



# **Supplemental Environmental Impact Statement (SEIS) for the Production of Tritium in a Commercial Light Water Reactor**

**Public Hearings on Draft SEIS**

September 9-10, 2014

National Nuclear Security Administration (NNSA)

Department of Energy (DOE)



# Background



- NNSA is the federal agency responsible for providing the nation with nuclear weapons and ensuring those weapons remain safe and reliable
- Tritium is a radioactive isotope of hydrogen and is an essential component of every weapon in the current and projected U.S. nuclear weapons stockpile.
- Because tritium decays at a rate of 5.5 percent per year, it must be replenished periodically



# Background (cont.)



- In March 1999, DOE published the Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (CLWR EIS)
- On May 14, 1999, DOE announced the Record of Decision (ROD) for the 1999 CLWR EIS, in which DOE decided to utilize:
  - TVA's Watts Bar Unit 1 and
  - Sequoyah Units 1 and 2 for tritium production



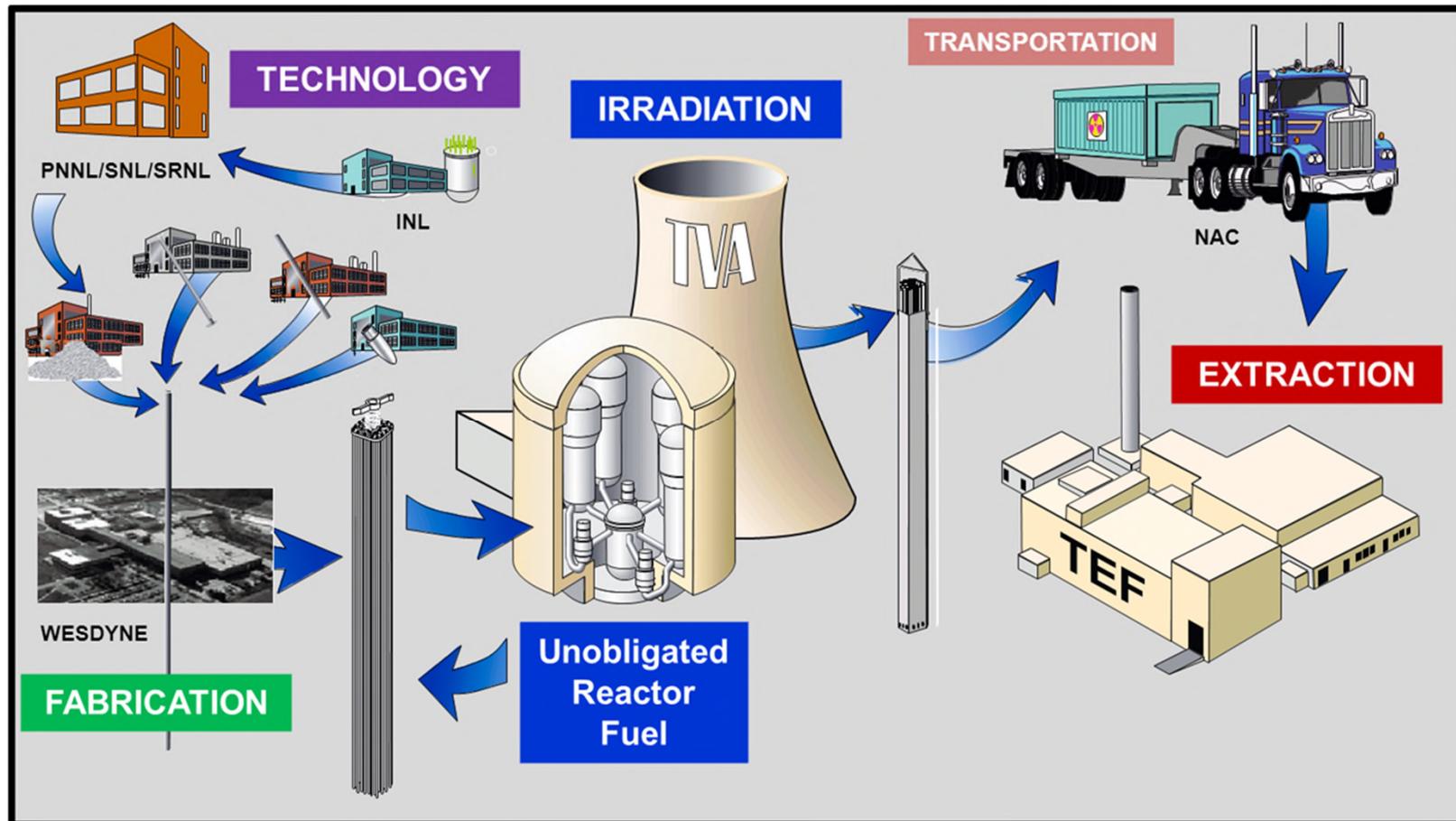
# Background (cont.)



