small fraction of those resulting from natural background radiation.

It should be noted that the assumption of two TPBAR failures has been modified in the CLWR Final EIS. As discussed in Volume 1, Section 1.9 of the CLWR Final EIS, in light of Westinghouse data concerning the historic failure rate of standard burnable absorber rods, the CLWR Final EIS still evaluates the failure of the two TPBARs, but this event is now categorized as "abnormal" and not part of normal operations. Consequently many of the numbers referred by the commentor have been changed in the CLWR Final EIS.

14.06 One commentor who reviewed the CLWR Draft EIS on behalf of the U.S. Public Health Service, Department of Health and Human Services, concludes the risks to the public health from the operation, transportation, and accident scenarios expressed by the CLWR Draft EIS are low and reasonable expectations from the operation of CLWRs. The U.S. Department of the Interior and U.S. Fish and Wildlife Service also reviewed the CLWR Draft EIS and concludes that tritium production would not adversely impact Federally threatened and endangered species. The draft also was reviewed by the Tennessee Department of Environmental Compliance, which concludes that the proposed action does not compromise the health and safety of the citizens in Tennessee. The Tennessee State Historic Preservation Office comments that the proposed action will have no impact on the National Register of Historic Places listed or eligible properties.

Comments Summarized: 101-1, 126-1, 142-1, 145-1

Response: The reviews of the CLWR Draft EIS by the U.S. Department of Health and Human Services, U.S. Department of the Interior, the Tennessee Department of Environmental Compliance, and the Tennessee State Historic Preservation Office are appreciated, and the conclusions presented by the commentors are noted.

14.07 The commentor, referring to a statement made on page 25 of the Summary of the CLWR Draft EIS that Watts Bar radiation exposure within 50 miles is 0.55 person-rem per year, asks how the value was derived.

Comment Summarized: 22-1

Response: Volume 1, Table 5-4 (formerly Table 5-3) of the CLWR EIS, Section 5.2.1.9.1, provides the data presented in the CLWR EIS Summary. Note “a” in Table 5-4 has been revised to read that the 1997 measurements and the associated population dose estimates were adjusted for estimated changes in the population for the year 2025.

14.08 Although agreeing with the radiation exposures to the workers and the public estimated in the CLWR Draft EIS, the commentor notes that the CLWR Draft EIS does not adequately address the fact that the commercial reactor industry does not possess the infrastructure and experience to deal with the magnitude of tritium contamination and exposures. The commentor suggests that the cost for building this infrastructure for radiation protection be folded into the cost assessment for producing tritium in a CLWR.

Comment Summarized: 31-1

Response: The commercial reactor industry has the infrastructure and experience to handle the postulated incremental increase in radiation exposure to workers due to tritium production. Reactor coolant radioactivity levels including tritium are routinely monitored, and corrective actions are taken to reduce the activity levels when required. No additional monitoring or sampling points requirements in the reactor coolant system and plant effluent streams have been identified as a result of tritium production. With the exception of TPBAR handling, TPBAR storage, transportation cask handling, and transportation cask shipping procedures, no new procedures have been identified as a result of tritium production. The projected additional costs were considered by TVA and were incorporated into their proposal to DOE. In the unlikely event that high activity levels are attributable to tritium production upset conditions, existing procedures would be used to reduce the level of tritium contamination in the reactor coolant system.

14.09 The commentor opines that the potential impact on workers involved in fuel operations should be evaluated, since it is likely that air-supplied plastic suits may be needed for their protection due to increased tritium oxide levels in the air above the refueling water canal and fuel storage pool. Adequacy of air supply, the need for communication systems, and the potential for increased chance of error all need to be included in the evaluation. The commentor also states the CLWR Draft EIS does not mention the role of the refueling water storage tank in the holdup of tritium as a liquid waste. This applies to all of the reactor options. If not vented or disposed of, the tritium in this tank and (subsequently) in the refueling water can increase with each refueling and would require personnel to wear air-supplied plastic suits for protection during this operation. This would be an impediment in refueling operations.

Comment Summarized: 41-9

Response: As discussed in Volume 1, Chapter 5 of the CLWR EIS, the analyses estimating the dose to the public postulated that all tritium added to the reactor coolant system as a result of tritium production would be released to the environment during the operating cycle (10 percent via air pathways and 90 percent via water pathways). The analyses did not credit the holdup and buildup of tritium in the reactor coolant to reduce plant emissions. Worker dose was calculated based on the tritium concentration in the reactor coolant system resulting from conservative assumptions regarding tritium permeation/leakages from the TPBARs. These calculations concluded that the tritium concentration in neither the reactor coolant system nor the refueling/spent fuel pool would reach a limit requiring the use of special protective gear to perform activities in the refueling area. The tritium concentration in the reactor coolant system would be maintained at an acceptable limit through the use of a reactor coolant water treatment system that maintains the coolant activity levels within operational limits and allows a portion of the treated volume to be released to the environment via controlled water pathways. The refueling water storage tank was not considered for the holdup of tritium as a liquid waste. When the reactor is shut down, the water in this tank is used to fill the reactor cavity during the refueling operation. The tank is refilled with this water, which could contain some level of tritium contamination. The tank is vented to the atmosphere, but no detectable concentration of tritium escapes through this route. Therefore, there will be no impact on the workers.

14.10 The commentor, referring to Section 4.2.2.4 of the CLWR Draft EIS, states that a significant source of tritium release to the river can occur if the reactor continues to operate with primary to secondary leakage and the cooling tower is bypassed. Alternately, a significant increase of airborne tritium oxide would occur if the cooling tower were in full use. This is an important distinction that needs to be made when evaluating the radiation impact on persons both on and off site. The commentor suggests that a projected use pattern should be incorporated into projected dose calculations based on past meteorological data and the projected power level of the reactor. Projected estimates of tritium concentration should be made at each of the drinking water supply intakes downstream of the site, based on cooling tower use and the projected buildup of tritium in Chickamauga Lake during various net flows.

The commentor also points out that Table 4-21 lists the sources of background radiation exposure to individuals in the vicinity of the Sequoyah site. In reality, the table lists the average exposure to the U.S. population from these sources and not the actual "measured" levels at the site. The commentor suggests that this point be clarified to avoid being misleading.

The commentor further points out that there are eight municipal water supplies downstream from the Bellefonte site, and suggests that a similar analysis should be made of the projected tritium concentration at each intake based on cooling tower usage, river flow, dam holdup, and meteorological conditions, as suggested for the Sequoyah site.

Comment Summarized: 41-12

Response: Primary to secondary leakage will not result in a direct pathway to the river or the air via the cooling tower. There is a potential for a direct pathway to the air if there is a sudden major drop of turbine load and the secondary side safety valves or atmospheric dump valves are actuated. This off-normal mode of operation could release some of the steam generator steam to the atmosphere. This effect was taken into consideration when the EIS conservatively assumed that all tritium released to the reactor coolant by the TPBARs would be released to the environment during normal operation. The EIS took no credit for the holdup or retention of tritium in the reactor coolant during sequential reactor operating cycles to reduce the effects of radioactive effluents on workers and on the general public. In accordance with NRC guidance for effluent releases, 10 percent of the tritium was assumed to be released via air pathways and 90 percent via water pathways. The dose estimates were based on past meteorological data and the reactor operating at 100 percent power.

The projected estimates of the tritium concentration at downstream drinking water supply intakes have been included in the revised Volume 1, Sections 5.2.1.4, 5.2.2.4, and 5.2.3.4 of the CLWR Final EIS.

The data presented in Volume 1, Table 4-21 reflect the average exposure to the U.S. population from the sources indicated. Notes have been added to Volume 1, Tables 4-9, 4-21, and 4-37 of the CLWR Final EIS to provide clarification.

14.11 The commentor states that the definition of "measurable health effects" was not included in the CLWR Draft EIS.

Comment Summarized: 86-2

Response: The term was used at the public meetings by DOE to characterize the results included in Chapter 5. The term "measurable health effects" does not appear in the CLWR Draft EIS. A measurable health effect is assumed to be a statistically measured health impact (i.e., risk of cancer incidence) resulting from the proposed operations. This impact is the estimated quantity above the normally occurring cancer mortality rate of 0.2 percent from all causes.

14.12 The commentor, referring to the terminology used in the CLWR Draft EIS for "affected environment," asks whether the term refers to "current prevailing winds."

Comment Summarized: 86-8

Response: The term "affected environment area" refers to the area within an 80-kilometer (50-mile) radius centered at the Watts Bar, Sequoyah, and Bellefonte reactor sites. Current prevailing wind patterns were used to estimate the potential environmental impacts on the affected environment area. The meteorological data used in the calculations are discussed in Volume 1, Appendix C, Section C.3.2 of the CLWR EIS.

14.13 The commentor suggests that Tables 3-9 and 3-16 of the CLWR Draft EIS include a breakdown of the isotopes that comprise the "other radionuclides" entry and the unidentified unit of measure in Table 3-9.

Comment Summarized: 94-19

Response: The breakdown of the isotopes identified as "other radionuclides" in Tables 3-5 and 3-9 of the CLWR Draft EIS have been added in Volume 1, Appendix C of the CLWR Final EIS as new Tables C-9 and C-10. Curies have been added as the unit of measure in the revised Table 3-9.

14.14 The commentor, referring to the limiting concentration of tritium in drinking water (20,000 picocuries per liter) in Table 5-24 of the CLWR Draft EIS, requests information on the meaning of the limit.

Comment Summarized: 116-14

Response: The EPA drinking water regulation tritium limit of 20,000 picocuries per liter, issued on July 9, 1976, was derived on the basis that the annual dose equivalent to the total body or any internal organ shall not be greater than 4 millirem per year. The 4 millirem dose was estimated based on a total water intake of 3 liters per day—2 liters per day by fluid intake and the balance by food and food oxidation. The dose conversion factors used as the basis for the 20,000 picocuries per liter limit have been refined since the limit was issued. Using current methodology and dose conversion factors, the dose estimate is reduced by approximately a factor of four. Using the conservative methodology presented in Volume 1, Section C.2.1.2 of the CLWR EIS to estimate health effects on an individual receiving a 4-millirem dose per year, the individual was estimated to have a 2.0×10^{-6} increased likelihood of cancer fatality per year.

14.15 The commentor expresses the opinion that the production of tritium at the Sequoyah and/or Watts Bar and/or Bellefonte Nuclear Plants as described in the CLWR Draft EIS does not appear to create a significant risk to the environment or human health, provided the tritium production is at a level that allows efficient power production. Less efficient power production would result in additional spent nuclear fuel and associated environmental and transportation risks.

Comments Summarized: 126-2, 127-1

Response: The primary mission of the Watts Bar and Sequoyah Plants is the generation of electricity. Production of tritium at these facilities is a potential secondary mission and would be based on agreements between TVA and DOE; it would not degrade the ability of these facilities to generate electricity. If no more than 2,000 TPBARs are irradiated in a reactor, no additional spent fuel would be generated. The generated spent fuel would be stored on site. Volume 1, Sections 5.2.1.12, 5.2.2.12, and 5.2.3.12, discuss the spent nuclear fuel management at each site, and Section 5.2.6 discusses the environmental impacts from the construction and operation of a generic ISFSI should one be needed. If Bellefonte is completed, the primary mission for this facility will be tritium production and the secondary mission will be generation of electricity. Based on agreements between TVA and DOE, the nominal 18-month operating cycle can be reduced to meet tritium production requirements. The operating power level would not be altered for tritium production. As stated under the Preferred Alternative in Volume 1, Section 3.2.7 of the CLWR Final EIS, DOE and TVA would minimize, to the extent practicable, the generation of additional spent nuclear fuel.

14.16 The commentor, while agreeing that the doses from tritium releases would be within Federal guidelines, suggests that the presentation in the CLWR Draft EIS implies that the increase in the quantity of tritium released is not significant. The commentor refers to numbers and sections in the CLWR Draft EIS where tritium releases with and without tritium-producing rods are compared.

Comment Summarized: 128-2

Response: The additional release of tritium as a result of tritium production at each potential reactor site is presented in Volume 1, Chapter 5 of the CLWR Draft EIS under "Air Quality" and "Water Resources." The estimated releases were based on the assumptions that 1 Curie of tritium per TPBAR per year could permeate through the cladding during irradiation and that two TPBARs could fail and release the entire inventory of tritium into the reactor coolant and eventually to the environment. These assumptions are very conservative and were used to provide a bounding estimate for the environmental analyses. The CLWR Draft EIS provided an assessment of the significance of these releases by estimating the resulting health and safety effects to the public and workers. While the TPBARs are not expected to fail during reactor operation, a failure rate of two TPBARs per cycle was chosen in the CLWR Draft EIS for conservatism. However, as discussed in Volume 1, Section 1.9, the CLWR Final EIS has been changed to reflect recent Westinghouse data on the failure rate of burnable absorber rods, which have characteristics similar to TPBARs. The CLWR Final EIS still evaluates the failure of two TPBARs per cycle as an abnormal event and not normal operation. As a result, the numbers quoted by the commentor have been changed in the CLWR Final EIS.

14.17 The commentor, referring to Section 5.2.7 of the CLWR Draft EIS notes that the text states that the environmental impacts from increasing the enriched uranium use in the reactor "would be minimal." The commentor asks how this compares with the tritium in liquid/air releases. The commentor also asks DOE to quantify the statement.

Comment Summarized: 143-8

Response: The basis for estimating radioactive releases during normal operation and potential accident conditions is the generation of fission products in the core during the operation of the reactor. As stated in Volume 1, Appendix A, Section A.3.1, tritium production would require an increase in fuel enrichment to just under 5 percent from the approximately 4.2 to 4.5 percent used currently (less than the licensing limit of 5 percent). The somewhat higher enrichments and reduced fuel assembly burnups associated with the tritium production core, as compared to the conventional core designs, can influence the radiological source term used in the calculation of radiological emissions other than tritium during normal operation and accident conditions. The *Tritium Production Core Topical Report* (WEC 1998) quantified the effect and concluded that, overall, the fission product inventories were the same or lower in the tritium-producing core. Therefore, the analysis presented in the CLWR EIS, which does not account for the increased enrichment, is conservative.

Tritium releases from TPBARs to the air or the water are independent of the fuel enrichment used.

14.18 The commentor refers to Section 4.2.1.9 of the CLWR Draft EIS where it states that conservative assumptions are used for both individual and population exposure times. The commentor recommends these conservative assumptions be expressly discussed in the CLWR Final EIS.

Comment Summarized: 146-3

Response: The exposure-time assumptions presented in Volume 1, Section 4.2.1.9 are cited directly from the *Annual Radiological Environmental Operating Report*, *Watts Bar Nuclear Plant 1997*, (TVA 1998b). Exposure-time assumptions associated with the health impact analyses for the alternatives presented in the EIS, however, are discussed in Volume 1, Appendix C, Section C.3.2 of the CLWR EIS.

14.19 The commentor, referring to Table 5-46 of the CLWR Draft EIS, notes that the assumption of one-month refueling is optimistic and recommends that an average refueling outage duration be used.

Comment Summarized: 146-21

Response: The one-month refueling assumed in the CLWR EIS is based on TVA experience at Watts Bar and Sequoyah.

14.20 The commentor notes that the health risks and impacts analyses in the CLWR Draft EIS deal with tritium production only, and not the risks and impacts of the plant itself (without tritium production). The commentor asks to know the health risks and impacts resulting from both tritium and nuclear power production. The commentor is concerned that people already are affected by nuclear power production and an additional 1.1 percent, or about 1,500 people, would die of cancer as a result of the proposed action.

Comment Summarized: 600-3

Response: As stated in Volume 1, Section 3.2.1 of the CLWR EIS, for the currently operating reactors (Watts Bar 1 and Sequoyah 1 and 2), the EIS assesses the incremental environmental impacts of tritium production at the reactors. This information is presented in Volume 1, Sections 5.2.1 and 5.2.2. The CLWR EIS addresses the impacts from the existing operation of these reactors under the No Action alternative and reports the total sum of the impacts in Volume 1, Section 5.3 of the CLWR EIS under Cumulative Impacts. The environmental impacts from the proposed action at Bellefonte, discussed in Section 5.2.3, include the impacts from the completion and the operation of the plant as a tritium-producing plant.

With respect to the commentor's assertion that an additional 1.1 percent, or about 1,500 people, would die of cancer as a result of the proposed action, the commentor is referred to Volume 1, Appendix C, Section C.2.1.2, where the CLWR EIS presents examples of how health effect risk factors are used and how latent cancer fatalities are calculated. One of the examples explains the calculation of latent cancer fatalities among people exposed to the natural background radiation of 300 millirem per year over a lifetime of 72 years. The proposed action will not result in the death of 1,500 people, and the resulting 1.1 percent risk is clearly not a risk resulting from the proposed action.

14.21 The commentor asks if his chances of winning the Georgia Lottery without buying a ticket are better than his chances of dying from radiation released by a tritium-producing Bellefonte Nuclear Plant.

