DOE/EH-0525

99

HIGHLY ENRICHED URANIUM WORKING GROUP REPORT

ON

ENVIRONMENTAL, SAFETY AND HEALTH VULNERABILITIES ASSOCIATED WITH THE DEPARTMENT'S STORAGE OF HIGHLY ENRICHED URANIUM

VOLUME II: NUMBER 6

SAVANNAH RIVER SITE

WORKING GROUP AND SITE ASSESSMENT TEAM REPORTS

U.S. DEPARTMENT OF ENERGY

DECEMBER 1996

Highly Enriched Uranium Working Group

Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Project Leader*
Marcia B. Allen, Parallax, Inc.*
David R. Allen, U.S. DOE, Oak Ridge Operations Office
John F. Baker, U.S. DOE, Office of Environmental Management
Frank W. Baxter, U.S. DOE, Office of Environmental Management
Shroff P. Behram, U.S. DOE, Office of Environmental Management
Alan I. Berusch, U.S. DOE, Office of Civilian Radioactive Waste Management
Sushil K. Bhatnagar, U.S. DOE, Office of Environment, Safety and Health
John L. Boccio, Brookhaven National Laboratory
Rex J. Bowser, U.S. DOE, Office of Environment, Safety and Health
William G. Boyce, U.S. DOE, Office of Environmental Management
Edson C. Brolin, U.S. DOE, Office of Environmental Management
Harold M. Burton, SCIENTECH, Inc.*
Robert E. Canaan, ANRCP, University of Texas*
Frank Y. Chen, U.S. DOE, Office of Environment, Safety and Health*
Mary Anne Chillingworth, SCIENTECH, Inc.
Shirley O. Cox, Lockheed Martin Energy Systems*
Ralph D. Crowe, Westinghouse Hanford Company
Maurice W. Daugherty, U.S. DOE, Office of Environmental Management
Robert M. Davis, Lockheed Martin Energy Systems
William C. Dennis, Jr., U.S. DOE, Savannah River Operations Office
Leo Derderian, U.S. DOE, Office of Environment, Safety and Health
Walter K. Duerksen, Lockheed Martin Energy Systems*
Richard D. Duncan, U.S. DOE, Office of Fissile Materials Disposition
Paul S. Dunn, Los Alamos National Laboratory
Salma El-Safwany, U.S. DOE, Oakland Operations Office
Rowland E. Felt, U.S. DOE, Office of Environment, Safety and Health*
Tim K. Gaines, U.S. DOE, Office of Environment, Safety and Health
Gary J. Gibson, Lockheed Martin Energy Systems
Harry R. Griffith, U.S. DOE, Amarillo Area Office
Pranab K. Guha, U.S. DOE, Office of Environment, Safety and Health*
Daniel J. Guzy, U.S. DOE, Office of Environment, Safety and Health*
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Deputy Project Leader*
Scott E. Harlow, U.S. DOE, Office of Nuclear Energy
Carl Hassell, Jr., U.S. DOE, Office of Nonproliferation and National Security
Steven L. Hayes, Argonne National Laboratory-West
William M. Hogle, Independent Consultant*
Michael K. Hooper, U.S. DOE, Oakland Operations Office
Darrell A. Huff, U.S. DOE, Office of Environment, Safety and Health
Ernest J. Hughes, U.S. DOE, Chicago Operations Office
Thomas J. Hull, U.S. DOE, Office of Environment, Safety and Health*
Monte L. Hyder, Westinghouse Savannah River Company
Robert A. Intrater, U.S. DOE, Pantex Plant
Brent H. Ives, Lawrence Livermore National Laboratory
William D. Jensen, U.S. DOE, Idaho Operations Office
Hoyt C. Johnson, U.S. DOE, Office of Environmental Management
Angel B. Joy, U.S. DOE, Richland Operations Office
Linda L. Kanz, SCIENTECH, Inc.*
Vishwa M. Kapila, U.S. DOE, Office of Environment, Safety and Health
Ashok K. Kapoor, U.S. DOE, Office of Environmental Management
Narsaiah Karne, U.S. DOE, Oak Ridge Operations Office
Sue M. King, U.S. DOE, Amarillo Area Office
Peter J. Klemkowsky, U.S. DOE, Office of Environmental Management
George V. Klipa, U.S. DOE, Office of Environmental Management
Barbara K. Kneece, Parallax, Inc.*
Alan M. Krichinsky, Oak Ridge National Laboratory
Calvin K. Lai, U.S. DOE, Office of Environment, Safety and Health*
David C. Lannom, Lockheed Martin Energy Systems
James A. Larson, U.S. DOE, Office of Energy Research
Raymond Lopiccolo, U.S. DOE, Office of Environmental Management
Jon MacLaren, U.S. DOE, Office of Defense Programs
Richard Mah, Los Alamos National Laboratory
Elmer H. Mann, Mason & Hanger
Kathleen O. Martin, U.S. DOE, Office of the General Counsel
Robert C. McBroom, U.S. DOE, Oak Ridge Operations Office
Timothy S. McCune, U.S. DOE, Office of Defense Programs