- In 2002, TVA received license amendments from the Nuclear Regulatory Commission (NRC) to produce tritium at Watts Bar 1 and Sequoyah 1 and 2
- Since 2003, TVA has been producing tritium for NNSA by irradiating tritium producing burnable absorber rods (TPBARs) at Watts Bar 1



# Tritium Readiness Production Flow



*Tritium Readiness  
Program Description*

*Provide tritium production capability by fabricating TPBARs, transport irradiated TPBARs, and extract tritium at the TEF; maintain RDT&E program to support production mission*



# Tritium Producing Burnable Absorber Rods (TPBARs)



- TPBARs are placed in the same locations in the reactor core and perform the same function as standard boron burnable absorber rods— they absorb excess neutrons during reactor operation. However, TPBARs use lithium-6 rather than boron. When lithium-6 absorbs neutrons, tritium is produced
- During the reactor’s normal operations cycle (approximately 18 months), TPBARs are irradiated and tritium gas generated is captured in the tritium “getter” (a solid metal nickel-plated zirconium material in the TPBAR)



# Tritium Producing Burnable Absorber Rod (TPBAR)



## Lithium Aluminate Pellets

Ceramic material containing Lithium-6, the active ingredient that transmutes to tritium when a neutron is absorbed.

## Zircaloy Liner

Supports the pellet stack and oxidizes to remove water.

## Zircaloy Getter

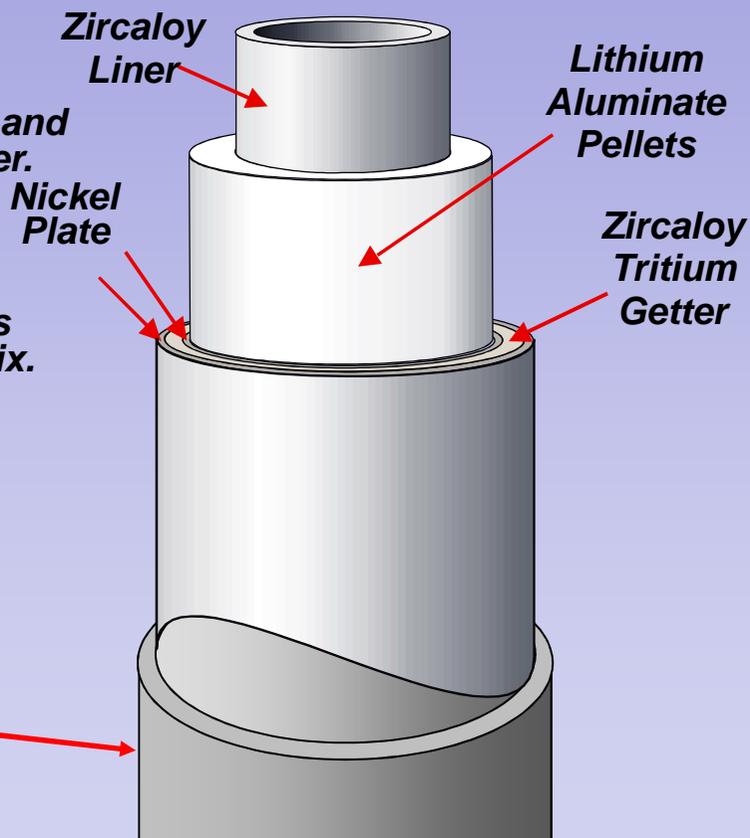
Absorbs free tritium gas and holds in a solid matrix.

## Nickel Plating

Protects the getter from oxidation.

## Stainless Tube with Aluminide Coating

Outer barrier to permeation.



Each rod is 12 feet long and ~3/8 inches in diameter. Assemblies consist of 16 or 24 rods suspended from a base plate





# Tritium Releases



- All nuclear reactors produce tritium as a normal by-product of their operations
- Tritium (whether from TPBARs or normal reactor operations) enters the reactor coolant system where it is treated as radioactive water
- Tritium is released under closely controlled and monitored conditions to the Tennessee River in accordance with regulations that protect the health and safety of the public and environment. Releases from Watts Bar to the Tennessee River are carefully managed and reported to the NRC to ensure that downstream concentrations are kept well within drinking water and other standards as applicable