Comment Summarized: 601-1

Response: The commentor's chances of receiving a fatal exposure to radiation produced by a completed, tritium-producing Bellefonte Nuclear Plant are equal to 1.6 x 10^{-7} per year or less than one in 6 million years (see Table 5-34 of the CLWR EIS). The commentor's chances of winning the Georgia lottery without buying a ticket are zero. The likelihood would be much higher that the commentor would die from causes other than radiation exposures resulting from tritium releases during Bellefonte operation. For example, an individual's chances of dying from cancer caused by natural background radiation (which is independent of the Bellefonte operation) over a 72-year lifetime are about 1.1 percent, or about 1,000 times more than that caused by Bellefonte operation.

14.22 The commentor states that the radiation exposure for residents of Jackson County, including background radiation and radiation from the Bellefonte reactor operations, would be 355.26 millirem per year, a lower dose than the average for U.S. citizens overall, which is 363 millirem per year.

Comment Summarized: 627-4

Response: As stated in the revised Volume 1, Appendix C, Section C.2.1.1 of the CLWR EIS, the average American receives a total of approximately 364 millirem per year from all sources of radiation, of which approximately 300 millirem is from natural background radiation and the rest from manmade sources. The commentor's statement is correct, but it should be noted that the background dose numbers are approximate and that the uncertainty associated with the approximation could be much larger than the 0.28 millirem per year contribution estimated in Volume 1, Section 5.2.3.9.1 of the CLWR EIS.

14.23 The commentor thinks the DOE presentation failed to sufficiently emphasize the high radioactivity of tritium.

Comment Summarized: 704-3

Response: Throughout the CLWR EIS, the health effects of tritium production on workers and members of the public have been analyzed. The analyses considered normal incident-free operation, plant upset events (i.e., abnormal occurrences), and a spectrum of accident scenarios. Tritium exists in the environment in two forms, elemental tritium and oxidized tritium. Of the two forms of tritium, oxidized tritium has a much more significant potential impact on human health. All analyses of tritium releases assumed that the tritium released would be in oxide form. In addition, Volume 1, Appendix C, Section C.2.2 of the CLWR EIS, summarizes the characteristics and biological properties of tritium. The CLWR EIS clearly identifies the impact of radiological releases due to tritium production on workers, the public, and the environment.

14.24 The commentor believes the cancer fatalities listed under environmental impacts in the EIS are exceedingly low and inaccurate, if recent newspaper stories are true.

Comment Summarized: 707-17

Response: The cancer fatality estimates presented in the CLWR EIS were made using accepted methods and data for estimating health impacts and industry-approved methodology, data bases, and computer analysis codes. Analysis results presented in this EIS have been reviewed for technical adequacy and accuracy. DOE cannot comment on the technical adequacy and accuracy of information published in newspapers.

14.25 A commentor expresses concern that low levels of tritium have been found in soil and water, and that DOE has said there is no easy way to treat it. The commentor further feels that DOE's position that a single dose or short-term exposure is not hazardous leads people to believe tritium is not dangerous. The commentor provides several examples of health effects from exposure to unspecified materials, and concludes that TVA and DOE are bringing nuclear thalidomide to the community.

Comments Summarized: 241-3, 811-6

Response: The environmental and biological behavior of tritium, as well as its health effects, are well understood and were the basis of the impact analyses presented in this EIS. The CLWR EIS provides a detailed analysis of the potential health effects from tritium production in Volume 1, Chapter 5 of the CLWR EIS. Conservative assumptions were used in those analyses as indicated in Volume 1, Appendix C of the CLWR EIS. In determining health effects, DOE treats all doses as having potentially adverse affects. The research studies indicated by the commentor do not concur with the results described in this EIS. Appendix C also includes studies on the health impacts of exposure to tritium.

CATEGORY 15: OCCUPATIONAL & PUBLIC HEALTH & SAFETY--ACCIDENT CONDITIONS

15.01 The commentor states that insurance companies do not cover any losses resulting from any type of nuclear power plant accident and asks if TVA and DOE would provide 100 percent of the cost of replacement for any losses suffered by the residents of Jackson County that are related to tritium production. The commentor suggests that, if the people of Jackson County are going to have tritium production at Bellefonte, maybe 100 percent coverage should be part of the plan—because they would be taking a risk in addition to receiving some advantages. The commentor asks for the name of an expert on Price-Anderson coverage.

Comments Summarized: 86-12, 623-3, 703-12

Response: The Price Anderson Act requires TVA, like all other owners of nuclear plants in the United States, to carry nuclear liability insurance. This insurance provides coverage for personal injury or property damage as a result of a nuclear accident. Under the current Price Anderson Act there would be over $9.5 billion available to pay claims. In *Resources Available for Nuclear Power Plant Emergencies Under the Price-Anderson Act and the Robert T. Stafford Disaster Relief and Emergency Assistance Act* (NUREG 1457) (NRC 1992), some examples of the type of assistance that is available under the Price Anderson Act are provided. NUREG 1457 states, for property that is deemed uninhabitable as a result of a nuclear accident, the insurer will reimburse for present real estate value, based on a pre-accident assessment. Information on the Price-Anderson Act may be obtained at: American Nuclear Insurers, Town Center, Suite 300S, 29 South Main Street, West Hartford, Connecticut, 06107-2430.

15.02 The commentor expresses opposition to use of the unfinished Bellefonte plant or any other commercial nuclear reactor for the production of tritium. The commentor regards this as a dangerous and highly undesirable course of action for several reasons. These include the effects of tritium on the human body and its DNA, DOE's history of tritium-releasing accidents at its other production facilities, the implication for accidental tritium releases from Bellefonte, and the effects of the resulting radioactive contamination of the Tennessee River water supply. The commentor suggests that such accidents are more likely to occur at a facility that is not designed for tritium production.

Comment Summarized: 25-1

Response: The commentor's opposition to the use of Bellefonte for tritium production is noted. The CLWR EIS analyzes the potential water quality impacts associated with the operation of Bellefonte 1 or Bellefonte 1 and 2 for tritium production. In analyzing the impacts to the health and safety of the public, the EIS takes into consideration the radiological and biological characteristics of tritium as discussed in Appendix C, Section C.2.2 of the CLWR EIS. The results of these analyses are presented in Volume 1, Sections 5.2.3.4 and 5.2.3.9. TVA, which would be the licensed operator of the Bellefonte Nuclear Plant, possesses a permit from the NRC to construct two nuclear power generation units at the Bellefonte site. As part of the construction permit approval process, the NRC reviewed the design of the two units and the projected chemical and radiological releases to the environment during normal operation, postulated operational upset events, and accidents. Operation of nuclear power generation units at the Bellefonte site and associated operational and accidental releases would be within the limits established by the NRC as the licensing basis for the safe operation of the Bellefonte Nuclear Plant. DOE has made environment, safety, and health considerations paramount in all operations at DOE sites through the use of internal and external regulations, appropriate controls in contracts, and day-to-day management and oversight of nuclear operations. DOE is confident that TVA is capable of safely operating the Bellefonte reactors. Although the Bellefonte reactors were not designed specifically to produce tritium, they can easily accommodate TPBARs. There is a very small increase in reactor accident consequences due to the irradiation of TPBARs at Bellefonte, as discussed in Volume 1, Section 5.2.3.9.2.

15.03 Several commentors oppose the implementation of the proposed action because of concerns about potential accidents. One commentor asserts that, since all of the DOE's former tritium production plants have had accidents resulting in leaks into the environment, there is no doubt that commercial reactors inherently unsuited for weapons production will leak and destroy the Tennessee River, the Tennessee Valley, and peoples' lives. The commentor also asserts that tritium can cause cancers, genetic mutations, and problems in unborn babies, and that there is no safe dose. Other commentors state that accidents would undoubtedly occur that could ruin the state, or that a chance of an accident occurring would be too risky considering the magnitude of a nuclear disaster.

Comments Summarized: 13-2, 80-3, 138-1, 252-2

Response: As discussed in Volume 1, Chapter 5 of the CLWR EIS, the environmental impacts and potential doses to the public from the proposed action are well within the standards adopted by the regulatory authorities. Sections 5.2.1.9.2, 5.2.2.9.2, and 5.2.3.9.2 of the CLWR EIS provide the results of the analyses of the incremental risk resulting from hypothetical accident scenarios during tritium production at CLWRs. These analyses are performed using generally accepted methods for design-basis and beyond design-basis accident analyses in support of the reactor operations promulgated by the NRC. The analyses used special models for the evaluation of consequences of accidental releases of tritium (tritiated water vapor) to the environment. Volume 1, Appendix C, Section C.2.2 of the CLWR EIS summarizes the characteristics and biological health effects of tritium. This appendix also provides the health effect standards used to estimate the potential lifetime cancer mortalities resulting from exposure to tritium and other radioactive materials. These health effects were calculated using a linear extrapolation from the nominal risk estimated for lifetime total cancer mortality at a dose of 10 rad to a very low dose level (i.e., zero dose). The impacts from the application of this model are considered to be an upper bound estimate. There is scientific uncertainty about the cancer risk in the low dose region below the range of epidemiological observation, and the possibility of no risk, or even a health benefit, cannot be excluded. The low dose region is defined as a dose level (~0.01 rad) where DNA repair can occur in a short period (a few hours) after irradiation-induced damage.

As explained in Volume 1, Section 3.1.1 of the CLWR EIS, CLWRs are well suited to produce tritium because they require no elaborate and complex engineering and test programs. This conclusion is based on numerous studies, analyses, and tests performed as part of new production reactor efforts in the early 1990s. The results of the EIS accident analyses indicate that only very small impacts would occur for any of the credible accident scenarios for tritium production in a CLWR.

15.04 The commentor expresses the opinion that a new safety analysis will have to be performed to consider the potential increased internal pressure in the reactor vessel during a melt-down that could result from partial fusion of the large quantities of tritium in a degraded core with uncontrolled recriticality. Temperature data from the Three Mile Island accident should be used in the analysis.

The commentor further asserts that, although beyond design-basis accidents were analyzed, the analysis was done using the MACCS2 accident analysis computer code (SNL 1997) for a standard pressurized water reactor core. However, if a significant increase in energy can be released in the reactor vessel due to fusion of tritium gas in the core during a meltdown accompanied with uncontrolled recriticality, the code would not be useful for assessment of accident conditions. The commentor suggests that Table 5-49 in the CLWR Draft EIS also should list under the beyond design-basis accident an evaluation of energy release from possible fusion of tritium in the core, using the Three Mile Island temperature data in the event of a recriticality of the degraded core.

Comment Summarized: 41-3

Response: Analyses of tritium production reactors have shown that only reactor cores with an enrichment greater than 7.5 percent uranium-235 have the potential for uncontrolled recriticality during severe core melt accidents. Since all CLWRs operate with a core enrichment of less than 5 percent, recriticality is not an issue during core melt accident sequences. In addition, the temperature distribution following a severe core melt accident is insufficient to promote any fusion reaction involving tritium or lithium. A fusion reaction requires a "confinement medium" corresponding to temperatures on the orders of tens of millions of degrees, which is not possible in a reactor accident. The analyses presented in the CLWR EIS correctly reflect the conditions expected in a severe core damage accident, and no change to Table 5-58 (formerly Table 5-49) is needed. Revised Volume 1, Appendix D, Section D.1.1.10 of the CLWR Final EIS states that the core enrichments in the CLWRs preclude any potential for uncontrolled recriticality after a severe core melt accident.

15.05 The commentor asserts that Section S.3.1.1 of the Summary of the CLWR Draft EIS, under Accident Conditions, should spell out that a reanalysis of the design-basis accident conditions would be needed because of reactivity changes to the core and no mention is made of the use of boron as a chemical shim early in core life and its relationship with the TPBARs, nor of the increased reactivity needed, if any, to accomplish the project. The commentor further asserts that a potential impact not mentioned is the effect of different metals such as zircaloy on corrosion interaction with parts of the core and on other primary systems.

Comment Summarized: 41-8

Response: DOE has produced a technical report documenting the design and analysis of a maximum tritium production core using a reference Westinghouse reactor similar to the Watts Bar 1 reactor titled, *Tritium Production Core Topical Report*, (WEC 1998). This report, which is currently being reviewed by the NRC, contains the evaluations of various design-basis accident scenarios performed in the plant safety analysis report. The report has concluded that the insertion of TPBARs would not change the progression of the design basis accidents previously analyzed. Prior to operating the reactor, the NRC will approve the analyses of specific tritium production reactor core configurations. NRC license holders must submit core reload analyses and demonstrate that core performance for a new core configuration, including tritium production cores, are within the licensing basis performance envelope for the plant.

As stated in Volume 1, Appendix A, Section A.3.2 of the CLWR EIS, the normal burnable absorber rods are clad with either type-304 stainless steel or zircaloy-4. The TPBAR cladding and end plugs are manufactured from 20 percent cold-worked type-316 stainless steel. The introduction of TPBAR type-316 stainless steel cladding into the reactor core will not introduce any new and unanalyzed corrosion condition with parts of the core and other primary systems. In September 1997, 32 TPBARs were inserted into the reactor core at Watts Bar 1 as part of a confirmatory demonstration program. To date, the TPBARs and their type-316 stainless steel cladding are performing as designed.

15.06 The commentor, referring to Appendix A, page A-18 of the CLWR Draft EIS, states that the last paragraph indicates that more new fuel assemblies may have to be loaded into the core during each refueling and that the enrichment of these assemblies may need to be increased. The commentor suggests that analysis be included on flux density, the interaction of chemical shim control on this density over time, and the total impact of this added reactivity on control systems. The commentor further suggests that a safety analysis is needed to determine the increased risk to personnel as a result of an out-of-core criticality incident and the steps taken to prevent one from occurring.

Comment Summarized: 41-13

Response: As indicated in Volume 1, Appendix A, Section A.3.1 of the CLWR EIS, the maximum enrichment for CLWR fuel is limited by the NRC to 5 percent. The *Tritium Production Core Topical Report,* NPD-98-181 (WEC 1998), submitted to the NRC for review in July 1998, evaluated the flux density of a reference tritium production core over time and concluded that no changes to reactivity control systems are required due to the introduction of TPBARs into the core with fuel assembly enrichment approaching 5 percent. In addition, each license holder must submit core reload analyses to the NRC prior to refueling and demonstrate that core performance for a new core configuration, including tritium production cores, is within the licensing basis performance envelope for the plant. Since all CLWRs are currently licensed to handle fuel assemblies with enrichments up to 5 percent, there is no increased risk to personnel as a result of an out-of-core criticality incident. Existing approved plant operating procedures are adequate to handle reactor fuel enriched up to 5 percent and ensure the safety of operating personnel.

15.07 One commentor asserts that the evaluation of human health effects from facility accidents (Appendix D of the CLWR Draft EIS) is not adequate, with three deficiencies:

1. The basis for estimating that 10 percent of the tritium released from the melted targets will be in the oxide form within the containment atmosphere is not documented (Table D-1). In some past safety analysis reports, DOE has assumed that 100 percent of released tritium is in the oxide form and is available for release to the environment. The commentor requests an explanation for the basis of and revision of the analysis.

2. Elemental tritium may be available in the containment atmosphere and released to the environment. The EIS analysis needs to quantify the estimated release of elemental tritium and the resultant safety and environmental effects.

3. The analysis does not address the disposition of tritium remaining in the reactor facility after the first 30 days (Table D-2). Since tritium is very mobile and cannot be easily removed from contaminated coolant water, how much additional tritium will be released to the environment, and with what effects? Also, what are the long-term disposition mechanism and associated environmental impacts for tritium that remain within the containment structure? The CLWR Draft EIS needs to be corrected to address the environmental impacts associated with the disposition of all tritium released in a design-basis accident.

Comment Summarized: 45-6, 503-9

Response:

1. Volume 1, Appendix D, Section D.1.1.2 of the CLWR EIS discusses the reasons for the reduction of tritium water vapor in the containment after a large-break loss-of-coolant accident. It states that the reduction in the amount of tritium available for release would result from post-accident processing and cooling of the containment atmosphere, operation of the hydrogen recombiners, and the absorption of elemental and oxidized tritium by water in the containment. This assumption is consistent with previous DOE analysis performed in support of the *Light Water Reactor (WNP-1) Plant Description-New Production Reactor* (New Production Reactor EIS), documented in a Westinghouse report (WHC 1991).

As a result of these removal processes, the analysis assumes that only 10 percent of the tritium released to the containment would be in the form of tritiated water vapor and would be available for release over a 30-day period following an accident. Tritium and tritiated water vapor would be released to the atmosphere through containment leak paths only. Potential leak pathways from containment are discussed in Volume 1, Appendix D, Section D.1.2.5.2 of the CLWR EIS.