*Project Support Group

Evelyn D. McKamy, U.S. DOE, Office of Defense Programs
Thomas P. McLaughlin, Los Alamos National Laboratory
Donald L. McWhorter, Westinghouse Savannah River Company
Edwin N. Moore, Westinghouse Savannah River Company
Charles L. Nalezny, U.S. DOE, Office of Environmental Management
John W. Newton, U.S. DOE, Office of Defense Programs
David J. Nickless, U.S. DOE, Rocky Flats Field Office
Jon B. Nielsen, Los Alamos National Laboratory*
P. K. Niyogi, U.S. DOE, Office of Environment, Safety and Health*
Carl F. Obenchain, Global Technologies, Inc.*
Craig S. Olson, Lockheed Martin Idaho Technologies Company
Steven S. Payne, U.S. DOE, Albuquerque Operations Office
James A. Phoenix, U.S. DOE, Los Alamos Area Office
W. Wilson Pitt, Jr., Texas A&M University*
John E. Powell, Lockheed Martin Energy Systems
Garland R. Proco, NAC International
William C. Rask, U.S. DOE, Rocky Flats Field Office
Bryce L. Rich, SCIENTECH, Inc.*
Lewis L. Richey, Kaiser-Hill Company, L.L.C.
Roger D. Rollins, U.S. DOE, Savannah River Operations Office
Burton M. Rothleder, U.S. DOE, Office of Environment, Safety and Health
Tracy S. Rudisill, Westinghouse Savannah River Company
John J. Saurwein, General Atomics
Subir K. Sen, U.S. DOE, Office of Environment, Safety and Health
Dustin M. Simonson, Roy F. Weston, Inc.
Robert C. Singleterry, Argonne National Laboratory-West
Nancy L. Still, SCIENTECH, Inc.*
Dennis L. Strenge, Pacific Northwest National Laboratory*
Anthony L. Takacs, U.S. DOE, Portsmouth Site Office
Sotirios (Sam) Thomas, U.S. DOE, Office of Environmental Management
Philip K. Tubesing, Los Alamos National Laboratory
James E. Vath, Lockheed Martin Energy Systems*
Russell J. Vranicar, U.S. DOE, Portsmouth Site Office
David L. Wall, U.S. DOE, Oak Ridge Operations Office
Patrick A. Ward, SCIENTECH, Inc.*
Dawn E. Wechsler, U.S. DOE, Oakland Operations Office
William C. White, U.S. DOE, Office of Defense Programs
Mark H. Williams, U.S. DOE, Office of Environment, Safety and Health, Senior Management Advisor*
Fred E. Witmer, U.S. DOE, Office of Defense Programs
Robert L. Wright, Mason & Hanger
Colleen A. Yelle, SCIENTECH, Inc.*

External Stakeholders
Wayne L. Andrews, Defense Nuclear Facilities Safety Board
Dennis R. Damon, U.S. Nuclear Regulatory Commission
Ralph Hutchison, Oak Ridge Environmental Peace Alliance
Robert M. Keller, United States Senate Staff
Kristen E. Klasky, U.S. Nuclear Regulatory Commission
Steven L. Krahn, Defense Nuclear Facilities Safety Board
David Levenstein, U.S. Environmental Protection Agency
Robert J. Lewis, Defense Nuclear Facilities Safety Board
Paul M. Longsworth, United States Senate Staff
Michael J. Merritt, Defense Nuclear Facilities Safety Board
Iain G. Ritchie, International Atomic Energy Agency
Joseph C. Sanders, Defense Nuclear Facilities Safety Board
Ralph W. West, Jr., Defense Nuclear Facilities Safety Board

Production Staff—Parallax, Inc.
Patricia A. Cleveland
Pamela M. Curry
Margie S. Lewis
Chris Mancusi
James F. Martin
Ronald D. Shaffer