# Tritium Permeation



- Permeation of small amounts of tritium through the TPBAR cladding into the reactor coolant systems is expected. The CLWR EIS projected and analyzed that tritium permeation would be less than or equal to one curie/TPBAR/year
- Based on tritium production experience at Watts Bar 1, tritium permeation through TPBAR cladding occurs at a higher rate (approximately 4 curies/TPBAR/year) than had been projected
- At the end of the reactor operating cycle, there are approximately 10,000 curies of tritium in each TPBAR
- Even with higher permeation levels than previously projected, the amount of tritium released from Watts Bar 1 to the environment is well below NRC limits



# Why has NNSA Prepared this SEIS?



- NNSA has prepared this SEIS to:
  - Analyze the potential environmental impacts associated with increased tritium permeation levels observed since 2004
  - Analyze the potential environmental impacts associated with increasing the number of TPBARs irradiated per fuel cycle, which is required to supply reasonably foreseeable tritium requirements
  - Update changes in the regulatory, environmental, and operating conditions since 1999



# Purpose of this Meeting



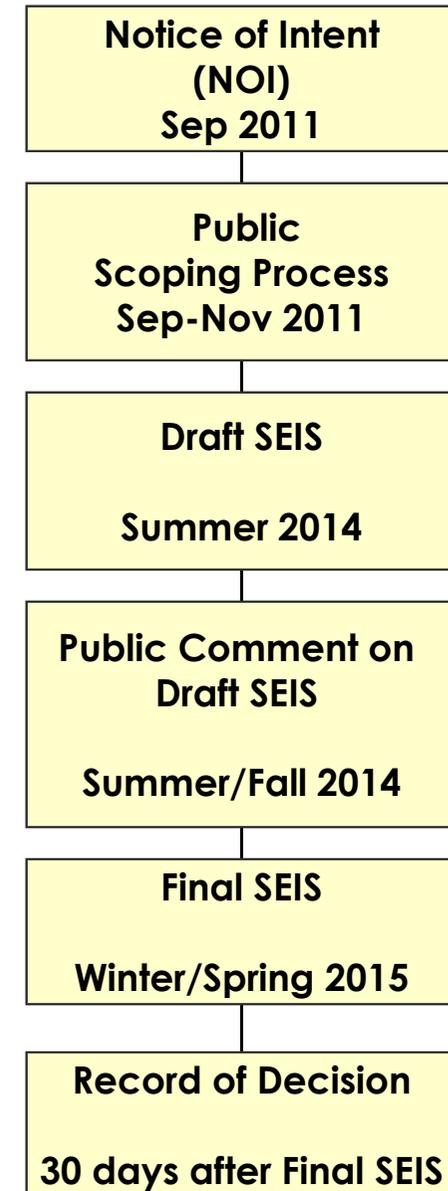
- To provide key information contained in the Draft SEIS to the public
- To receive public comments on the Draft SEIS
  - NNSA will consider all comments received
  - NNSA will make changes to the Final SEIS, as appropriate



# NEPA Process and Schedule



- Provide for public involvement and ensure that public officials consider the environmental effects of proposed actions and alternatives in order to foster better decision-making
- Supplemental EIS is required when there are substantial changes to a proposal or when there are significant new circumstances or information relevant to environmental concerns
- This Supplemental EIS builds on the 1999 CLWR EIS and includes a thorough, up-to-date analysis, particularly in areas in which there have been significant changes since the original CLWR EIS was published





# Content of SEIS



**Summary**  
**Introduction and Background**  
**Purpose and Need**  
**Alternatives**  
**Affected Environment**  
**Environmental Impacts**  
**Regulatory Compliance**  
**Technical Appendices**



# SEIS Alternatives



**Alt. 1:** Watts Bar site only (2,500 TPBARs maximum). This is the preferred alternative

**Alt. 2:** Sequoyah site only (2,500 TPBARs maximum)

**Alt. 3:** Both Watts Bar and Sequoyah sites (2,500 TPBARs maximum)

**Alt. 4:** Watts Bar site only (5,000 TPBARs maximum)

**Alt. 5:** Sequoyah site only (5,000 TPBARs maximum)

**Alt. 6:** Both Watts Bar and Sequoyah sites (5,000 TPBARs maximum)

**No Action (“Status Quo”):** Produce tritium at currently approved facilities (Watts Bar 1 and Sequoyah 1 and 2) to keep permeation levels within currently approved NRC license and regulatory limits



# SEIS Assessments



- Land
- Air Quality
- Water Resources
- Biotic Resources
- Cultural Resources
- Waste Management
- Intentional Destructive Acts
- Infrastructure
- Socioeconomics
- Environmental Justice
- Human Health
- Accidents
- Transportation



# Key Conclusions in Draft SEIS



- Tritium releases would have an insignificant impact on the health of workers and the public
  - Worker dose would result in additional latent cancer fatality risk of a maximum of 1 chance in 100,000
  - Public dose would result in an additional latent cancer fatality risk of a maximum of 1 chance in 2.5 million