2. The analysis assumed that all tritium released from the containment to the environment was in oxide form. This assumption is very conservative because the dose conversion factors for tritium in oxide form are much greater (by a factor of 10,000) than for elemental tritium gas. As stated in Volume 1, Appendix C, Section C.2.2.2, the total effective dose from a tritium gas exposure is about 10,000 times less than the total effective dose from an equal exposure to airborne tritium oxide.

3. As stated in Volume 1, Appendix D, Section D.1.1.2 of the CLWR EIS, the analysis assumed that, after 30 days, all of the tritiated water vapor in the containment atmosphere would be condensed and would not be available for further release. As part of the post-accident cleanup and restoration activities, the contaminated water remaining in the containment would be treated to remove radioactive fission products and the treated water would be tanked and stored on site to allow the tritium to decay as appropriate before it is recycled and released to the environment via controlled pathways.

15.08 The commentor asserts that it is irresponsible to state that an explosion of the Bellefonte facility is outside of the scope of this EIS. The commentor adds that the Chernobyl Plant accident is a mere decade behind us and that residents around such facilities need to be informed of the results of such an explosion.

Comment Summarized: 116-25

Response: The CLWR EIS was searched for all references to the word "explosion" to identify what postulated explosion the commentor was referencing. Two references to "explosion" were identified:

1. Volume 1, Appendix F addressed issues raised during the Public Scoping Process. One of the issues raised was the possible explosion of a nuclear warhead. DOE's position on this issue has not changed. Appendix F of the CLWR EIS states, "The environmental impacts associated with a possible explosion of a nuclear warhead are speculative and beyond the scope of the CLWR EIS."

2. Volume 1, Section 5.2.10, Safeguards and Security, addresses design-basis threats from a dedicated adversary group with suitable weapons and explosives. The section describes the provisions of the DOE Safeguards and Protection Program. Section 5.2.10 of the CLWR EIS states, "Accidents initiated as a result of sabotage are considered speculative and, accordingly, have not been addressed in the CLWR EIS." DOE has not changed their position on this issue. However, it should be noted that the EIS did evaluate the consequences of severe reactor accidents (i.e., core-disruptive accidents with containment bypass or breach of containment). The consequence of any act of sabotage, including an explosion, is bounded by the analysis of severe reactor accidents. The commentor references the Chernobyl accident and infers that it was an explosion. The accident at Chernobyl is classified as a severe reactor accident, not an explosion. As stated above, this EIS did evaluate severe reactor accidents. The Chernobyl reactor design differs markedly from the reactors proposed for tritium production. The Chernobyl initiating events, accident sequences, and resulting consequences could not occur at U.S. NRC-licensed reactors.

15.09 The commentor refers to Section 5.2.1.9.2 of the CLWR Draft EIS under Radiological Impacts where it states that the assessment of dose and associated cancer risk to the noninvolved worker is not applicable for beyond design-basis accidents. The commentor believes that the rationale given following this statement is of dubious validity and explains that the assumption of a slow-moving accident is not a general case; many scenarios of fast-moving, beyond design-basis accidents exist. The commentor further refers to a statement made that the public within 10 miles would have been evacuated. The commentor remarks that this evacuation would not occur immediately and most likely would take hours to accomplish. The commentor recommends that the dose and associated cancer risk be evaluated for the noninvolved worker.

Comment Summarized: 146-10

Response: The severe accidents evaluated include containment failure and bypass scenarios, which lead to releases. Each scenario has a warning time and a release time. The warning time is the time at which notification is given to offsite emergency response officials to initiate protective measures for the surrounding population. The release time is the time when the release to the environment begins. At Sequoyah and Watts Bar, the minimum time between the warning time and the release time is two hours. At Bellefonte, the minimum time is one hour. The minimum time of one hour is more than enough time to evacuate onsite personnel. This also conservatively assumes that an onsite emergency has not been declared prior to initiating an offsite notification. Releases from these scenarios take place on an even longer time frame. Therefore, the assumption that consequences to the noninvolved worker need not be considered for beyond design-basis accidents is justified. Volume 1, Sections 5.2.1.9.2, 5.2.2.9.2, and 5.2.3.9.2 of the CLWR EIS have been revised for clarity. The offsite population within the 10-mile Emergency Planning Zone is not evacuated prior to release. The offsite evacuation is initiated at the warning time, as mentioned above. There is a delay time for notification and then a significant time for evacuation, usually on the order of a few hours.

15.10 The commentor remarks that, while Table 5-6 of the CLWR Draft EIS presents risk increments associated with various accidents, the paragraph following this table describes these numbers as the actual risk. The commentor suggests that the terminology between narratives and tables be made consistent.

Comment Summarized: 146-11

Response: Volume 1, Sections 5.2.1.9.2 and 5.2.2.9.2 of the CLWR EIS have been revised to address the commentor's concern.

15.11 The commentor refers to Table 5-32 of the CLWR Draft EIS where the assumption of mean (50 percent) meteorological conditions for the maximally exposed offsite individual is made. The commentor recommends that the worst case credible meteorological conditions be used to bound the risks.

Comment Summarized: 146-14

Response: As stated in Volume 1, Appendix D, Section D. 1.2.4 of the CLWR EIS, the impact analyses were performed in accordance with guidance provided in NRC Regulatory Guide 4.2. This guide recommends using an atmospheric diffusion value (X/Q) corresponding to one tenth of the value determined in Safety Guide No. 4. This safety guide has been revised and reissued as Revision 2, Regulatory Guide 1.4. In 1983, the NRC issued Regulatory Guide 1.145, providing guidance in determining 95th percentile X/Q values using a site meteorological direction-dependent approach. In this analysis, DOE assumes the 95th percentile direction-dependent X/Q values to be consistent with the guidance provided in Safety Guide 4 and Regulatory Guide 1.4. The GENII computer code, which is based on the NRC's current acceptable direction-dependent approach, was used to determine the 50th and 95th percentile meteorological conditions at each site. The results indicated that the estimated doses using 50th percentile meteorological conditions were more than one tenth times the 95th percentile meteorological doses. Therefore, the 50th percentile meteorological condition at each site was used to estimate the consequences.

CATEGORY 16: WASTE MANAGEMENT

16.01 The commentor notes that there likely will be an increase in the generation of low-level radioactive waste which must be stored somewhere and asks about plans to store this waste on site.

Comment Summarized: 116-27, 800-3

Response: As discussed in Volume 1, Sections 5.2.1.11, 5.2.2.11, and 5.2.3.11 of the CLWR EIS, tritium production would increase low-level radioactive waste by 0.1 percent. Low-level radioactive waste would not be stored on site, but would be transported and managed at the low-level radioactive waste facility at Barnwell, South Carolina, or the Savannah River Site. The 40-year production of tritium at CLWRs would produce a total amount of low-level radioactive waste that would fill 0.06 percent of the capacity of one of a series of existing vaults at the Savannah River Low-Level Radioactive Waste Disposal Facility, which has been operational since 1994.

16.02 The commentor remarks that DOE's assertion that waste will be produced and that the waste may be stored on site or in a Federal storage facility does not satisfy the requirements of NEPA.

Comment Summarized: 116-3

Response: The CLWR EIS has been prepared in accordance with the Council on Environmental Quality regulations (40 CFR 1500-1508) and DOE's NEPA regulations (10 CFR 1021) and procedures. To the extent that potential environmental impacts associated with waste management could be identified for the alternatives analyzed, they are included in the CLWR EIS. DOE believes that it has complied with requirements of NEPA for actions analyzed in this EIS including, as applicable, NEPA documentation at disposal sites. This analysis includes the direct, indirect, and cumulative environmental consequences of the production of tritium in three operating CLWRs and the completion and operation of two partially completed commercial reactors.

With respect to the waste produced, the EIS addresses low-level radioactive waste in Volume 1, Sections 5.2.1.11, 5.2.2.11, and 5.2.3.11; it also addresses spent nuclear fuel management in Sections 5.2.1.12, 5.2.2.12, and 5.2.3.12. The CLWR EIS states that additional low-level waste associated with tritium production would be transported and managed at either the Barnwell, South Carolina or the Savannah River Site. Both options are possible and in accordance with the Council on Environmental Quality regulations; both options are evaluated in the CLWR EIS. The CLWR also states that any additional spent nuclear fuel would be stored on site in a dry cask ISFSI facility until a national repository is available. In accordance with the Council on Environmental Quality regulations, the impacts from a generic dry cask ISFSI facility are evaluated in Section 5.2.6 of the CLWR EIS. NEPA documentation would be prepared if and when it becomes necessary to construct a dry cask ISFSI facility at each of the proposed sites.

16.03 The commentor is concerned with onsite leakage of radioactive and other toxic waste.

Comment Summarized: 136-2

Response: As discussed in Volume 1, Chapter 5 of the CLWR Draft EIS, there would be no onsite accidental leakage of radioactive and other toxic waste during normal operations. However, the EIS assumes conservatively that some liquid and gaseous radioactive material could be released. The CLWR EIS addresses the impacts of normal operation releases in Sections 5.2.1.9.1, 5.2.2.9.1, and 5.2.3.9.1. The CLWR EIS addresses the impacts of releases during accident conditions in Sections 5.2.1.9.2, 5.2.2.9.2, and 5.2.3.9.2.

16.04 Commentors oppose tritium production in general and Bellefonte in particular because of concerns about waste removal capabilities from TVA facilities.

Comments Summarized: 50-1, 84-3, 712-3

Response: Currently operating nuclear power plants effectively manage all radioactive waste without any impact to public health and safety. Significant reductions in the quantity and volume of radioactive waste have been achieved during the past 10 years. Low-level radioactive waste is currently subject to volume reduction by compaction and incineration and then shipment to one of several available low-level waste disposal sites in the United States. The Bellefonte plant represents one of the CLWR options for producing tritium (the other options are use of the Watts Bar and/or Sequoyah Nuclear Plants), but the Bellefonte plant, if selected, would also produce electric power for the TVA system.

16.05 The commentor expresses opposition to the proposed action because it would produce at least 50 percent more low-level waste, and disposal of nuclear waste is already a serious problem that this proposal can only exacerbate.

Comment Summarized: 25-3

Response: Volume 1, Sections 5.2.1.11, 5.2.2.11, and 5.2.3.11 of the CLWR EIS state that the additional low-level waste generated due to tritium production at the CLWRs would constitute approximately 0.1 percent of the low-level waste currently being generated at the operating nuclear power plants, or 0.1 percent of the electric power production-associated low-level waste that would be generated at the Bellefonte plant. This small additional low-level waste would be transported to the low-level radioactive waste disposal facility at the Savannah River Site or the low-level radioactive waste facility at Barnwell, South Carolina, where the low-level radioactive waste of the reactor facilities is normally transported and disposed. The 40-year total low-level radioactive waste generated from tritium production represents 0.06 percent of the capacity of one vault at the facility at the Savannah River Site, which contains a series of vaults for low-level radioactive waste storage. The amount of additional low-level radioactive waste produced at a CLWR due to tritium production is a very small fraction (0.1 percent) of that already produced. United States CLWRs have been successfully reducing the activity, amount, and volume of low-level waste they produce by using advances in technology and improving operational and maintenance procedures. Further reductions in low-level radioactive waste production are expected to be far greater than the small increase due to tritium production. CLWRs send low-level radioactive waste to operating licensed low-level waste disposal facilities.

CATEGORY 17: SPENT NUCLEAR FUEL MANAGEMENT

17.01 The commentor states that the generation of additional spent fuel waste and removal and shipment of TPBARs is not the "normal" operation of a CLWR. DOE must be forthright about the changes in normal operations required to produce tritium.

Comment Summarized: 94-12

Response: The impacts of tritium production on reactor operations are discussed qualitatively in Section 3.1.3 of the CLWR EIS. As indicated in this section, tritium could be produced with only a few impacts on the normal operation of the reactor. The terminology used ("normal operation") reflects that a CLWR can continue to operate and produce electricity with no disruption. The environmental impacts resulting from these operations and differences are evaluated and presented in detail in Volume 1, Chapter 5.

17.02 The commentor expresses opposition to the proposed action because production of tritium at a commercial nuclear plant will produce much more nuclear waste—three times more high-level waste than the plant would produce under normal operating conditions by DOE's own estimate.

Comment Summarized: 25-2

Response: Volume 1, Sections 5.2.1.12, 5.2.2.12, and 5.2.3.12 of the CLWR EIS address spent nuclear fuel management at each of the sites and present the fact that up to 2,000 TPBARs can be irradiated in the reactor core of each CLWR without generating any additional spent nuclear fuel. In implementing the proposed action, DOE and TVA would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel. The CLWR EIS addresses the impacts of additional spent nuclear fuel generation in Section 5.2.6.

17.03 The commentor expresses concern about the storage of spent fuel. If the Nuclear Waste Policy Act of 1982 mandates that spent fuel will be managed at a national repository, then DOE needs to expedite and assist in resolving the siting issues and not create additional onsite spent fuel storage facilities. The commentor further recommends that the last major planning assumption of paragraph S.3.2.1 on page 17 of the CLWR Draft EIS Summary be revised to state that spent fuel rods resulting from the tritium project will be stored at an existing spent fuel storage facility until the national repository becomes operational in accordance with the Nuclear Waste Policy Act of 1982.

Comments Summarized: 58-4, 610-4

Response: DOE is committed to the development of a licensed national spent nuclear fuel waste repository. This commitment is being actively pursued by DOE. Siting and development of a repository is ongoing, and the location and opening date for a suitable repository has not been determined. The last major assumption in Section S.3.2.1 of the CLWR EIS Summary correctly states that additional spent nuclear fuel would be generated if more than 2,000 TPBARs were irradiated in a fuel cycle. In implementing the proposed action, DOE and TVA would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel. The assumption on Summary page 17 of the CLWR Draft EIS correctly states that, for the purposes of calculating conservative and bounding environmental impacts, the maximum possible additional spent nuclear fuel generated due to irradiating 3,400 TPBARs in each fuel cycle is assumed. The environmental impacts of a dry cask ISFSI designed specifically for this conservatively assumed amount of additional spent nuclear fuel are presented in the CLWR EIS as a bounding case. The CLWR EIS conservatively assumes that dry spent fuel storage will be required without the availability of a national repository during the tritium production time frame. This assumption bounds the environmental impact of spent fuel storage since the availability of a national repository would result in a smaller environmental impact than that presented in the CLWR EIS.

17.04 The commentor, referring to Section 3.2.1 of the CLWR Draft EIS regarding the explanation (according to the commentor) that DOE essentially is deferring questions about the management/storage of spent fuel, remarks that, since Watts Bar does not have fuel storage capacity for the time period under consideration in this proposed action (40 years), issues of spent fuel storage and management cannot be finessed, but must be discussed in detail, specific to each reactor under consideration.

Comment Summarized: 94-18

Response: The CLWR EIS specifically addresses the most conservative scenario with regard to spent nuclear fuel storage at Watts Bar (and all the CLWRs being considered for tritium production). This scenario assumes that no spent nuclear fuel national waste repository will be available for the entire 40-year tritium production time frame, so additional dry cask spent nuclear fuel storage would be required. Volume 1, Sections 4.2.1.11, 4.2.2.11, and 4.2.3.11 of the CLWR EIS, in conjunction with the projected spent nuclear fuel generation numbers in Chapter 5, also show that the spent nuclear fuel pool storage capacity of each nuclear power plant would not be adequate for the amount of spent nuclear fuel discharged during the entire licensed electric power production time period without any consideration of tritium production. Therefore, each considered CLWR would need to provide additional spent nuclear fuel storage capacity even if it is not used for tritium production.

17.05 The commentor refers to Section 4.2.3.11, where the CLWR Draft EIS describes storage capacity at Bellefonte and says that each unit has a storage pool which has the capacity to hold 1,058 spent fuel assemblies. The commentor asks whether the pool can or cannot accommodate 3,400 TPBARs every 18 months for 40 years.

Comment Summarized: 94-22

Response: The 3,400 TPBARs would be inserted into all 141 fuel assemblies in the Bellefonte reactor core. When the fuel is discharged to the storage pool, the TPBARs would only remain in the pool for a period of one to two months before being consolidated and loaded into transportation casks for shipment to the Savannah River Site. Therefore, the Bellefonte spent nuclear fuel storage pool can accommodate the 3,400 TPBARs that would be discharged every 18 months for the one- to two-month time period after each fuel cycle prior to their shipment to the Savannah River Site.

17.06 The commentor refers to Table 5-42 of the CLWR Draft EIS, where the environmental impacts for dry cask storage are considered generically. The commentor asserts that the information about earthquake and tornado damage is not sufficient to allow the reader to determine the adequacy of this method of estimating environmental impacts.