DO NOT REMOVE
FROM READING ROOM

NMENT

DO NOT REMOVE
FROM READING ROOM

SAVANNAH RIVER SITE
WORKING GROUP AND SITE ASSESSMENT TEAM REPORTS
VOLUME II, NUMBER 6

TABLE OF CONTENTS

PART A: WORKING GROUP ASSESSMENT TEAM REPORT

PART B: SITE ASSESSMENT TEAM REPORT

PART A

WORKING GROUP ASSESSMENT TEAM REPORT

DEPARTMENT OF ENERGY

HIGHLY ENRICHED URANIUM ES&H VULNERABILITY ASSESSMENT

WORKING GROUP ASSESSMENT TEAM REPORT

SAVANNAH RIVER SITE

August 31, 1996

301-903-1498

Fax to
Ron Shaffer

SR 4220 (Rev 9-19-95)
DOE 1430.1D

U.S. Department of Energy
Savannah River Operations Office
Document Review Sheet

To
- ☐ Cognizant Div./Off. _____
- ☐ Patent Attorney, OCC
- ☒ Classification, SMD
- ☐ Export Control Program Manager, SMD
- ☐ Office of External Affairs
- ☐ Technical Information Officer, OPS&FHR

Roger Rollins

Document No.	Document Date
N/A	7-29-96

Title: DOE - Highly Enriched Uranium ES&H Vulnerability Assessment - Working Group Assessment Team Report - Savannah River

Reason For Review
- ☐ Declassification
- ☐ Congressional Request
- ☐ Publication
- ☐ FOI Request No. _____
- ☒ External Distribution Determination _____

Present Classification
- ☒ Unclassified
- ☐ Official Use Only (OUO)
- ☐ Unclassified Controlled Nuclear Information (UCNI)
- ☐ Confidential (C)
- ☐ Secret (S)
- ☐ Restricted Data (RD)
- ☐ Formerly Restricted Data (FRD)
- ☐ National Security Information (NSI)

1. Classification Determination: → Based on Plan View of Building 247-F Being Deleted From Document Per R. Rollins. (Figure 2.3-2, Page 16)
- ☒ Unclassified
- ☐ Confidential
- ☐ Secret
- ☐ RD
- ☐ FRD
- ☐ NSI
- ☐ UCNI
- ☐ OUO

121 - Pages

Classification Officer, SR	Classification Analyst, SR	Date
D. A. Thomas	V. W. Gardner	7-31-96

2. Patent Counsel

From a patent standpoint, there is no objection to publication or declassification as proposed.
- ☐ No items of patent interest noted.
- ☐ Released on basis of patent review by contractor representative.
- ☐ Subject matter previously released for publication.

DOE Case No. _____
- ☐ Release will not adversely affect this case.
- ☐ Release subject to deletions or restrictions as noted.
- ☐ Contractor and DOE restrictive stamps cancelled; DOE disclaimer stamp affixed. This should be done to all copies transmitted.
- ☐ Publication withheld pending patent action

Patent Counsel, SR	Date

3. Cognizant Division/Office
- ☐ Approved for release—a no review determination was made
- ☐ Approved for release
- ☐ Approved for release—subject to changes
- ☐ Not approved for release—revise and resubmit

ognizant Division/Office, SR	Date

Export Control Review
- ☐ Contains ECI
- ☐ Does not contain ECI

Export Control Program Manager, SR	Date

Office of External Affairs
- ☐ Approved for release
- ☐ Not approved for release

Office of External Affairs, SR	Date

Technical Information Officer
- ☐ Approved for release
- ☐ Not approved for release