## Key Conclusions in Draft SEIS (con't)



- Tritium releases from TPBAR irradiation increase tritium concentrations in the Tennessee River in comparison with not irradiating TPBARs
  - Even with higher permeation levels than previously projected, tritium concentration at any drinking water intake would remain well below the maximum permissible EPA drinking water limit of 20,000 picocuries per liter
  - Tritium concentration at any drinking water intake would be no more than about one-tenth the 20,000 picocurie per liter limit

Note: drinking water limit of 20,000 picocuries per liter is based on a dose of 4 millirem per year, which is less than 1 percent of the dose the average person receives from both natural and manmade radiation



## Key Conclusions in Draft SEIS (con't)



- TPBAR irradiation would not have adverse impact on the operation and safety of TVA reactor facilities
  - Potential accident risks would remain essentially the same
  - Potential consequences of intentional destructive acts would be no worse than other bounding accidents
  - TPBAR irradiation could increase spent fuel generation
    - Increase of 24% for 2,500 TPBARS and 48% for 5,000 TPBARS
    - TVA has an infrastructure in place or has a plan to manage the increased volume of spent nuclear fuel



# Record of Decision (ROD)



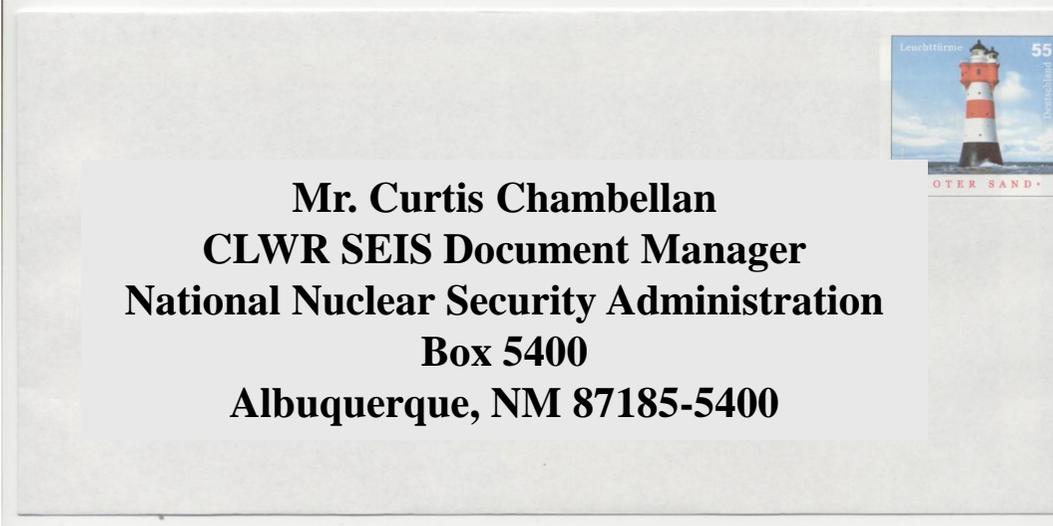
- In making a decision among the alternatives considered, NNSA will consider input from the SEIS as well as technical, policy and cost analyses
- ROD will announce decisions regarding:
  - Number of TPBARs irradiated per fuel cycle
  - Which site(s) and how many reactors TVA may use to meet NNSA tritium requirements



# How to Provide Comments



- At public meeting
  - Oral and written
- By U.S. mail →
- By e-mail:  
tritium.readiness.seis@doeal.gov
- By fax:  
505-284-7084

A photograph of a white envelope with a printed address label. The label text is centered and reads: "Mr. Curtis Chambellan", "CLWR SEIS Document Manager", "National Nuclear Security Administration", "Box 5400", "Albuquerque, NM 87185-5400". In the top right corner of the envelope, there is a small rectangular sticker featuring a lighthouse and the text "Leuchtturm 55" and "OTER SAND".

**Mr. Curtis Chambellan**  
**CLWR SEIS Document Manager**  
**National Nuclear Security Administration**  
**Box 5400**  
**Albuquerque, NM 87185-5400**

***Note: Comment period ends September 22, 2014***



# NRC SQN Licensing

## Submitting Comments After the Meeting

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- By mail: Chief, Rules, Announcements, and Directives Branch (RADB)  
Division of Administrative Services  
Mailstop 3WFN-06-44M  
U.S. NRC, Washington, D.C. 20555-0001
- In person: Soddy-Daisy City Hall  
September 17, 2014; 2-4 pm and 7-9 pm
- Internet: [www.regulations.gov](http://www.regulations.gov), docket ID: NRC-2013-0037

**Comments due by September 29, 2014**