Comment Summarized: 94-23

Response: The information in Volume 1, Table 5-51 (formerly Table 5-42) of the CLWR EIS, regarding earthquake and tornado accidents, reflects the fact that all NRC-licensed dry spent nuclear fuel storage designs are required by law to withstand earthquakes and tornadoes without posing any unacceptable risk to public health and safety. The environmental impact of dry cask spent nuclear fuel storage presented in Volume 1, Section 5.2.6 of the CLWR EIS assumes that any storage system used for spent nuclear fuel would be licensed by the NRC. The NRC evaluates the safety of each spent nuclear fuel storage system and confirms that, for accidents such as tornadoes and earthquakes, they meet all regulatory requirements, including design safety and acceptable consequences. All currently NRC-licensed dry cask spent nuclear fuel storage designs present safety analyses that show that earthquakes and tornadoes would result in no radiological consequences to the public.

17.07 The commentor refers to page A-23 of Appendix A of the CLWR Draft EIS. The commentor remarks that the numbers on that page indicate that Bellefonte would produce an additional 1,863 spent fuel assemblies if it were selected to produce tritium. The commentor adds that this number exceeds the total capacity of Bellefonte's current spent fuel pools.

Comment Summarized: 94-26

Response: As indicated in Volume 1, Appendix A, Table A-1, the operation of each of the Bellefonte units without tritium production would generate approximately 1,944 spent nuclear fuel assemblies over a 40-year period (i.e., 72 fuel assemblies per operating cycle x 27 operating cycles of 18 months each.) This number also exceeds the total capacity of Bellefonte's current spent nuclear fuel pools. Therefore, additional spent nuclear fuel storage beyond the pool capacity would be required at Bellefonte whether or not it is used for tritium production. The environmental impacts of a dry cask ISFSI system are presented in Volume 1, Section 5.2.6 of the CLWR EIS. This section presents the environmental impacts from construction, operation, and postulated accidents.

17.08 The commentor states that, if tritium is produced at levels that increase reactor fuel consumption, the EIS should clarify who owns the additional spent nuclear fuel and who will pay for its eventual treatment, storage, and disposal.

Comment Summarized: 127-4

Response: As the licensee for the CLWRs under consideration for tritium production, TVA is responsible for all spent nuclear fuel. A DOE interagency agreement with TVA would provide the financial terms for the treatment, storage, and disposal of any additional spent nuclear fuel that may be generated from the production of tritium.

17.09 The commentor states that the CLWR Draft EIS does not discuss the fact that there is no disposal site for spent fuel, so the environmental effects of tritium production could include centuries of on site spent fuel storage at commercial reactor site(s).

Comment Summarized: 137-9

Response: The operating and shut-down CLWRs in the United States are expected to have generated over 183,000 spent nuclear fuel assemblies (85,000 metric tons of uranium) by the end of their licensed lifetime. The additional spent nuclear fuel generated for 40 years of tritium production represents approximately 1 percent of this spent fuel inventory. Currently licensed technology exists for interim storage of spent nuclear fuel. DOE is committed to the development of a licensed national spent nuclear fuel waste repository. This waste repository will be required for the spent nuclear fuel that has been produced while generating electric power. The tritium production contribution to this spent nuclear fuel of about 1 percent will not affect the design or schedule for completion of this repository. The impacts from an onsite dry cask ISFSI are discussed in Volume 1, Section 5.2.6 of the CLWR EIS.

17.10 The commentor states that the CLWR Draft EIS mentions numerous times that production of tritium in a CLWR may result in more spent fuel, and this fuel will have higher enrichments and lower burnup than fuel currently discharged to the spent fuel pools; thus, it will have higher reactivity. The commentor remarks that the CLWR EIS contains no discussion of the effects of this high reactivity fuel on spent fuel pool design parameters or spent fuel pool fuel handling accidents. The commentor recommends that a detailed analysis be done to determine the effects of this high reactivity fuel on the various plants' spent fuel pools, and on fuel pool and fuel handling accident analyses, and a discussion of the results should be included in the CLWR Final EIS.

Comment Summarized: 146-1

Response: Full production loading of TPBARs may require the use of slightly higher enriched fuel (up to approximately 4.9 percent, compared to approximately 4.5 percent currently used). Such an increase would be allowed by the current NRC licenses (current licensing provisions allow for up to 5 percent enrichment); thus, the reactor systems and equipment are already designed to accommodate fuel enriched to the level required for tritium production. The somewhat higher enrichments and reduced fuel assembly burnups associated with the tritium production core, as compared to the conventional core designs, can influence the radiological source term used in the calculation of radiological emissions other than tritium during normal operation and accident conditions. The *Tritium Production Core Topical Report* (WEC 1998) quantified this effect and concluded that, overall, the fission product inventories were the same or lower in the tritium-producing core. Therefore, the analysis presented in the CLWR EIS, which does not account for the increased enrichment, is conservative. It is also not expected that the higher enrichments and reduced fuel assembly burnups would affect the design parameters of the existing spent fuel pools. The NRC will review these parameters when the reactor facility applies for a licensing amendment to operate in a tritium-producing mode.

17.11 The commentor states that there is no discussion of the effect of the high reactivity fuel on the postulated geologic repository. The commentor poses the following questions: Since there will be much more spent fuel generated by this process, will this affect the capability of the geologic repository to accept fuel from other CLWRs? Will its high reactivity make it ineligible for geologic storage or cause it to require special handling? The commentor recommends that these issues should be evaluated and discussed in the CLWR Final EIS.

Comment Summarized: 146-2

Response: The maximum number of additional spent nuclear fuel assemblies (e.g., 1,863 at Bellefonte) generated for the 40-year CLWR production of tritium represents less than 1 percent of the total mass of spent nuclear fuel expected to be placed in a future geologic repository. The maximum uranium-235 enrichment of this spent fuel would be approximately 4.9 percent (less than 5 percent). The TVA reactors under consideration use commercial nuclear fuel with uranium-235 enrichments as high as 4.5 percent. The trend in reload fuel at nuclear power plants has been toward higher uranium-235 enrichments. Since current and future projected nuclear fuel is expected to be similar in enrichment to the fuel used in tritium production, and the spent nuclear fuel associated with tritium production represents less than 1 percent of all the spent nuclear fuel to be discharged into the repository, the CLWR spent nuclear fuel associated with tritium production is expected to be compatible with repository requirements and should have no significant effect on repository reactivity and require no special handling.

17.12 The commentor, referring to the Uranium Fuel Cycle and Waste Management entry of Table 5-38 in the CLWR Draft EIS, remarks that it discusses only transportation. The commentor recommends that issues associated with additional onsite storage capacity for spent fuel also be discussed.

Comment Summarized: 146-16

Response: Environmental impacts of onsite spent nuclear fuel storage are analyzed in Volume 1, Section 5.2.6 of the CLWR EIS. As discussed in Section 5.2.4.2 of the CLWR EIS, Table 5-47 (CLWR Draft EIS Table 5-38) includes the issues that need to be addressed by the licensees as part of the life extension license renewal application. Issues of lesser importance which appear in 10 CFR 51, Subpart A, Appendix B, were not included in Table 5-47. The finding under Onsite Spent Fuel in the 10 CFR 51 table states: "SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or retrievable storage is not available." Section 5.2.6 of the CLWR EIS reaffirms this NRC finding for storage of spent nuclear fuel in a dry cask ISFSI.

17.13 The commentor asks that the EIS include the assumptions behind the conservatively estimated dose to a worker from the ISFSI, CLWR Draft EIS, page 5-94, top of the page.

Comment Summarized: 146-18

Response: These assumptions are presented in the two references, DUKE 1988 and BGE 1989b as indicated on the referenced page. The nature of this conservatism is due principally to the time and dose rate estimates for each operation in loading a dry spent nuclear fuel storage cask.

17.14 The commentor states the following: Page 5-94 of the CLWR Draft EIS, second paragraph, states no chemical, biocide, or sanitary wastes would be generated in the operation of the ISFSI. This disagrees with Table 5-41, which implies that small amounts of these would be generated. The commentor suggests that the two references should be consistent.

Comment Summarized: 146-19

Response: The information presented in Volume 1, page 5-94 and in Table 5-41 of the CLWR Draft EIS is consistent. The waste generation presented in Table 5-41 (now Table 5-50 in the CLWR Final EIS) occurs only during the process of loading the fuel from the spent nuclear fuel pool into the transfer cask and subsequently into the storage cask. Once the storage casks are loaded, they do not generate any chemical, biocide, or sanitary waste. This is explained in the second paragraph on page 5-94 of the CLWR Draft EIS. There was no change to this text in the CLWR Final EIS.

17.15 The commentor remarks that the United States has yet to find a safe, permanent storage facility for radioactive waste and adds that, until it does so, creating more radioactive waste, no matter how small, is environmentally and socially irresponsible.

Comment Summarized: 102-4

Response: DOE would be responsible for the low-level radioactive waste generated by tritium production. The amount of low-level radioactive waste resulting from tritium production would represent approximately 0.1 percent of the total low-level radioactive waste currently generated at the site. The 40-year production of tritium at CLWRs would produce a total amount of low-level radioactive waste which would fill 0.06 percent of the capacity of one of a series of existing vaults at the Savannah River Low-Level Radioactive Waste Disposal Facility, which has been operational since 1994. Additional spent nuclear fuel would be generated for tritium production if more than 2,000 TPBARs were irradiated in a single reactor core. The impacts from storing the additional spent nuclear fuel are discussed in Volume 1, Section 5.2.6 of the CLWR EIS. In implementing the proposed action, DOE and TVA would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel.

17.16 The commentor asks if the speaker at the public hearing meant to say that: (1) reactor units at either the Watts Bar or Sequoyah plants would generate 75 percent more spent fuel if they were run at the higher rate required for tritium production; and (2) spent fuel generation would double if tritium were produced in one of the Bellefonte units.

Comment Summarized: 700-5

Response: The commentor's statements are accurate. Impacts associated with tritium production and the generation of spent nuclear fuel are summarized in Volume 1, Section 3.2.6.2 of the CLWR Final EIS for Watts Bar, Sequoyah, and Bellefonte.

17.17 The commentor states that tritium production in excess of 2,000 targets per year would generate additional spent fuel. The commentor requests clarification concerning whether any of the three TVA nuclear power plants is capable of managing their existing and projected spent fuel load and whether adding to it would only complicate the situation.

Comment Summarized: 700-7

Response: Volume 1, Sections 5.2.1.12, 5.2.2.12, and 5.2.3.12 of the CLWR EIS address spent nuclear fuel management at each of the sites and indicate that all three TVA nuclear power plants are capable of managing their existing and projected spent nuclear fuel load. The management of spent nuclear fuel is a well-understood process at nuclear power plants. Many nuclear power plants are managing their spent nuclear fuel by constructing supplementary dry cask storage facilities on site. The proposed action would add more spent nuclear fuel if more than 2,000 TPBARs were irradiated in any one reactor core. With 2,000 or less TPBARs, there would be no impact on spent nuclear fuel storage requirements. If more than 2,000 TPBARs were irradiated in a reactor, the additional spent nuclear fuel would be accommodated in the same manner in which TVA would manage its projected additional spent nuclear fuel without tritium production. In implementing the proposed action, DOE and TVA would manage the tritium production process to minimize, to the extent practicable, the generation of additional spent nuclear fuel.

CATEGORY 18: TRANSPORTATION

18.01 The commentor questions how much additional risk is involved in transporting the TPBARs to South Carolina to remove tritium versus transporting the TPBARs somewhere else for disposal.

Comment Summarized: 23-2

Response: The TPBARs would be transported to the Tritium Extraction Facility at the Savannah River Site in Aiken, South Carolina, as stated in Volume 1, Sections 1.5.2.2 and 3.2.1 of the CLWR EIS. The Tritium Extraction Facility is an integral part of the program to produce tritium in a CLWR. Volume 1, Appendix E provides a conservative analysis of the health and environmental impacts along the transportation routes. Volume 1, Tables E-7 and E-8 show the per-shipment risk analysis, and Table E-9 summarizes the risk of transporting hazardous materials.

18.02 The commentor cannot find the definition for "associated impacts of transporting."

Comment Summarized: 86-3

Response: The phrase quoted by the commentor appears in the CLWR EIS Summary, S.1.6.1.2, in the context of topics addressed in the environmental assessment document for the Lead Test Assembly. Section 5.5 of the *Environmental Assessment, Lead Test Assembly Irradiation and Analysis, Watts Bar Nuclear Plant, Tennessee and Hanford Site, Richland, Washington* (DOE/EA-1210) (DOE 1997a) describes the impacts associated with transporting both unirradiated and irradiated TPBAR lead test assemblies. The CLWR EIS addresses the environmental impacts associated with the transportation of TPBARs in Volume 1, Section 5.2.8 and Appendix E. In both documents, the NEPA analysis addresses incident-free transportation impacts and transportation accident impacts. Those impacts include external radiation exposures (in-transit doses to the public or transport workers), nonradiological impacts due to pollutants emitted by the transport vehicles, vehicular accident fatalities, and maximum individual doses (on site and off site) resulting from breaches in the shipping cask or damage to the cask shielding.

18.03 The commentor states that the analysis for transportation impacts should consider the expected timing of shipments (regular basis stretched throughout the year or in bursts over a brief period every 18 months).

Comment Summarized: 94-16

Response: TPBARs would be transported in batches as a core load of irradiated TPBARs becomes ready for shipment. TPBARs do not come out of the reactor core on a regular basis spread throughout the year. They are only removed from the core when the core is refueled. In any case, the timing does not affect the risk, since the number of TPBARs per shipment is solely a function of the cask, and the number of shipments is a function of the production rate. The transportation analysis considered this in the per-shipment analysis shown in Volume 1, Appendix E, Tables E-7 and E-8, and reported the risks for the entire program (40 years) in Table E-9.

18.04 The commentor states that the risks associated with the leakage of radioactive material that could occur during the transportation of irradiated TPBARs should not be taken.

Comment Summarized: 136-4

Response: The Type B packages that would be used to transport irradiated TPBARs associated with the CLWR program are designed to withstand test conditions (described in Volume 1, Appendix E, Section E.3.2 of the CLWR EIS) representing extremely severe accidents (estimated to be more severe than over 99 percent of all accidents that could occur), while maintaining the packaged radioactive contents. Type B packages have been used for years to ship radioactive materials in the United States and around the world. To date, no Type B package has ever been punctured or has released any of its contents, even in actual highway accidents. As described in Volume 1, Section E.3.2 of the CLWR EIS, the Type B package is extremely robust and provides a high degree of confidence that, even in extremely severe accidents, the integrity of the package would be maintained with essentially no loss of the radioactive contents or serious impairment of the shielding capability. Section 5.2.8 of the CLWR EIS summarizes the impacts from transporting TPBARs from each reactor site to the Savannah River Site under incident-free and accident scenarios. Appendix E provides specific details on the transportation impact evaluations.

18.05 The commentor asks whether transporting TPBARs from three different reactors in two states would increase the opportunities for a transportation accident.

Comment Summarized: 703-4

Response: The likelihood of a transportation accident is proportional to the distance traveled. The per-shipment accident risk factors are shown in Volume 1, Appendix E, Table E-8 of the CLWR EIS. Since each of the possible CLWR sites is about the same distance from the Savannah River Site, the per-shipment accident risk is within 10 percent for each. The number of shipments required to transport the TPBARs is independent of the site chosen, but is related to the number of TPBARs produced. Appendix E, Table E-9, shows the traffic accident risks associated with different production rates at different sites.

18.06 The commentor asks whether DOE plans for a single truck to pick up irradiated TPBARs at each reactor and transport them collectively to the Savannah River Site.

Comment Summarized: 703-5

Response: A truck is capable of carrying one and only one of the Type B transportation casks that would be used for irradiated TPBARs. A cask would be loaded at a CLWR site, placed on a truck, and transported directly to the Savannah River Site. It would not stop at other CLWRs to pick up additional material.

18.07 The commentor says he believes the additional shipping requirements for tritium production are likely to cause accidents and traffic problems. The commentor states that the transportation accident risk found in the CLWR Draft EIS is exceedingly low—less than one fatal accident per 100,000 years is unrealistic. The commentor is concerned about the potential effect of transportation accidents on interstate traffic. The commentor wonders whether other agencies like the Tennessee Emergency Management Agency or the Federal Emergency Management Agency have plans to deal with any accidents, because accidents are inevitable in any line of work.

Comment Summarized: 707-2

Response: DOE has analyzed accident risks based on the best available transportation statistics and believes that it is unlikely that a traffic fatality will occur as a result of the 40-year program. The results of the analysis shown in Volume 1, Appendix E, Table E-9 of the CLWR EIS indicate that, depending on the alternative selected, the transportation accident risk is significantly lower than one fatal accident per 100,000 years. DOE would develop emergency plans with the carrier and state, local, and Tribal officials and would provide training courses for first responders along the transportation routes to enhance their capabilities to respond appropriately in the unlikely event of an accident. Technical assistance would also be provided to supplement existing resources if any deficiencies are identified. State, local, and some Tribal governments have the basic capabilities and training that would be required in order to take initial measures to respond to a transportation accident by virtue of their preparation for responding to accidents involving hazardous materials (e.g., assess the scene, administer emergency care, control the area, and call for a hazardous materials special team). In the unlikely event that a serious accident does occur, state and local responders would be the first to arrive at the scene, as they would to any overland shipment involving hazardous materials. If requested by state, Tribal, or local government, DOE would send a radiological monitoring assistance team from the closest of eight DOE regional offices located across the country.