Technical Information Officer, SR	Date

estor	Date

CONTENTS

ACRONYMS iv

GLOSSARY v

EXECUTIVE SUMMARY ES–1

1.0 INTRODUCTION 1

2.0 EVALUATION OF SITE ASSESSMENT TEAM REPORT AND ES&H VULNERABILITIES 4

2.1 FB-Line 4

2.1.1 Facility Description 4

2.1.2 Site Assessment Team Report Evaluation 5

2.1.3 Working Group Assessment Team Evaluation 5

2.2 Building 235–F 6

2.2.1 Facility Description 6

2.2.2 Site Assessment Team Report Evaluation 7

2.2.3 Working Group Assessment Team Evaluation 10

2.3 Building 247–F 13

2.3.1 Facility Description 13

2.3.2 Site Assessment Team Report Evaluation 14

2.3.3 Working Group Assessment Team Evaluation 15

2.4 H-Canyon 18

2.4.1 Facility Description 18

2.4.2 Site Assessment Team Report Evaluation 21

2.4.3 Working Group Assessment Team Evaluation 22

2.5 HB-Line 25

2.5.1 Facility Description 25

2.5.2 Site Assessment Team Report Evaluation 26

2.5.3 Working Group Assessment Team Evaluation 26

2.6 Building 321–M 28
2.6.1 Facility Description 28
2.6.2 Site Assessment Team Report Evaluation 29
2.6.3 Working Group Assessment Team Evaluation 29
2.7 105–K Assembly Area 30
2.7.1 Facility Description 30
2.7.2 Site Assessment Team Report Evaluation 31
2.7.3 Working Group Assessment Team Evaluation 32
2.8 K-Reactor Disassembly Basin 33
2.8.1 Facility Description 33
2.8.2 Site Assessment Team Report Evaluation 34
2.8.3 Working Group Assessment Team Evaluation 34
2.9 L-Reactor Disassembly Basin 35
2.9.1 Facility Description 35
2.9.2 Site Assessment Team Report Evaluation 36
2.9.3 Working Group Assessment Team Evaluation 36
2.10 P-Reactor Disassembly Basin 37
2.10.1 Facility Description 37
2.10.2 Site Assessment Team Report Evaluation 38
2.10.3 Working Group Assessment Team Evaluation 38
2.11 Receiving Basin for Off-site Fuel 40
2.11.1 Facility Description 40
2.11.2 Site Assessment Team Report Evaluation 40
2.11.3 Working Group Assessment Team Evaluation 40
2.12 Savannah River Technology Center 42
2.12.1 Facility Description 42
2.12.2 Site Assessment Team Report Evaluation 42
2.12.3 Working Group Assessment Team Evaluation 43
2.13 Central Laboratories 43
2.13.1 Facility Description 43
2.13.2 Site Assessment Team Report Evaluation 44
2.13.3 Working Group Assessment Team Evaluation 44

3.0 SUMMARY OF ADDITIONAL VULNERABILITIES IDENTIFIED BY WORKING GROUP ASSESSMENT TEAM 45
3.1 FB-Line 45
3.2 Building 235–F 45
3.3 Building 247–F 46
3.4 H-Canyon 46
3.5 HB-Line 46
3.6 Building 321–M 46
3.7 105–K Assembly Area 47
3.8 K-Reactor Disassembly Basin 47
3.9 L-Reactor Disassembly Basin 47
3.10 P-Reactor Disassembly Basin 47
3.11 Receiving Basin for Off-Site Fuel 47
3.12 Savannah River Technology Center 47
3.13 Central Laboratories 47
3.14 General Site 47

4.0 CONCLUSIONS 48

Appendices:
A Working Group Assessment Team Membership and Biographical Sketches . . . . . A- 1
B Working Group Assessment Team Vulnerability Assessment Forms B-1
C Classification of Vulnerabilities by Likelihood and Consequence C-1
D References D-1
E Stakeholder Involvement E-1
F Previous SRS Vulnerability Assessments F-1

ACRONYMS

ALARA	as low as reasonable achievable
BIO	Basis for Interim Operation
DBA	design basis accident
DBE	design basis earthquake
DBT	design basis tornado
DOE	U.S. Department of Energy
EOP	emergency operating procedures
ES&H	environment, safety and health
EU–S	enriched uranyl nitrate storage
HBBS	Horizontal Bundle and Bucket Storage
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HVAC	heating, ventilation, and air conditioning
NDA	nondestructive analysis
NIM	nuclear incident monitor
NMSP	Nuclear Material Stabilization Program
OSR	Operational Safety Requirement
PEF	Plutonium Experimental Facility
PuFF	Plutonium Fuel Form (Facility)
RCA	Radiological Control Areas
RBOF	Receiving Basin for Off-site Fuel
RC&HP	Radiological Controls and Health Physics
RINM	reactor-irradiated nuclear material
SAR	Safety Analysis Report
SAT	Site Assessment Team
SNF	spent nuclear fuel
SNM	special nuclear material
SQP	Structural Qualification Program
SRS	Savannah River Site
SRTC	Savannah River Technology Center
TSR	Technical Safety Requirement
USQ	unreviewed safety question
VAF	Vulnerability Assessment Form
VTS	Vertical Tube Storage
WGAT	Working Group Assessment Team
WSRC	Westinghouse Savannah River Company