18.08 The commentor opposes the radioactive waste associated with TPBARs being transported for disposal to the Savannah River Site or the Barnwell disposal facility.

Comment Summarized: 18-3

Response: Volume 1, Appendix E, Section E.5.3 of the CLWR EIS describes the amount of low-level radioactive waste generated during tritium production at a CLWR. Tables E-7 and E-8 show the per-shipment risk analysis, and Table E-9 summarizes the risk of transporting hazardous materials. The two to eight shipments of low-level waste over the entire program do not significantly increase the traffic or the risk in the State of South Carolina. The commentor's objection to the shipments is noted. Radioactive waste, similar to that associated with tritium production, is currently being shipped safely to the Savannah River Site and the Barnwell facility as part of their ongoing operations.

18.09 The commentor suggests that the CLWR EIS be revised to include an explanation of the response to a transportation accident and the impacts if a spill occurred.

Comment Summarized: 27-1

Response: DOE would develop emergency plans with the carrier and state, local, and Tribal officials and would provide training courses for first responders along the transportation routes to enhance their capabilities to respond appropriately in the unlikely event of an accident. Technical assistance also would be provided to supplement existing resources if any deficiencies are identified. State, local, and some Tribal governments have the basic capabilities and training that would be required to take initial measures to respond to a transportation accident by virtue of their preparation for responding to accidents involving hazardous materials (e.g., assess the scene, administer emergency care, control the area, and call for a hazardous materials special team). In the unlikely event that a serious accident does occur, state and local responders would be the first to arrive at the scene, as they would to any overland shipment involving hazardous materials. If requested by state, Tribal, or local governments, DOE would send a radiological monitoring assistance team from the closest of eight DOE regional offices located across the country. Volume 1, Section 5.2.8 of the CLWR EIS summarizes the impacts from transporting TPBARs from each reactor site to the Savannah River Site under incident-free and accident scenarios. Appendix E provides specific details on the transportation impact evaluations.

18.10 The commentor states that the risks associated with the leakage of radioactive material that could occur during the transportation of spent fuel rods and other wastes should not be taken.

Comment Summarized: 136-5

Response: Transportation of spent fuel rods (or spent fuel assemblies) is not in the scope of the CLWR EIS, as described in Volume 1, Chapter 1. The irradiated TPBARs and TPBAR-related low-level radioactive wastes are transported in Type B packages, as described in the response to Comment Summary 18.04.

18.11 The commentor is concerned with environmental factors and the health and safety of the population along the transport routes, particularly at and near the vicinity of the Savannah River Site.

Comment Summarized: 18-4

Response: Volume 1, Section 5.2.8 and Appendix E of the CLWR EIS provide a conservative analysis of the health and environmental impacts along the transportation routes. Some impacts are in the area of the Savannah River Site. The analysis shows that impacts on the environment and human health and safety are minor; the EIS finds that it is unlikely that transportation of hazardous materials will cause an additional latent or immediate fatality.

18.12 The commentor states that the transportation of raw materials to the TPBAR fabrication facility should be discussed in Section 5.2.8.

Comment Summarized: 146-20

Response: Volume 1, Section 5.2.7 of the CLWR EIS describes the materials needed for the fabrication of TPBARs. Raw materials required include stainless steel, zircaloy, aluminum, zirconium, lithium carbonate, and aluminum oxide. None of these raw materials is considered to be hazardous, and none is radioactive. These materials are commercially available. As stated in Section 5.2.7, no environmental consequences of any significance are expected from activities other than fabrication and assembly of the TPBARs.

CATEGORY 19: DESIGN AND FABRICATION OF TPBARs

19.01 The commentor, referring to Section 5.1.2 of the CLWR Draft EIS, suggests that the statement, "Experience with boron burnable absorber rods bounds what would be expected from tritium production burnable absorber rods," needs more amplification. The commentor further notes that there are several types of boron burnable absorber rods with different materials of construction, and that the number of boron burnable poison rods installed in a core is much less than the possible number of TPBARs that would be installed for tritium production.

Comment Summarized: 146-9

Response: The subject assumption has been removed in the CLWR EIS. The CLWR Draft EIS assumes that two TPBARs fail in each core load of TPBARs and that the entire tritium inventory is released to the reactor coolant and then to the environment. This is extremely conservative, since there has not been a single burnable absorber rod failure in the last 18 years, during which time over 500,000 such rods made by Westinghouse have been irradiated. As discussed in Volume 1, Section 1.9, the CLWR EIS has been revised to reflect the recent Westinghouse data on burnable absorber rods (WEC 1999). While the CLWR EIS still evaluates the failure of two TPBARs, this event is now categorized as an “abnormal" event that could happen in a given operational cycle, not normal operation.

19.02 The commentor requests information on the Pacific Northwest National Laboratory tests performed to show that tritium targets are satisfactory; they do not leak tritium during irradiation; and that tritium can be quantitatively recovered. The commentor requests a copy of the test results.

Comment Summarized: 4-2

Response: The question refers to the Lead Test Assembly program in Watts Bar 1. Prior to September 1997, the specific TPBAR design described in the CLWR EIS had not been used in a commercial reactor. DOE developed a series of experimental test designs between 1974 and 1992. The series of designs concluded with an irradiation test of 10 5-foot long rods in the Advanced Test Reactor at Idaho National Engineering and Environmental Laboratory in 1990-1991. The test conditions were similar to conditions that are found in a typical pressurized water reactor. Test data indicated that the rod performance was consistent with the performance expectations that existed prior to the tests. Post-irradiation examination of those test rods indicated that there were no failures and confirmed that the performance met the design requirements as defined in 1990.

The TPBAR design that would be employed in commercial reactors was developed using those early DOE designs as a basis; however, additional improvements have been made to those designs. DOE has relied upon the irradiation test information from those previous programs to provide insight into the operational characteristics of the TPBARs. Based on knowledge gained from those programs, DOE designed and fabricated the lead test assemblies. During the design process, specific performance requirements for the TPBAR components were mandated to assure satisfactory target performance during operation.

During those early test programs, research and development were also initiated on techniques to extract tritium from the targets. In the last several years, DOE has performed extraction experiments both on previously irradiated test specimens and on "simulated" TPBARs (using deuterium instead of tritium). The results of these tests have indicated that DOE will be able to efficiently recover tritium from the TPBARs.

The analytical conclusions of the test program can be found in the Lead Test Assembly Technical Report, *Report on the Evaluation of the Tritium Producing Burnable Absorber Rod Lead Test Assembly*, Rev. 1 (PNNL 1997). The NRC assessment of the technical report can be found in NUREG-1607 (NRC 1997).

19.03 The commentor requests information on the structural design to keep the TPBARs stable in the reactor and suggests that, since the target design appears to be a cantilevered-top-attached target, it would be subject to damage during irradiation from water flow vibration.

Comment Summarized: 4-3

Response: The TPBAR design is a cantilevered-top-attached target, as the commentor suggests. The external dimensions and design features of the TPBAR are virtually identical to the design used for discrete burnable absorber rods used for reactivity control in many commercial pressurized water reactors. The TPBAR was intentionally designed to be mechanically similar to these commercial burnable absorbers. Many thousands of the commercial burnable absorbers have been irradiated to date with no damage from flow-induced vibration. Elimination of flow-induced vibration was one of the many functional criteria placed upon the TPBAR design.

19.04 The commentor, referring to information contained in a PNNL report (PNNL-11419) questions the validity of the quantity of tritium release (1,890 Curies) which appeared in Table 3-13 of the CLWR Draft EIS under "Radioactive Emissions." The commentor suggests that the quantity should be 22,780 Curies.

Comments Summarized: 44-8, 501-10

Response: Pacific Northwest National Laboratory Report No. 11419 (PNNL 1997) is the technical report for the lead test assembly rods that were inserted into the Watts Bar 1 reactor in 1997. The functional design criterion on leakage was established as 6.7 Curies per rod per year. [This is a limit; not a leakage rate.] For full core production, a leakage of 6.7 Curies per rod per year was deemed unacceptable. DOE has considered the "lessons learned" from the Lead Test Assembly program and has designed and analyzed an improved production TPBAR model. The production TPBAR is designed to an average permeation rate of 1 Curie per rod per year. The commentor used the 6.7-Curie per rod per year leakage to arrive at 22,780 Curies. The design and analysis is found in NDP-98-181, *Tritium Production Core Topical Report* (WEC 1998).

19.05 The commentor refers to a statement in the CLWR Draft EIS that the system is so effective that the rods will have to be heated to 1,000° C (1,800° F) to recover the tritium captured. The commentor also refers to another area in the CLWR Draft EIS where the design temperature maximum of the extraction furnace at the Tritium Extraction Facility is said to be 1,100° C. The commentor suggests that operating the equipment within 10 percent of the maximum temperature is not a good practice and that the recovery process may be flawed.

Comments Summarized: 44-9, 501-11

Response: DOE has performed extensive research and development on techniques to extract tritium from the targets. The results of these tests have indicated that DOE will be able to efficiently recover tritium from the TPBARs within the temperature limitations noted in the Tritium Extraction Facility EIS and Volume 1, Section 3.1.2 of the CLWR EIS. These research and development efforts have been used to establish the furnace design values. Specific warranties and limitations with respect to furnace lifetime will be addressed during the furnace procurement process.

19.06 The commentor suggests that the CLWR Draft EIS should have used a TVA experience statistic for the "fuel rod burns" rather than a national statistic.

Comments Summarized: 86-6, 703-7

Response: It is assumed that the commentor is questioning the validity of the assumption that two TPBARs could fail per cycle. This assumption is, in fact, extremely conservative. Because of similarities between the TPBAR design and commercial burnable absorber rods used in nuclear reactors, the TPBAR failure rate is expected to be as low as the failure rate for these commercial burnable absorbers. Electric Power Research Institute Report NP-1984, *Control Rod Materials and Burnable Absorbers* (November 1981) (EPRI 1981) indicates statistics for burnable absorber rod failures through 1980 as 2 in 29,700 rods. The two failures were attributed to early manufacturing defects that were corrected in later fabrication campaigns. In the 17 years since that report was written, Westinghouse has fabricated over 500,000 burnable absorber rods with no observable failures. This includes the burnable absorber rods irradiated in the TVA reactors.

While TPBARs are not expected to fail during reactor operation, a failure rate of two TPBARs per cycle was chosen in the CLWR Draft EIS to provide a conservative and bounding estimate for environmental analysis. The impact of two failed TPBARs was assessed to show that the plant is capable of safely operating and that plant releases can be maintained within regulatory limits even in the unlikely event of two TPBAR failures. As indicated in Volume 1, Section 1.9, the CLWR Final EIS has been revised to reflect the recent

Westinghouse data (WEC 1999). While the CLWR Final EIS still evaluates the failure of two TPBARs, this event is now categorized as an abnormal event and is not part of normal operations.

19.07 Referring to the material composition of the TPBARs, the commentor questions whether all the lithium-6 necessary for the fabrication of the TPBARs is already available or needs to be produced. The commentor suggests that, if lithium-6 needs to be produced, the environmental impacts of its production need to be documented in the EIS.

Comment Summarized: 94-13

Response: As discussed in Volume 1, Section 5.2.7 of the CLWR EIS, the quantities of lithium required for the fabrication of the TPBARs have been mined and processed and are part of DOE's inventory of material resources. Therefore, no environmental consequences are expected from activities other than the fabrication and assembly of the TPBARs.

19.08 The commentor requests an explanation of the fact that, while during the public hearings for the Environmental Assessment of the Lead Test Assembly DOE assured the public that leakage from TPBARs was virtually impossible, the CLWR Draft EIS states in Volume 1, Section 3.1.3 that, "some tritium is expected to permeate through the TPBARs during normal operation."

Comment Summarized: 94-14

Response: The performance of the TPBAR getter is such that there is virtually no tritium in the TPBARs available in a form that could permeate through the TPBAR cladding. For conservatism, the CLWR EIS makes the assumption that 1 Curie of tritium per year could permeate through the cladding and be released to the environment. In comparison to the total quantity of tritium produced (nominally 10,000 Curies per TPBAR), this permeation rate is very small, and yet a conservative quantity.

19.09 The commentor opines that the discussion of environmental impacts in the CLWR Draft EIS is flawed because it does not fully explain that TPBARs are a new technology, so there are great uncertainties in their use, including the actual leakage rate, which could be much larger than the 1 Curie per year estimate, or explain the environmental effects of handling, storing, and transporting them.

Comment Summarized: 137-8

Response: The TPBAR concept is not entirely new. Prior to September 1997, the specific TPBAR design described in the EIS had not been used in a commercial reactor. Between 1974 and 1992, DOE developed a series of experimental test designs. The series of designs concluded with an irradiation test of 10 5-foot-long rods in the Advanced Test Reactor in 1991. The test conditions in the loop were similar to conditions that are found in a typical pressurized water reactor. Test data indicated that the rod performance was consistent with the performance expectations that existed prior to the tests. Post-irradiation examination of those test rods indicated that there were no failures during operation.

The TPBAR design was developed using those early DOE designs as a basis; however, additional improvements have been made to those designs. DOE has relied upon the irradiation test information from those previous programs to provide insight into the operational characteristics of the TPBAR design. Based on knowledge gained from those programs, DOE designed and fabricated 32 TPBARs that were inserted into the Watts Bar 1 Nuclear Reactor in lead test assemblies in September 1997. To date, these lead test assemblies are performing as expected and there are no indications of failure. When the TPBAR lead test assemblies are removed from the Watts Bar 1 in the spring of 1999, they will be examined extensively, both in a nondestructive and destructive manner.

Therefore, prior to the initiation of a production mission, DOE will have experience and irradiation data from a broad range of tests, including the lead test assemblies that are prototypic of the production TPBAR design. The cumulative DOE experience with the target technology has provided high confidence that the design and operation of the TPBARs will be within the defined safety and environmental limits.

Issues involving the environmental effects of handling, storing, and transporting radioactive materials in the United States, including tritium, have been well analyzed and documented and are generally well understood. There are no new issues raised by the transportation of TPBARs, as compared to other radioactive materials, other than design-specific accident responses. Conservative analysis of accident responses has been made in the CLWR EIS using the design and experience base noted above.

19.10 The commentor, referring to a statement made in Section 3.1.2 of the CLWR Draft EIS that, "The tritium produced would be bound to the getter and extracted only after heating to a high temperature...," questions whether there is no release potential of any form of tritium that contributes to the doses calculated in the EIS. Even with the very conservative assumptions used to assess impacts from the potential leakage of tritium from the TPBARs, the estimated impacts on human health are very small.

Comment Summarized: 143-5

Response: The performance of the getter is such that there is virtually no tritium in the TPBARs available in the form that could permeate through the TPBAR cladding. For conservatism, the CLWR EIS makes the assumption that 1 Curie of tritium per TPBAR per year could permeate through the cladding and be released to the environment. It is also assumed, as an abnormal event, that two TPBARs could fail in a core load of TPBARs and that the entire tritium inventory is released to the reactor coolant and then to the environment. This is extremely conservative, since there has not been a single burnable absorber rod failure in the last 18 years, during which time over 500,000 such rods made by Westinghouse have been irradiated. Notwithstanding these conservative assumptions, the assumed tritium releases give rise to the doses calculated for workers and the public and are included in Volume 1, Section 3.1.3, Chapter 5, and Appendix C, Section C.3.4 of the CLWR EIS. Even with the very conservative assumptions used to assess impacts from the potential leakage of tritium from the TPBARs, the estimated impacts on human health are very small.

19.11 Referring to Appendix A, page A-12 of the CLWR Draft EIS, the commentor states that the text does not go into any detail about the differences between using TPBARs and standard burnable poison rods. The commentor suggests that more details be provided.

Comment Summarized: 143-9

Response: For the purposes of this EIS, a qualitative description of the rods is considered to be sufficient to demonstrate the significance of the design to the environmental impacts. These descriptions are provided in Volume 1, Section 3.1.2 (including Table 3-1), and Appendix A, Sections A.2 and A.3. Further details on the differences between the two types of poison rods (burnable absorber rods versus tritium-producing burnable absorber rods) are discussed in the *Tritium Production Core Topical Report* (WEC 1998), which has been provided to the NRC and which will become the basis of the safety review, should tritium be produced in any of the TVA reactors. It should be noted that neither rod contains fissile material or is radioactive prior to reactor operation.

19.12 In response to a statement made by Steven Sohinki of DOE at the public hearing, the commentor asks why DOE says that TPBARs would be under less stress in the reactor core than standard burnable absorber rods.