EXECUTIVE SUMMARY

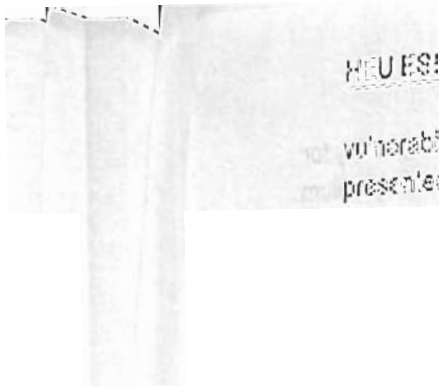
This report presents the results of the Working Group Assessment Team (WGAT) assessment of the storage and handling of highly enriched uranium (HEU) at the Savannah River Site (SRS). The WGAT was on site over the period June 3–14, 1996. The WGAT confirmed the results of the SRS Site Assessment Team's (SAT) self-assessment and the vulnerabilities identified. It also identified additional vulnerabilities. HEU ES&H vulnerabilities are defined as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive materials to the environment, or radiation exposure of the public."

The WGAT consisted of 13 members from the U.S. Department of Energy (DOE), DOE management and operations contractors, and consulting firms. Team activities included a detailed review of the self-assessment report developed by the SRS SAT, inspection of SRS uranium facilities, tabletop discussions with SRS staff regarding potential vulnerabilities, and review of SRS technical reports and analyses related to vulnerabilities.

The WGAT and SAT reviewed 15 major SRS facilities with uranium holdings:

- FB-Line, a plutonium/uranium recovering, processing, and storage facility
- Building 235–F, a plutonium/uranium storage facility with deactivated plutonium-processing operations
- Buildings 247–F, a shut-down uranium conversion facility for producing naval fuel material
- H-Canyon facility, a processing facility for the separation of HEU and neptunium from spent fuel
- HB-Line, a processing and storage facility for uranium, plutonium 238, and neptunium
- 321–M, a shut-down reactor fuel and target-manufacturing facility
- Receiving Basin for Off-site Fuel, a facility for underwater storage of spent fuel, which is currently used to store irradiated uranium fuel
- The Savannah River Technology Center (Buildings 773–A and 735–A), a multipurpose research and development facility that handles small quantities of uranium
- The Central Laboratories (Buildings 772–F and 772–F), an analytical laboratory in the 200–F Area that handles small uranium samples
- K-, L-, and P-Disassembly Basins, storage areas for irradiated uranium fuel
- K-Assembly Area, a storage and staging area for unirradiated uranium fuel

While on site, the WGAT reviewed four vulnerabilities identified initially by the SAT and concluded that one of the four (dealing with DBA releases and DBA-induced criticality in Building 247-F) should be split into two separate vulnerabilities (one for DBA releases and the other for DBA-induced criticality). This caused the total to increase to five. Following reviews, discussions, and facility walk downs, the WGAT identified six additional vulnerabilities, bringing the SRS total to 11



lower reliability and less assurance of adequate barriers to releases of uranium. New vulnerabilities could develop over time.

The WGAT concludes that the highly enriched uranium ES&H vulnerabilities at the SRS do not pose an imminent danger to the health and safety of workers or, the public; or to the environment. However, the potential for criticality in H-Canyon's new outside HEU storage tank and the accumulation of combustible waste in facilities should receive near-term action. The SRS is aware of its uranium vulnerabilities, as demonstrated by the level of detail in the SAT Report.

Table ES–1. Summaries of Working Group Assessment Team Vulnerability Assessment Forms

Vulnerability Number	Executive Summary
SRS/235–F/WGAT/001	At several locations in the Building 235–F storage vault, there is evidence of roof leakage. Beneath one of the leak locations, HEU is stored in 30-gallon shipping containers in a floor storage area. Although a sheet of plastic has been placed over some of the containers, several have rusted lids and the sides have begun to corrode. Beneath another leak location, HEU is stored in 5- and 10-gallon metal pails. A sheet of plastic has been placed over the containers in this area, and no container corrosion is evident. Beneath still another leak location, water stains are visible on the floor. At the time of the vault walkdown, no accumulated water or wetness was observed at any of the identified locations, but evidence of previous cycles of wetting/evaporation was present. This indicates a breakdown in the facility barrier (roof) and corrosion/deterioration of the outer layer of HEU packaging. Facility staff stated that a roofing contractor had made several attempts to fix the leaking roof but could not confirm that the latest attempt had been successful.
SRS/321–M/WGAT/001	Site waste disposal activities are in various stages of shutdown, and thus combustible contaminated waste is accumulating in Building 321–M and various other facilities. Building 321–M does not have an operational automatic fire suppression system. This poses an unnecessary risk of fire, as well as risks of higher heat release rates and longer fire duration, and thus additional exposure of facility and Fire Department personnel. This condition was also identified in the RBOF; K-, L-, and P-Disassembly Basins; and K-Assembly Basin.
SRS/HBL/WGAT/001	Observation of source material stored in a HB-Line safe showed that numerous metal containers are dented or otherwise deformed. Other packaging types (plastic, ice cream–cans, etc.) prevented visual inspection of the physical condition of the source material and inner packaging. Over time, the physical condition of the containers/packaging could degrade, thus increasing the possibility of worker exposure to radioactive material.

Table ES-2. Summaries Savannah River Site Assessment Team Vulnerability Assessment Forms

Vulnerability Number	Executive Summary
SRS/235–F/SAT/001	Certain stored materials in the 235-F vaults may be the metal SNM is in direct contact with plastic bags this configuration is not known to exist, the lack of su information allows this to be a suspected arrangeme is in very close proximity to the plastic, radiolysis and of the plastic can occur at a rapid pace, resulting in t hydrogen, and possibly HCl, gases. These gases w pressurization of the immediate confinement barriers the pyrophoric species, and subsequent increased r release of contamination.
SRS/247–F/SAT/001	Design Basis Accident breaches containment resulti material.
SRS/321–M/SAT/001	A facility fire, tornado, or straight winds could cause material from exhaust ducts and equipment in Buildi
SRS/H-Canyon/SAT/001	The Kitchen Nitrate solutions in outside facilities, as well as the are unsuitable for extended storage because of the potential f which may result in the release of radioactive materials to the environment, increased exposure to facility workers or exposu public. These events could result from the inherent vulnerabil technical uncertainties associated with extended sto e, inclu potential: 1) evaporation, radiolysis, or changes in sp on che can initiate adverse events; 2) tank cooling coil or re exchan failures coupled with detection delay errors, that cou result in significant releases of radioactivity; and 3) for a num of oth that could result in the releases, including soil, lead nolan transfers, and hydrogen generation.

Key: SNM, special nuclear material; SAT, Site Assessment Team; SAR, Safet

1.0 INTRODUCTION

1.1 Objective

The objective of the Highly Enriched Uranium (HEU) Environment, Safety and Health (ES&H) Vulnerability Assessment was to determine the ES&H vulnerabilities arising from storage and handling of U.S. Department of Energy (DOE) HEU at the Savannah River Site (SRS), South Carolina. Selection of the SRS for a Working Group Assessment Team (WGAT) visit was based on the quantity, form, and conditions of the HEU at the site; the results of previous assessments; stakeholder interests; and the best judgment of the HEU Working Group.

1.2 Material Scope

HEU materials within the scope of this assessment include:

- Pits and disassembled nuclear weapons parts
- Metal
- Oxide
- Process residues
- Compounds
- Solutions
- Reactor fuel
- Uranium 233
- Holdup materials
- Samples, sources, and standards
- Hazardous materials commingled or collocated with HEU
- Irradiated spent fuel not evaluated in the Spent Nuclear Fuel (SNF) Vulnerability Assessment

HEU materials outside the scope of this assessment include:

- Intact nuclear weapons
- Highly enriched uranium expended in nuclear device tests
- Materials in the custody of the U.S. Nuclear Regulatory Commission or the agreement state licensee
- Materials in the custody of the U.S. Department of Defense
- Irradiated spent fuel and targets evaluated in the SNF Vulnerability Assessment
- Highly enriched uranium materials evaluated in the Plutonium Vulnerability Assessment
- High-level waste
- Transuranic and low-level waste
- Materials in areas subject to funded environmental restoration programs

It is important to understand, in the context of the Secretary's initiative to conduct vulnerability assessments of the Department's fissile materials and the facilities that house them, that SRS has been assessed under the SNF and Plutonium Vulnerability Assessments. (see Appendix F.) Many of the same facilities reviewed by those assessments were also addressed in this HEU Vulnerability Assessment. Many of the previously assessed materials were considered but not reassessed.