Comment Summarized: 704-5

Response: As discussed in Volume 1, Section 1.9 of the CLWR EIS, the only two early observed failures among standard burnable absorber rods were attributed to slumping of the absorber material, a failure mechanism that cannot occur in the TPBARs. Therefore, assuming that the TPBARs are designed and fabricated under the same standards and with the same margins to failure as the standard burnable absorber rods, it could also be assumed that the TPBAR failure rate would be similar to the standard commercial burnable absorber rods.

19.13 The commentor, referring to a request previously made to DOE, reiterates the request for DOE to provide the State of Tennessee and interested stakeholders the TVA sampling data from the primary coolant at the Watts Bar Pilot Project, both before and during actual production of tritium. The commentor asks DOE to send the data as it becomes available. Measurements of tritium in particular should be provided. The commentor remarks that, since the TPBARs contain different materials than standard burnable absorber rods, other relevant neutron activation products should be included in the data. The commentor requests the detection limits and bounding statistics.

Comment Summarized: 127-5

Response: The requested information was provided by TVA to Mr. Monroe of the State of Tennessee on October 8, 1998. Additional information was provided on December 14, 1998.

19.14 A commentor asks who is going to fabricate the tritium rods that DOE plans to use in the Watts Bar reactor. The commentor asks whether DOE will examine the fabricator's past performance specifically with regards to cladding. The commentor notes that there is a massive decay going on with the cladding in the rods that will cut down on the production of electricity at Watts Bar and suggests that DOE is going to derate the plant even more.

Comment Summarized: 811-2

Response: DOE will issue a request for proposals to commercial fuel fabricators to determine who will fabricate the TPBARs. As part of the selection process, the fabricator's past performance with regard to cladding will be evaluated. The production of tritium does not impact the rated power of a CLWR.

CATEGORY 20: DECONTAMINATION AND DECOMMISSIONING

20.01 Two commentors ask who is responsible for the cleanup of the tritium production site. The commentor asks who will pay the additional cost.

Comments Summarized: 86-1, 707-14

Response: Any costs associated with the normal nuclear site decontamination and decommissioning are the responsibility of TVA. Any cleanup of tritium-related contamination is the subject of the contract negotiations between DOE and TVA.

20.02 The commentor states that the CLWR Draft EIS fails to include a comparison of the eventual costs of decontaminating and decommissioning Bellefonte as a nuclear site and as a fossil fuel electricity-generating plant—which it should do, since those are the two possible futures for the plant.

Comment Summarized: 702-16

Response: It is a well-established principle under NEPA that the purpose and need of a proposed action should delineate the limits of the reasonable alternatives to that action. That is, an alternative which does not accomplish the agency's goals is not a reasonable alternative. As explained in Volume 1, Chapter 3 of the CLWR EIS, the purpose of the EIS is to assess reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. DOE believes that the CLWR EIS discusses all of the reasonable alternatives for producing tritium in one or more CLWRs to satisfy national security requirements as directed by the President. The alternative of converting the Bellefonte reactors to fossil fuel electricity-generating plants is discussed in the CLWR EIS (see Volume 1, Section 1.5.2.4). As discussed in that section, TVA has completed a Final EIS for the Bellefonte Conversion Project (TVA 1997) which analyzes the reasonably foreseeable environmental impacts associated with converting the Bellefonte plants to fossil fuel plants. However, with respect to the CLWR EIS, conversion of the Bellefonte plants to fossil fuel electricity-generating plants would not accomplish DOE's purpose and need as stated in the CLWR EIS. As such, conversion of the Bellefonte plants to fossil fuel plants is not a reasonable alternative for the CLWR EIS and, thus, is not analyzed in the CLWR EIS.

20.03 The commentor thinks DOE and TVA should consider the long-term effects and the cleanup and the decontamination aspects of CLWR tritium production, which are all parts of the process, before starting such a project.

Comment Summarized: 707-18

Response: Volume 1, Section 5.2.5 of the CLWR EIS addresses the subject of decommissioning and decontamination. Section 3.2.1 delineates the underlying assumptions used in calculating decontamination and decommissioning of the tritium production CLWRs. The most important assumption is that the production of tritium at a CLWR is not expected to affect the radiological condition of the reactor at the end of its lifetime.

20.04 Two commentors question who would be responsible for the costs associated with decontamination and decommissioning of the Bellefonte reactor plant if it were completed and used for tritium production. One commentor is concerned with the cost of decontamination and decommissioning, stating that it will be high and that the issue is not addressed in the CLWR Draft EIS.

Comments Summarized: 41-11, 707-12

Response: Impacts associated with decontamination and decommissioning are assessed in Volume 1, Section 5.2.5 of the CLWR EIS. The eventual costs of decontamination and decommissioning would be the responsibility of TVA. See also the response to Comment Summary 20.01.

CATEGORY 21: REACTOR LICENSING ISSUES

21.01 The commentor asks whether TVA would expect the operational technical specification limits to remain the same under tritium production.

Comment Summarized: 705-1

Response: At this time, it is unclear whether the operational technical specification limits would remain as they are currently. As part of the license amendment to produce tritium, these limits will be reviewed by the NRC.

21.02 One commentor, referring to the 25-year-old design of the Bellefonte plant, suggests that an evaluation of the aged equipment (reactor vessel, instrumentation, wiring) be made to ensure that today's safety requirements are met. Another commentor opposes the use of Bellefonte as a tritium plant because the reactor design is old and outdated. The commentor thinks that using an outdated reactor design would place all of the people in the area in jeopardy from a potential accident.

Comment Summarized: 41-10, 49-1

Response: As discussed in Section 3.2.5.3 of the CLWR Draft EIS, the equipment at Bellefonte has been maintained in a lay-up mode. No fuel has been added to the reactor, and there has been no degradation of the reactor vessel. The NRC makes periodic inspections to verify that the lay-up procedures are being followed and that the conditions for the equipment defined by the plant procedures are maintained. The lay-up approaches and procedures used to maintain the equipment at Bellefonte are similar to those that were used at Watts Bar 1. Watts Bar is currently in its second operating cycle and has maintained an outstanding performance record since the start of operation. The NRC would review the "as built" condition of the Bellefonte plant, as well as updated design and safety information, prior to the start of operation. Some of the plant instrumentation, including the plant computer, would be upgraded prior to operation. Additional plant modifications would be implemented to bring the plant configuration up to today's safety and licensing requirements. The NRC also would hold public hearings and address concerns raised by the public prior to granting an operating license for either of the units.

21.03 The commentor raises the question of whether Watts Bar and Sequoyah will be available after the existing operating licenses expire. The commentor also states that it doesn't make sense to produce tritium until it is needed.

Comments Summarized: 94-3, 702-12

Response: The CLWR EIS addresses license renewal in Volume 1, Section 5.2.4.1. DOE assumes that the reactors will be capable of meeting the NRC licensing extension requirements. In the event that a reactor is unable to meet these requirements, it is assumed that other reactors will be available. DOE also has the option of increasing the production of tritium during the life of the existing reactors in the event that life extension is not a viable option. The commentor references another scenario concerning when the tritium is required. DOE is required to accept the mandates of the President in the Nuclear Weapons Stockpile Plan. If these requirements are reduced, DOE has the flexibility of reducing the level of irradiation services purchased from TVA.

21.04 The commentor asks when the NRC's review of the Production Core Topical Report and its plant-specific reviews will be available to the public.

Comment Summarized: 704-13

Response: The safety evaluation report on the Production Core Topical Report is expected to be issued by the NRC in March 1999. The plant-specific application for a licensing amendment will be submitted for review after the Record of Decision for the CLWR EIS is published.

21.05 The commentor opposes tritium production at a CLWR because the NRC may delay any DOE programs assigned to a CLWR.

Comments Summarized: 14-2, 504-2

Response: There is no credible evidence that the NRC will intentionally delay a licensing associated with the production of tritium in a civilian nuclear plant. DOE has been working with the NRC for the last three years. DOE and the NRC have entered into a Memorandum of Understanding that governs the roles and responsibilities of each agency. The NRC acted in a timely manner in approving the use of the lead test assemblies currently in place at the Watts Bar facility. NRC has very specific and important safety requirements that must be met before any licensing actions can occur. If questions arise, it is anticipated that there will be more than one reactor alternative DOE can rely on in order to produce tritium in a timely manner. DOE's schedule allows sufficient time for licensing issues to be resolved satisfactorily.

21.06 The commentor believes there are uncertainties in the ability to obtain a license for CLWR tritium production based on public concerns over safety and environmental hazards resulting from releases of tritium and public discomfort with the commingling of military purposes in a civilian reactor.

Comments Summarized: 45-2, 503-2

Response: The commentor is correct that, as with any project, there are uncertainties. The purpose of the CLWR EIS is to address environmental impacts of the production of tritium in a CLWR. The issues raised by the commentors will be taken into consideration during the final decisionmaking process and will be reflected in the Record of Decision. DOE believes that the issues raised by the commentors, while accurate, will not preclude the CLWR as a viable option to produce tritium. The NRC does not issue licenses based on public opinion. The NRC considers public concerns in the licensing process; however, they make decisions based on safety.

21.07 A commentor asks what the NRC time line for licensing would be once a decision has been made to use Watts Bar for tritium production.

Comment Summarized: 812-2

Response: A license amendment would be necessary, and one is expected to be submitted to the NRC by the Spring of 2000.

21.08 A commentor asks whether the license to finish the Bellefonte unit is still in effect.

Comment Summarized: 810-1

Response: Yes. TVA has construction permits from the NRC for the completion of the Bellefonte Nuclear Plant Units 1 and 2 that are valid until October 1, 2001, and October 1, 2004, respectively.

CATEGORY 22: SAFEGUARDS AND SECURITY

22.01 Commentors have suggested that the use of civilian reactors will make them attractive targets for attack by terrorists and foreign powers. The commentor states that, since the Sequoyah Plant is located only 7.5 miles from Chattanooga, it is a comparatively attractive target for terrorists. Furthermore, the commentor points out that such a CLWR would be the "weak link" in the nuclear weapons complex security system and, accordingly, such an attack should be analyzed by the CLWR EIS. Another commentor indicates the EIS, at a minimum, should assume the CLWR would be bombed by a foreign power nuclear weapon and the impacts of such an action should be included in the EIS. Another commentor indicates that it is unreasonable for DOE to dismiss accidents resulting from sabotage as speculative. The World Trade Center bombing proves that the United States is no longer impervious to terrorist activities. Another commentor states that DOE does not consider the possible attack on the transport of TPBARs from the production site to either the Savannah River Site or the Richland, Washington, site. Another commentor suggests that the conclusion reached in the CLWR Draft EIS that no environmental impacts are expected as a result of compliance with the NRC and DOE safeguard and security provisions illustrates the cursory analysis in the EIS.

Comments Summarized: 6-4, 13-4, 41-2, 80-2, 94-20, 116-7, 136-1, 702-13

Response: Facilities and activities associated with the production of tritium are required to comply with the stringent security provisions of DOE Orders 5632.1C and 5633.3A. These Orders require a graded protection for all safeguard and security interests, classified matter, property, and sensitive information from theft, diversion, industrial sabotage, radiological sabotage, espionage, unauthorized access or modification, loss or compromise, or other hostile acts which could cause unacceptable adverse impacts on national security, our business partners, or on the health and safety of employees and the public. The DOE Orders further require a facility associated with the production of tritium to provide protection against a design-basis threat. DOE has further security provisions specifically designed to ensure that the transport of materials, equipment, and articles utilized in the defense mission are not subject to sabotage, terrorism, or mishandling. Transportation of national defense-sensitive materials must comply with the extensive provisions of DOE Order 5610.14. Similar to facility security requirements, these transportation security requirements necessitate that DOE guards against a design-basis threat.

In order for a CLWR to produce tritium, it would be required to comply with the NRC and DOE security requirements. Requirements for developing a safeguards and security system sufficient to protect against a design-basis threat may be found in 10 CFR Parts 73 and 74. Prior to the operation of any TVA reactor to produce tritium, compliance with these regulatory requirements must be demonstrated to NRC's satisfaction.

The safeguard and security procedures of the TVA facilities have already been reviewed for the Lead Test Assembly program (an ongoing program which is currently testing 32 TPBARs in TVA's Watts Bar reactor) and have been found to be sufficiently protective of Federal property, employees, and the general public. As indicated in Volume 1, Section 5.2.10 of the CLWR EIS, no environmental impacts are expected as a result of compliance with both NRC and DOE safeguard and security provisions. Prior to the placement of additional, production-quantity TPBARs in any of the TVA reactors, an additional, similar, site-specific review of security procedures would be conducted. This analysis would include transportation of all materials associated with the program. If it were determined that the requirements of either the NRC or DOE security provisions could not be met, additional procedures would be implemented to achieve compliance with these requirements.

DOE has presented what it believes to be a site-specific probabilistic assessment of severe accidents, including the effects of external events such as fires, floods, and earthquakes. The severe accident analysis in the CLWR EIS includes a loss-of-coolant accident which results in core overheating, fuel melting, loss of containment, and release of radionuclides to the environment.

It is not possible to assign a probability to an attack by either a terrorist or a foreign nuclear power. Such analysis is considered to be beyond the state-of-the-art of probabilistic risk assessment. However, if one were to assume such an event occurred, the environmental impacts resulting from such an event are expected to be similar to the severe accident scenario which is analyzed in the CLWR EIS and which is presented in Volume 1, Section 5.2.1.9.2 for the Watts Bar Nuclear Plant, Section 5.2.2.9.2 for the Sequoyah Nuclear Plant, and Section 5.2.3.9.2 for the Bellefonte Nuclear Plant.

CATEGORY 23: COST ISSUES

23.01 The commentor asserts that the ratepayers in Tennessee are ultimately responsible for the costs currently being incurred by TVA for the construction of Bellefonte (TVA issues bonds, but the bonds are the responsibility of the ratepayers). The commentor states that, as a result, the Federal Government's argument that it already owns the TVA plants is thin.

Comment Summarized: 704-12

Response: As explained in Volume 1, Section 1.3.6 of the CLWR EIS, TVA was established by an Act of Congress in 1933, as a Federal corporation. All of the TVA reactors are the property of the United States.

23.02 A commentor expresses the opinion that DOE has significantly underestimated the cost associated with the CLWR option and that these estimates should be subjected to an independent third-party review. Another commentor is concerned about cost overruns in view of TVA's history.

Comments Summarized: 503-3, 600-1, 800-2

Response: The TVA estimate to complete Bellefonte Unit 1 has undergone several reviews by independent organizations, including Bechtel, Ebasco, and Fluor Daniel. These reviews have confirmed the estimate. The total life cycle cost of the CLWR option includes not only the cost to complete Bellefonte, but also all other DOE program costs, such as the completion of the Tritium Extraction Facility and the cost of shipping irradiated TPBARs from the reactor facility to the Tritium Extraction Facility. The capital costs to complete Bellefonte are fixed under TVA's proposal. Should any additional monies be needed to complete the reactor, TVA would be responsible for the additional cost. The TVA Bellefonte offer includes the use of the Watts Bar Unit 1 reactor at no additional cost to DOE. Use of both of these reactors would meet START I requirements, including any tritium requirements associated with replenishing the tritium reserve. [See also the response to Comment Summary 03.03.] DOE management issued an official summary of the cost for the two options, including life cycle costs (DOE 1998c). This official DOE summary showed the Bellefonte offer to be significantly less expensive than the APT.

23.03 The commentor asks, since DOE and the TVA plants are government-owned, when will everybody in the nation be responsible for TVA's $29 billion in debt, and how soon can ratepayers expect a rate reduction from the current TVA debt (i.e., why should the ratepayers be responsible for the proposed action, which they will be, since TVA has so magnanimously offered some of the money they will be making on the production of electricity to DOE, and why isn't the rest of the nation paying for the proposed action?).

Comment Summarized: 623-2

Response: TVA's $29 billion debt financed total construction needs, not just for the nuclear program construction. This debt is not the responsibility of the U.S. Government and is not part of the national debt. TVA's power program is financially self-sufficient and relies on bond proceeds and revenues from the sale of power. Since TVA bonds are not the obligation of the U.S. Government, they are not part of the national debt. TVA's Board has already established a cap on the outstanding debt and is implementing a 10-Year Business Plan that will reduce the $29 billion amount by one-half by the end of Fiscal Year 2007. This will allow TVA to attain a competitive, reduced delivered price of power by the end of the plan period. The TVA-proposed arrangement with DOE to complete Bellefonte for tritium production would allow for the effective use of a TVA asset and would result in a significant benefit to all TVA ratepayers, both in debt reduction and in reduced operating costs. The Board of Directors will continue to review TVA's power rates annually and make adjustments based on sound business decisions.

23.04 The commentor asks who would benefit from electricity sales revenues from a completed Bellefonte Nuclear Plant—the taxpayers, TVA, or DOE?

Comment Summarized: 700-4

Response: The benefit from electricity sales revenues at Bellefonte could be split between TVA and DOE, depending on the outcome of contract negotiations. Since DOE funding to complete Bellefonte would come from Congress, any revenue returned to DOE to offset initial expenditures would benefit U. S. taxpayers. Any revenue returned to TVA would benefit TVA and the TVA ratepayers.

23.05 The commentor expresses his belief that cost overruns are likely if TVA plants are used for tritium production. The commentor requests DOE to guarantee that the CLWR Final EIS will contain more discussion and analysis of the potential risks and consequences of cost overruns. The commentor states that not doing so would be a mischaracterization of the NEPA process.

Comment Summarized: 700-10, 803-8

Response: TVA believes the estimate to complete Bellefonte is accurate and conservative. This estimate has been reviewed by several independent outside organizations, including Fluor Daniel, Ebasco, and Bechtel. TVA's 10-Year Business Plan does not assume any benefit from the completion of Bellefonte and sale of electricity from the plant. To the extent the plant generates positive cash flow, TVA's 10-Year Business Plan objective would be realized earlier than projected. Should cost overruns occur, the ratepayer would see no negative impact until the cost to complete is greater than the cumulative net cash flow generated from power sales. The probability of negative socioeconomic impacts is therefore minimized and considered negligible.

23.06 The commentor is disconcerted as a TVA ratepayer to learn that, first, Chairman Crowell stated in TVA's 1996 Integrated Resource Plan that TVA will not engage in further nuclear power plant construction without a full partner, and now, under one of DOE's tritium production scenarios, TVA would invest $4.5 billion (essentially its current expenditures for construction of Bellefonte) into the partnership with DOE, resulting in someone else (DOE) completing the reactor at no additional cost to the ratepayers. The commentor believes DOE's CLWR tritium production proposal is nothing more than a thinly veiled attempt to subsidize TVA's attempts to complete the Bellefonte reactor with taxpayer money.

Comment Summarized: 700-17

Response: DOE's purpose and need, as described in the CLWR EIS, is to provide a source of tritium and not to complete Bellefonte. DOE would only select the Bellefonte option if producing tritium at Bellefonte is in the best interest of the United States. TVA's proposal for the completion of Bellefonte is fully consistent with TVA Chairman Crowell's statements regarding future nuclear power plant construction.

23.07 The commentor expresses his belief that DOE needs to understand how delicate and fragile the contractual situation is with TVA's distributors, as well as the liabilities related to TVA's ability to meet the obligations of its 10-Year debt [reduction] plan and the restructuring of the electric utility environment. The commentor further states that these issues are significant and should be addressed socioeconomically to evaluate their long-term implications for the Valley and for U.S. taxpayers. Another commentor asks whether residents of Scottsboro would see their rates go up or down as a result of tritium production at Bellefonte.

Comment Summarized: 700-18, 806-2

Response: TVA believes the estimate to complete Bellefonte is accurate. This estimate has been reviewed by several independent outside organizations including Fluor Daniel, Ebasco, and Bechtel. In the unlikely event of a cost overrun, TVA would delay debt reduction from its currently planned level. The revenues from the sales of electricity generated by Bellefonte likely would offset the amount of delay. These revenues are not realized in TVA's current debt reduction program. TVA would use these revenues to offset any cost overrun. TVA does not envision any impact to the ratepayer.

23.08 The commentor asks if TVA's offer for tritium production includes a fixed price.

Comment Summarized: 706-2

Response: TVA's offer to produce tritium at Bellefonte is a fixed price to DOE.

23.09 The commentor expresses the opinion that the EIS would benefit from including more information about the actual costs of the various alternatives and the implications of the costs for the specific economic proposals being considered (e.g., if the project costs $1.9 billion, who will be responsible for supplying the rest of the money if the costs exceed the fixed price?).

Comment Summarized: 706-3

Response: Actual costs of the various tritium production alternatives are not part of the EIS process. However, DOE has issued an official cost summary that compares tritium production alternatives, including life cycle costs (DOE 1998c).

23.10 Commentors ask whether TVA plans to pass on the cost of an overrun on its fixed price contract with DOE to ratepayers and, if not, whether TVA is subsidized by some other means.

Comments Summarized: 703-11, 704-16, 706-4

Response: TVA believes the estimate to complete Bellefonte is accurate and conservative. This estimate has been reviewed by several independent outside organizations including Fluor Daniel, Ebasco, and Bechtel. TVA's 10-Year Business Plan does not assume any benefit from the completion of Bellefonte and sales of electricity from the plant. To the extent the plant generates positive cash flow, TVA's 10-Year Business Plan objective would be realized earlier than projected. Should cost overruns occur, the ratepayer would see no negative impact until the cost to complete is greater than the cumulative net cash flow generated from power sales. The probability of negative socioeconomic impacts is, therefore, minimized and considered negligible.

23.11 The commentor is concerned about TVA's debt, suggesting that maybe TVA should take a little breather before starting another project and incurring more debt.

Comment Summarized: 707-11

Response: The funds needed to complete Bellefonte would be received from DOE. There would be no additional TVA funding needed to complete Bellefonte.

23.12 A commentor asks how the $2.9 billion will be dispersed if tritium production takes place at the Watts Bar plant.

Comment Summarized: 816-2

Response: The commentor misspoke; the estimated dispersement presented at the December 14, 1998, meeting was $1.9 billion. The procurement process is ongoing. It is impossible to determine how much money TVA might receive until the negotiations are complete.

23.13 Several commentors express disagreement with spending money for tritium production. Commentors opine that money would be spent better on social needs, education, environmental restoration, and other matters. Some commentors opine that the CLWR program was an effective use of taxpayers' money.

Comments Summarized: 2-3, 3-2, 7-3, 40-1, 53-3, 84-4, 99-3, 103-4, 108-2, 112-2, 115-1, 119-3, 125-2, 137-7, 141-2, 208-5, 212-8, 223-1, 239-4, 248-4, 250-5 621-2, 707-8, 712-6, 828-2

Response: Congress determines how funds are allocated. DOE spends monies consistent with Congressional direction. DOE is not in a position to make the difficult tradeoffs that may be required between alternative Federal programs and spending priorities. The issue of spending money for tritium production is beyond the scope of the CLWR EIS.

23.14 The commentor questions whether the $1.9 billion to complete Bellefonte Unit 1 included the costs of TPBAR transportation and the cost of the extraction facility. The commentor also questions whether TVA is a Government agency.

Comments Summarized: 86-10, 501-3

Response: Official DOE cost estimates for both the APT and the CLWR were made available at the CLWR public hearings. Additional copies of those cost estimates are available by contacting the CLWR program office. The $1.9 billion figure cited by the commentor is a fixed-price quote of the investment cost to complete the Bellefonte Unit 1. The costs associated with TPBAR transportation and the extraction facility are included in the official DOE cost estimate. As explained in Volume 1, Section 1.3.6 of the CLWR EIS, TVA was established by an Act of Congress in 1933 as a Federal corporation. All of the TVA reactors are the property of the United States.

23.15 Several commentors express support for the CLWR over the APT due to lower costs. Some commentors question whether the cost comparisons between the APT and the CLWR were equitable. One commentor asks what percentage of the accelerator program would pay for the design.

Comments Summarized: 4-10, 44-10, 45-8, 90-1, 114-1, 501-12, 605-1, 702-5, 713-2, 719-2

Response: Official DOE cost estimates for both the APT and the CLWR were made available at the CLWR public hearings. Those official cost estimates are DOE's best estimates of the costs for both the CLWR and the APT. Any assumptions and basis for analysis in developing those cost estimates are contained within the cost estimates. Cost issues associated with the CLWR and the APT are beyond the scope of the CLWR EIS.

23.16 Several commentors request that DOE be explicit concerning the costs associated with tritium production. Another commentor requests that the costs associated with spent fuel management be included in the EIS. Another commentor asserts that cost should not be the major factor in determining where tritium is produced. Another commentor asks whether DOE economic analysis includes the costs of pursuing the CLWR and APT options as both primary and backup alternatives to each other.

Comments Summarized: 127-3, 143-1, 245-2, 501-13, 504-5, 700-3, 702-4

Response: The CLWR EIS was prepared in accordance with NEPA, the Council on Environmental Quality's regulations on implementing NEPA (40 CFR Parts 1500 through 1508), and DOE's NEPA implementation procedures (10 CFR Part 1021). None of these require inclusion of a cost analysis in an EIS. As discussed in Volume 1, Section 3.2.1 of the CLWR EIS, the basic objective of this EIS is to provide the public and DOE decision-makers with a description of the reasonable alternatives and their potential environmental impacts.

While costs could be an important factor in DOE's decision regarding the production of tritium in a CLWR, the focus of an EIS is on the environmental consequences. DOE has performed several cost analyses on the various proposals associated with the production of tritium and made these cost analyses available to the public at the three public hearings DOE held in October, 1998. DOE is pleased to provide the public with these analyses upon request.

23.17 One commentor expresses concern regarding a number of issues related to costs: that costs to complete Bellefonte were underestimated and not subjected to independent third-party review, while the APT costs have been reviewed; that costs would overrun the TVA estimated cost of $2.44 billion to complete the cost of the Bellefonte 1 reactor; that the Government Accounting Office states that TVA estimates are very unreliable; that another utility estimates over $4 billion would be required to complete Bellefonte; that Bellefonte would not meet START I tritium requirements; that there is serious question concerning the ability of Bellefonte to generate sufficient revenues to offset costs; and that Watts Bar and Sequoyah, although discussed at length, are being withdrawn.

Comments Summarized: 45-3, 503-4

Response: The TVA estimate to complete Bellefonte Unit 1 has undergone several reviews by independent organizations, including Bechtel, Ebasco, and Fluor Daniel. These reviews have confirmed the estimate. The $2.44 billion cited in the comment is the total life cycle cost of the CLWR option, which includes not only the cost to complete Bellefonte, but also all other DOE program costs, such as the completion of the Tritium Extraction Facility, and the cost of shipping irradiated TPBARs from the reactor facility to the Tritium Extraction Facility. The capital costs to complete Bellefonte are fixed under TVA's proposal. Should any additional monies be needed to complete the reactor, TVA would be responsible for the additional cost. The TVA Bellefonte offer includes the use of the Watts Bar Unit 1 reactor at no additional cost to DOE. Use of both of these reactors would meet START I requirements, including any tritium requirements associated with replenishing the tritium reserve. [See also the response to Comment Summary 03.03.] DOE management issued an official summary of the cost for the two options, including life cycle costs. When considering the life cycle costs of the completion and utilization of the Bellefonte facility for producing tritium, the revenues to be generated from the sales of electricity, which TVA would share with DOE, would offset the initial, up-front costs. These up-front costs, however, are quite sizable. The Watts Bar/Sequoyah offer gives DOE an attractive alternative based upon an annual fee for irradiation services, without any large up-front costs. In addition, this flexible offer becomes even more attractive, considering the possibility of smaller, future tritium requirements as a result of additional cuts in the size of the nation's nuclear weapons stockpile.

23.18 The commentor states that the Congressional Research Service review raises a serious question on the ability of Bellefonte to generate sufficient revenue to offset operating costs, much less amortize construction.

Comment Summarized: 503-12

Response: TVA's Watts Bar 1, Sequoyah 1 and 2, and Browns Ferry 2 and 3 nuclear units generate power at an operating cost significantly lower than current market price for firm baseload power. TVA expects the same level of low-cost efficient generation at Bellefonte 1. With the margin between the cost of generation at a nuclear unit and the market price of power, TVA would be able to cover both fixed and variable operating costs of generating power at Bellefonte 1, while also reducing TVA debt and sharing revenue with DOE.

23.19 The commentor wants to know what guarantees exist that TVA can finish completion of Bellefonte within the stipulated costs. The commentor asks if all funding for the completion of Bellefonte will be up front prior to completion and before an NRC license is obtained.

Comment Summarized: 506-3

Response: In response to the Secretary of Energy's request that TVA provide its best and final offers, DOE received several proposals for the completion of the Bellefonte facility (see Volume 1, Section 1.1.4 of the CLWR EIS). All of these proposals were for a fixed price, with varying programs for completion funding by DOE. These programs range from two annual up-front payments to six such payments. In all instances, funding would be prior to the operation of this facility and, in all probability, most funding would be prior to obtaining an NRC operating license.

There are no guarantees for the completion of the facility within the stipulated costs. It should be noted, however, that these cost projections are for the completion of a facility which is already 90 percent complete. Furthermore, the cost proposals have been reviewed by three separate, independent, outside groups.

23.20 The commentor expresses belief that the capital costs for the Bellefonte reactors will be significantly more than for the APT and that life cycle costs will be comparable.

Comment Summarized: 503-6

Response: Cost issues associated with the CLWR and the APT are beyond the scope of the CLWR EIS. Nevertheless, official DOE cost estimates for both the APT and the CLWR were made available at the CLWR public hearings (DOE 1998c). Those official cost estimates are DOE's best estimates of the costs for both the CLWR and the APT. Any assumptions and basis for analysis in developing these cost estimates are contained within the cost estimates.

23.21 The commentor asks whether the fixed price for completing the Bellefonte plant would also include defense of the project against any nuclear activist suits or intervenors.

Comment Summarized: 506-4

Response: The costs for potential litigation are not within the scope of the CLWR EIS.

23.22 The commentor states that using the Watts Bar plant only for tritium production clearly is the least expensive reactor option and asks why TVA let this option expire. The commentor suggests TVA's reason was to preclude the lower-priced option (Watts Bar only) so that Federal monies could be obtained to finish the Bellefonte plant. Another commentor asks why TVA did not include negative EIS comments in their latest offer letter to DOE.

Comments Summarized: 232-3, 700-2, 806-5

Response: DOE is not in a position to explain TVA's decisions during the procurement process. As discussed in Volume 1, Section 1.1.4 of the CLWR EIS and in the response to Comment Summary 06.03, TVA resubmitted a proposal for irradiation services at the Watts Bar plant and the Sequoyah plant after the issuance of the CLWR Draft EIS.

23.23 A commentor feels that, as part of the decision process, TVA and DOE should compensate local government, thereby helping local ratepayers and taxpayers. Another commentor asks what effect irradiation services at the Watts Bar and Sequoyah plants would have on ratepayers, and whether electric rates would change. Another commentor asks whether residents of Rhea County would receive a tax break.

Comments Summarized: 230-2, 802-2, 809-1

Response: If Watts Bar and Sequoyah were selected, DOE expects to enter into an interagency agreement with TVA under the Economy Act, discussed in Volume 1, Section 1.1.4 of the CLWR EIS. Under that agreement, DOE would pay TVA for the cost of tritium production. This would have no effect on ratepayers or taxpayers. If Bellefonte were selected, the benefit from electricity sales revenue could be split between TVA and DOE, depending on the outcome of contract negotiations. Because DOE funding to complete Bellefonte would come from Congress, any revenue returned to DOE to offset initial expenditure would benefit U.S. taxpayers. Any revenue returned to TVA would benefit the agency and its ratepayers.

23.24 A commentor asks for clarification regarding the numbers given for the Watts Bar and Sequoyah plants in the presentation. The commentor also asks about the breakdown that led to TVA's estimate of $85 million for irradiation services. The commentor suggests that TVA is inflating the taxpayer costs to make the Bellefonte alternative more attractive.

Comment Summarized: 803-1

Response: Negotiations are currently ongoing between TVA and DOE to determine the cost of irradiation services. Details of the negotiation process are procurement-sensitive.

23.25 A commentor asks how TVA can reduce its estimated costs for completing the Bellefonte plant for tritium production. The commentor asks whether ratepayers would have to pay more to make up the $.5 billion difference.

Comment Summarized: 806-1

Response: In the latest proposal, TVA assumes a share of the costs to complete Bellefonte. TVA would borrow money to do this; the rates would not be increased, but the debt pay-down plan would be delayed.

23.26 A commentor asks whether TVA is paying back the principal on its debt yet.

Comment Summarized: 810-2

Response: The principal on the Bellefonte debt is included as part of the 10-year debt package that is currently being paid.

23.27 A commentor asks whether DOE has determined over the 25- or 30-year production period which reactor method is the most economical way to produce tritium.

Comment Summarized: 810-3

Response: Because the procurement process in ongoing, definitive costs have not been finalized yet and, therefore, it is not possible to say with absolute certainty which of the reactor alternatives is the most economical. Based on current estimates on a life cycle cost basis, TVA's proposal to complete Bellefonte and produce tritium is the least costly alternative, but in the near term, the irradiation services proposal to use Watts Bar and Sequoyah is less costly than completing and operating Bellefonte.

CATEGORY 24: MISCELLANEOUS

24.01 The commentor questions whether DOE and TVA can effectively communicate.

Comment Summarized: 501-8

Response: The effectiveness of communication between TVA and DOE is beyond the scope of the EIS.

24.02 The commentor expresses concern that nuclear energy is a complicated process and wonders if using highly complicated processes makes mistakes and failures more likely.