One of the most important activities of the WGAT during the HEU Vulnerability Assessment, therefore, was differentiating between HEU materials that had or had not been previously assessed. (*The Highly Enriched Uranium Environmental, Safety and Health Vulnerability Assessment Plan,* dated March 29, 1996, stated that previously

Table ES–2. Summaries Savannah River Site Assessment Team Vulnerability Assessment Forms

Vulnerability Number	Executive Summary
SRS/235–F/SAT/001	Certain stored materials in the 235–F vaults may be packaged such that the metal SNM is in direct contact with plastic bags or containers. While this configuration is not known to exist, the lack of sufficient packaging information allows this to be a suspected arrangement. Since the metal is in very close proximity to the plastic, radiolysis and thermal breakdown of the plastic can occur at a rapid pace, resulting in the generation of hydrogen, and possibly HCl, gases. These gases will cause pressurization of the immediate confinement barriers, possible ignition of the pyrophoric species, and subsequent increased risk to the worker for release of contamination.
SRS/247–F/SAT/001	Design Basis Accident breaches containment resulting in a release of material.
SRS/321–M/SAT/001	A facility fire, tornado, or straight winds could cause release of holdup material from exhaust ducts and equipment in Building 321–M.
SRS/H-Canyon/SAT/001	The Uranyl Nitrate solutions in outside facilities, as well as the canyons, are unsuitable for extended storage because of the potential for events which may result in the release of radioactive materials to the environment, increased exposure to facility workers or exposure to the public. These events could result from the inherent vulnerabilities and technical uncertainties associated with extended storage, including the potential: 1) evaporation, radiolysis, or changes in solution chemistry that can initiate adverse events, 2) tank cooling coil or heat exchanger failures coupled with detection delay errors, that could result in significant releases of radioactivity, and 3) for a number of other events that could result in the releases including spills, leaks, unplanned transfers, and hydrogen generation.

Key: SNM, special nuclear material; SAT, Site Assessment Team; SAR, Safety Analysis Report.

1.0 INTRODUCTION

1.1 Objective

The objective of the Highly Enriched Uranium (HEU) Environment, Safety and Health (ES&H) Vulnerability Assessment was to determine the ES&H vulnerabilities arising from storage and handling of U.S. Department of Energy (DOE) HEU at the Savannah River Site (SRS), South Carolina. Selection of the SRS for a Working Group Assessment Team (WGAT) visit was based on the quantity, form, and conditions of the HEU at the site; the results of previous assessments; stakeholder interests; and the best judgment of the HEU Working Group.

1.2 Material Scope

HEU materials within the scope of this assessment include:

- Pits and disassembled nuclear weapons parts
- Metal
- Oxide
- Process residues
- Compounds
- Solutions
- Reactor fuel
- Uranium 233
- Holdup materials
- Samples, sources, and standards
- Hazardous materials commingled or collocated with HEU
- Irradiated spent fuel not evaluated in the Spent Nuclear Fuel (SNF) Vulnerability Assessment

HEU materials outside the scope of this assessment include:

- Intact nuclear weapons
- Highly enriched uranium expended in nuclear device tests
- Materials in the custody of the U.S. Nuclear Regulatory Commission or the agreement state licensee
- Materials in the custody of the U.S. Department of Defense
- Irradiated spent fuel and targets evaluated in the SNF Vulnerability Assessment
- Highly enriched uranium materials evaluated in the Plutonium Vulnerability Assessment
- High-level waste
- Transuranic and low-level waste
- Materials in areas subject to funded environmental restoration programs

It is important to understand, in the context of the Secretary's initiative to conduct vulnerability assessments of the Department's fissile materials and the facilities that house them, that SRS has been assessed under the SNF and Plutonium Vulnerability Assessments. (see Appendix F.) Many of the same facilities reviewed by those assessments were also addressed in this HEU Vulnerability Assessment. Many of the previously assessed materials were considered but not reassessed.

One of the most important activities of the WGAT during the HEU Vulnerability Assessment, therefore, was differentiating between HEU materials that had or had not been previously assessed. (*The Highly Enriched Uranium Environmental, Safety and Health Vulnerability Assessment Plan,* dated March 29, 1996, stated that previously

assessed HEU would not have to be reassessed.) Previously assessed HEU materials include spent fuel in the K-, L-, and P-Disassembly Basins and the Receiving Basin for Off-site Fuel (RBOF), as well as HEU materials collocated or commingled with plutonium. The WGAT also determined which of the previously assessed materials resulted in ES&H vulnerabilities and are covered by corrective action plans. Many SNF and plutonium vulnerabilities are addressed, for example, in the *Spent Nuclear Fuel Corrective Action Plan*; the *Plutonium Savannah River Site Corrective Action Plans*, dated November 21, 1994; and the *Integrated Program Plan: Implementation Plan*, DNFSB 94–1, dated February 28, 1995.