Comment Summarized: 707-13

Response: The CLWR EIS assesses the environmental impacts associated with tritium production in one or more CLWRs. Included in the EIS is an assessment of the probabilities, consequences, and risks associated with potential accidents. Currently, tritium is being produced in Watts Bar 1 as part of the Lead Test Assembly demonstration. Results from that demonstration are confirming that tritium production in a CLWR is straightforward and safe.

24.03 The commentor asks if the amount of tritium now possessed by the United States is losing its efficiency or leaking somewhat and, if so, is there no way to prevent this loss.

Comment Summarized: 707-4

Response: Tritium is a radioactive form (or isotope) of the hydrogen atom and, like all radioactive isotopes, will spontaneously change into a different isotope (Helium-3) through a process called "radioactive decay." There is no known way to stop tritium from decaying.

24.04 The commentor questions, "What is the current uranium-235 enrichment, 4.0 percent? Why would DOE supply the higher-enriched uranium, and not the U.S. enrichment plants? Is it because of the uranium surplus at DOE?" The commentor wonders if releases from higher enrichment fuel would be greater.

Comment Summarized: 143-7

Response: As discussed in Volume 1, Appendix A, normal enrichment of fuel used in CLWRs is from 4.2 to 4.5 percent. Full production loading of TPBARS may require the use of slightly higher enriched fuel (4.6 to 4.9 percent). Such an increase would be allowed by the current NRC licenses (current NRC licensing provisions allow for up to 5 percent enrichment).

DOE has offered to provide TVA with any required uranium of higher enrichment levels to avoid causing TVA any cost increases for normal operations. DOE already has specific quantities of highly enriched uranium which could be blended down to the appropriate concentration levels (within the NRC licensing limitations), should such fuel be required. DOE has clarified this in Volume 1, Section 5.2.7 of the CLWR EIS. The somewhat higher enrichments and reduced fuel assembly burnups associated with the tritium production core, as compared to the conventional core designs, can influence the radiological source term used in the calculation of radiological emissions other than tritium during normal operation and accident conditions. The *Tritium Production Core Topical Report* (WEC 1998) quantified this effect and concluded that, overall, the fission product inventories were the same or lower in the tritium-producing core. Therefore, the analysis presented in the CLWR EIS, which does not account for the increased enrichment, is conservative.

24.05 The commentor asks how a one-year delay in completing construction at Bellefonte 1 would impact the schedule to complete the Tritium Extraction Facility by 2005. Another commentor questions why DOE would want to run the Tritium Extraction Facility furnaces within the top 90th percentile of their maximum temperature, and why there is no data in the CLWR Draft EIS that addresses recovery efficiency in the Tritium Extraction Facility.

Comment Summarized: 500-3

Response: The Tritium Extraction Facility construction is not related to the completion of Bellefonte. Therefore, any delay associated with completing Bellefonte would have no impact on the construction of the Tritium Extraction Facility. While specific comments regarding the Tritium Extraction Facility are beyond the scope of the CLWR EIS, these comments have been forwarded to the preparers of the Tritium Extraction Facility EIS for response and inclusion in the Tritium Extraction Facility EIS.

24.06 The commentor asks where the tritium produced by a CLWR would go and what would be done with it. Another commentor asks whether the tritium would be extracted immediately at the Tritium Extraction Facility or stored at the site.

Comments Summarized: 603-1, 629-2, 704-7

Response: As explained in Volume 1, Chapter 1 of the CLWR EIS, tritium produced at a TVA reactor would be shipped to the Savannah River Site for extraction from the TPBARs. This tritium would then undergo purification and would be loaded into the tritium reservoir for use in the nuclear weapons stockpile. Tritium would be extracted at the Tritium Extraction Facility as necessary to meet stockpile demands. The Tritium Extraction Facility would have the capability to store irradiated TPBARs until extraction is necessary.

24.07 The commentor remarks that the actual tritium extraction occurs in areas already overexposed to mismanagement. TVA would only expose special control rods and ship them to the extraction plant. It appears that this in no way adds significantly to any existing situation.

Comment Summarized: 103-2

Response: The potential environmental impacts associated with the irradiation of TPBARs at any of five TVA reactors are presented in the CLWR EIS. Following irradiation, TPBARs would be shipped to the proposed Tritium Extraction Facility that would be constructed at the Savannah River Site. As discussed in Volume 1, Section 1.5.2.2 of the CLWR EIS, a separate EIS has been prepared for this facility to evaluate the potential environmental impacts of the tritium extraction. A summary of the environmental consequences related to the construction and operation of the Tritium Extraction Facility appears in Section 5.3.4 of the CLWR EIS.

24.08 The commentor expresses the opinion that to establish a new use for civilian nuclear power reactors is counter to the growing worldwide consensus that nuclear power should be eliminated as a source of energy since it is inherently unsafe, uneconomic, and most importantly, unnecessary.

Comment Summarized: 110-6

Response: Whether there is any worldwide consensus regarding nuclear power is beyond the scope of the CLWR EIS. Nonetheless, the position for many of the world's governments in developed countries is that nuclear power will continue to play an important role in the next century in meeting substantially increasing energy demands and may be essential to cope with global warming. The construction of new nuclear plants outside of the United States continues to increase, especially in the Far East, to satisfy the rising demand for energy in the fast-expanding economies of Japan, the Republic of Korea, and China. The strengthening of nuclear safety is now an international collaborative effort. TVA takes its responsibility seriously to maintain competitive rates and growth in the Tennessee Valley while protecting the health and safety of the environment and the public; the performance records of its nuclear program support this priority. For example, last year TVA's nuclear plants generated 27 percent of the total TVA generation, allowing TVA to meet record peak demands during the summer and winter. TVA's operating nuclear plants have been named among the most efficient nuclear utilities in the country and as leaders in cost reduction.

24.09 The commentor states that, when his group of retired engineers, scientists, and physicists met in April of last year, someone told them there was absolutely no increase in any kind of disease, including cancer, in areas where TVA facilities are operating.

Comment Summarized: 620-2

Response: A National Cancer Institute survey in the *Journal of the American Medical Association*, March 20, 1991 (NCI 1991), showed no general increased risk of death from cancer for people living in the 107 counties containing or closely adjacent to 62 nuclear facilities. Included in the study were 52 commercial nuclear power plants, 9 DOE research and weapons plants, and 1 commercial fuel processing plant. TVA's Brown's Ferry and Sequoyah Nuclear Plants were included in this survey.

24.10 The commentor asks for clarification of a statement found in the CLWR Draft EIS Summary that indicates no design changes would be necessary to complete Bellefonte for tritium production. The commentor suggests clarification be added to the summary document.

Comment Summarized: 706-5

Response: Minor modifications would be required for radiological, security, and operational impacts. Additional radiological monitoring equipment such as portable monitors, discrete air samplers, and liquid scintillation counters would be procured, and air and water sampling station equipment would be installed for environmental monitoring. Some minor tooling modifications may be made to facilitate handling of TPBARs in the spent fuel storage pool. Also, some security enhancements would be made to accommodate storage of classified documents and TPBARs. However, no major modifications would be required for tritium production, as discussed in Section 3.2.5.3 of the CLWR EIS.

24.11 The commentor wants clarification that TVA will own the facility and at no time will it be sold or given to DOE.

Comment Summarized: 714-2

Response: TVA has no plans or intent to transfer ownership to DOE. Since TVA facilities such as Watts Bar and Bellefonte are government-owned, there is no reason to sell these facilities to DOE. As discussed in Volume 1, Section 1.1.1 of the CLWR EIS, DOE is only interested in the purchase of irradiation services, not the purchase of a reactor.

24.12 Commentors note editorial changes to be made to the CLWR Draft EIS, including the addition of words and sentences to clarify the text, the correction of the sequence of footnotes to some tables, the elimination of inconsistent terminology, and the correction of typographical or grammatical errors.

Comments Summarized: 89-1, 94-1, 146-4

Response: The text cited by the commentors has been revised. Additional edits have been made throughout the document as necessary. A list of sections affected by this type of revision is included in Volume 1, Section 1.9 of the CLWR EIS.

24.13 Commentors request clarification concerning the cumulative effects of using multiple reactors.

Comments Summarized: 146-23, 703-6

Response: Volume 1, Section 3.2.6 explains that the impacts of using more than one CLWR for tritium production can be determined by adding the impacts of each individual CLWR together. Tables 5-59, 5-60, and 5-62 in the CLWR Final EIS present the cumulative impacts at each site. For the sites with two potential units operating (Sequoyah, Bellefonte) the CLWR Draft EIS assumed that one of the units is operating in a tritium-producing mode while the other is operating in a normal electricity-producing mode. Tables 5-51 and 5-53 have been revised in the CLWR Final EIS to reflect tritium production in both units at the same time; the tables appear as Tables 5-60 and 5-62 in the CLWR Final EIS.

24.14 The commentor notes that the CLWR Draft EIS fails to list and examine mitigation measures for the increased risks due to the proposed action.

Comment Summarized: 116-5

Response: The CLWR Draft EIS discusses the need for mitigation measures right after the presentation of the impacts for each environmental resource, if such need is warranted. The CLWR Final EIS includes a summary of these discussions in a new Volume 1, Section 5.5.

24.15 The commentor requests information on the effect on the reactor physics and asks about the differences between regular burnable absorber rods and TPBARs.

Comment Summarized: 143-6

Response: Regular burnable absorber rods are depleted during a normal reactor cycle. That is, at the end of a normal operating cycle, regular burnable absorber rods no longer have the ability to absorb neutrons. In general, the TPBARs will continue to absorb neutrons throughout the entire fuel cycle. Since the TPBARs will absorb more neutrons than regular burnable absorber rods during a reactor operating cycle, they could require higher enriched fuel to have equivalent core performance characteristics at the end of the operating cycle. Prior to operating the reactor, the NRC will approve the analyses of specific tritium production reactor core configurations. NRC license holders must submit core reload analyses and demonstrate that core performance for a new core configuration, including tritium production cores, is within the licensing basis performance envelope for the plant. The NRC currently licenses CLWRs to operate with fuel enrichments up to 5 percent.

24.16 The commentor notes that Table 4-11 in the CLWR Draft EIS did not contain a reference to the source of the data presented in the table. The commentor recommends the inclusion of the reference.

Comment Summarized: 146-5

Response: The reference (TVA 1998e, now TVA 1998d) is shown at the bottom of Table 4-11 of both the Draft and Final versions of the CLWR EIS.

24.17 The commentor notes that the first assumption listed in Section 5.1.2 of the CLWR Draft EIS is not an assumption, but a statement concerning the conservatism of the model used. The commentor suggests that the statement be moved from the list of assumptions up into the paragraph which precedes the list of assumptions.

Comment Summarized: 146-8

Response: The list of assumptions provides numerous examples of how the analysis was conservatively performed. Part of this conservative approach was the use of computer models, which conventionally overestimate health risks associated with low dose rates. Thus, the inclusion of this passage within the assumptions list is deemed appropriate.

24.18 The commentor, referring to Sections 5.2.1, 5.2.3, 5.2.7, and Tables 5-46 and 5-47 of the CLWR Draft EIS, questions the consistency of the use of the terms "baseline" and "baseline configuration." The commentor recommends that the baseline assumed in Section 5.2.9 be stated explicitly and the tables be checked for consistency.

Comment Summarized: 146-22

Response: Volume 1, Section 5.2.9 and associated tables have been revised to reflect consistency in the use of the term "baseline" between text and tables.

24.19 A commentor asks if DOE and TVA are in Y2K [Year 2000] compliance.

Comment Summarized: 800-8

Response: All Federal agencies have a coordinated and aggressive program underway to ensure compliance with Y2K requirements so that they can enter the millennium without any disruptions to required activities. Y2K compliance is outside the scope of the CLWR EIS.

24.20 The commentor, referring to Table 5-32 of the CLWR Draft EIS, remarks that the table does not give units for the data presented. The commentor recommends that units be provided in the table.

Comment Summarized: 146-15

Response: Note "a" of Table 5-42 (Volume 1) of the CLWR EIS (Draft EIS Table 5-32), which is cited in the heading for each column of data, identifies the units as "Increased likelihood of cancer fatality per year."

24.21 A commentor asks what DOE would do if TVA were dismantled as a result of deregulation.

Comment Summarized: 800-7

Response: Speculation as to the continuance or dismantlement of TVA is beyond the scope of the CLWR EIS.

24.22 The commentor asks how many TPBARs were inserted into the Advanced Test Reactor.

Comment Summarized: 704-10

Response: Eleven.

24.23 The commentor, referring to the discussion of a "real" individual in Section 5.2.6 of the CLWR Draft EIS, recommends that information should be included concerning what is meant by placing the word "real" in quotes.

Comment Summarized: 146-17

Response: The term is often used by the NRC in their safety evaluations. The term "real" in quotations indicates that the dose is calculated for actual individuals living near the ISFSI, as opposed to a hypothetical individual. A hypothetical individual is used often in analyses when the results are purposely overestimated for conservatism. Such a hypothetical individual, for example, may be assumed to stand, completely exposed, at the worst possible location for radiological exposure. Volume 1, Section 5.2.6 is revised to include an explanation of a "real" individual.

24.24 A commentor asks what "point of departure" means as used in the slide presentation.

Comment Summarized: 800-1

Response: This phrase was used in the DOE slide presentation on December 14, 1998, to refer to the starting point of discussions between DOE and TVA on all the elements of the Watts Bar/Sequoyah proposal. In other words, DOE considers that TVA proposal negotiable.

24.25 A commentor notes that both the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) say they have Memorandums of Understanding with TVA that allow an exchange of paperwork instead of onsite inspections. The commentor asks where copies of these Memorandums of Understanding can be obtained.

Comment Summarized: 811-3

Response: According to TVA's Office of General Council, there are no specific memoranda of understanding between TVA and these agencies.

24.26 A commentor asks whether tritium production would shorten the life span of the Watts Bar or Sequoyah units.

Comment Summarized: 814-1

Response: As discussed in Volume 1, Section 3.2.1 of the CLWR EIS, tritium production is not expected to shorten the life span of the Watts Bar or Sequoyah plants.

24.27 A commentor asks how many organizations are qualified to do this job that did not want it. The commentor asks why TVA bid on DOE tritium production. The commentor asks why TVA had no competition.

Comments Summarized: 813-1, 815-1

Response: There are approximately 72 pressurized water reactors in the United States that potentially could be used for tritium production, as discussed in Volume 1, Section 3.2.2. It is unknown how many utilities are represented by that number. TVA bid on the DOE tritium production proposal because it felt that responding to DOE's request for proposals is in the best interest of TVA. With regard to why TVA had no competition, DOE will not speculate on why other utilities did not bid.

24.28 A commentor asks when the last environmental impact study was done that used Bellefonte as a nuclear reactor without tritium production.

Comment Summarized: 816-1

Response: The *Final Environmental Impact Statement Related to Construction of Bellefonte Nuclear Plant Units 1 and 2 at the Tennessee Valley Authority* was published in June 1974 (TVA 1974). TVA reviewed the continuing validity of this document in 1994. This document addressed construction and operation of Bellefonte Units 1 and 2 as nuclear-powered electrical generation facilities only, and did not address tritium production.

24.29 A commentor states that tritium is a weapons component, and DOE should be honest about that fact.

Comment Summarized: 835-3

Response: DOE recognizes that tritium is a component of nuclear weapons and addresses this point in Volume 1, Section 1.3.2 of the CLWR EIS. Within that section the following statement is made: "Tritium is not a fissile material and cannot be used by itself to construct a nuclear weapon. However, tritium is a key component of all nuclear weapons presently in the nation's nuclear weapons arsenal. Tritium enables weapons to produce a larger yield while reducing the overall size and weight of the warhead."

24.30 A commentor expresses concern about the impacts from tritium production on uranium mine workers and people living in the vicinity of uranium mines.

Comment Summarized: 835-4

Response: As indicated in Volume 1, Section 5.2.7 of the CLWR EIS, the enriched uranium that would be used for fuel assemblies in tritium production has already been mined and processed. Additionally, DOE may provide blended-down highly enriched uranium from its inventory that has been set aside for national security purposes. Section 5.2.7 discusses the environmental impacts associated with blending down this highly enriched uranium. No additional environmental consequences of any significance are expected from TPBAR fabrication activities other than the fabrication and assembly of TPBARs and the conversion of highly enriched uranium to commercial reactor fuel.

24.31 Several commentors ask why TVA's irradiation services proposal is for 25 years, when the original programmatic proposal was for 40 years. The commentor also asks whether the requirements changed.

Comment Summarized: 803-4, 808-4

Response: In the original request for proposals, DOE asks for a minimum 10-year contract for irradiation services. The commentor is correct that the programmatic plan calls for 40 years of tritium production. TVA has offered 25 years, anticipating that DOE may issue another request for irradiation services proposals at some time.

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