At the time of this assessment, Savannah River had 22.1 metric tons (MT) of HEU, of which approximately 8.3 MT had been assessed in the earlier SNF and Plutonium Vulnerability Assessments. This yields an assessment inventory of approximately 13.8 MT. Over 99 percent of this material is contained in unirradiated MK–22 fuel assemblies in the 100–K Assembly Area, uranyl nitrate solutions in the 221–H and 211–H Process Areas, and uranium oxide in aluminum cans and spent fuel received since the SNF Vulnerability Assessment, both located at the RBOF.

1.3 Facilities

Specific SRS facilities that contain HEU and their corresponding ages are listed in Table 1.

The WGAT noted that facility age has become a factor for most HEU facilities. In the context of its review of the SAT Report, the WGAT observed that the facilities containing most of the 22.1 MT of HEU at the SRS are more than 40 years old. These facilities were constructed in accordance with building codes in effect at the time of construction, and most have been

Table 1. HEU Facilities at SRS

Facility Name	Facility age (years)
FB-Line	45
Building 235–F	45
Building 247–F	15
H-Canyon Facility	41
HB-Line	10
Building 321–M	39
K-Assembly Area	42
K-Disassembly Area	42
L-Disassembly Area	42
P-Disassembly Area	30+
Receiving Basin for Off-site Fuel	33
Building 773–A	42
Building 735–A	42
Building 772–F	42
Building 772–1F	9

today, such as resistance to the effects natural phenomena hazards. Facility wa downs revealed signs of aging of faci structures, such as leaking roofs a deteriorating process and support equipme

1.4 Hazardous Materials

In general, there are few hazardous mate collocated with the HEU in SRS facilities have not been previously assessed. Not exceptions include significant quantities HEU-bearing combustible wastes in Buil 321–M, which are described in the Buil 321–M section of this report and in Vulnera Assessment Form V SRS/321–M/WGAT/001, and obs neptunium 237 reactor targets in the vcin unirradiated HEU reactor fuel in K-Asse Area. The neptunium 237 provides a 1 r radiation field in the area of the HEU

have to be assessed HEU he K-, L-, and P- Receiving Basin s well as HEU ommingled with etermined which terials resulted in are covered by Many SNF and addressed, for *ir Fuel Corrective vannah River Site* ed November 21, *Program Plan:* SB 94–1, dated

it, Savannah River of HEU, of which en assessed in the ium Vulnerability an assessment 13.8 MT. Over 99 is contained in assemblies in the yl nitrate solutions rocess Areas, and cans and spent fuel SNF Vulnerability at the RBOF.

t contain HEU and re listed in Table 1.

ity age has become lities. In the context Report, the WGAT s containing most of SRS are more than ies were constructed ng codes in effect at and most have been

Table 1. HEU Facilities at SRS

Facility Name	Facility age (yea
FB-Line	45
Building 235–F	45
Building 247–F	15
H-Canyon Facility	41
HB-Line	10
Building 321–M	39
K-Assembly Area	42
K-Disassembly Area	42
L-Disassembly Area	42
P-Disassembly Area	30+
Receiving Basin for Off-site Fuel	33
Building 773–A	42
Building 735–A	42
Building 772–F	42
Building 772 1F	9

today, such as resistance to the effect natural phenomena hazards. Facility v downs revealed signs of aging of fa structures, such as leaking roofs, deteriorating process and support equipn

1.4 Hazardous Materials

In general, there are few hazardous mat collocated with the HEU in SRS facilitie have not been previously assessed. N exceptions include significant quantiti HEU-bearing combustible wastes in B 321–M, which are described in the B 321–M section of this report and in Vulne Assessment Form (SRS/321–M/WGAT/001, and ot neptunium 237 reactor targets in the vic unirradiated HEU reactor fuel in K-As Area. The neptunium 237 provides a 1 radiation field in the area of the HE

Highly enriched uranium material in FB-Line is in the form of metal alloy or oxides. It is stored in the fourth-level vault, and is either collocated or commingled with plutonium.

2.1.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for FB-Line.

Question Set Responses

For the purpose of the HEU vulnerability study, FB-Line was determined to have only one partitioned area: the fourth-level vault. This vault contains the only HEU material within the FB-Line. The WGAT agrees with this determination.

Barriers between the HEU material and the workers, the public, and the environment include storage containers (e.g., cans, pails, drums); the vault structure; and the heating, ventilation, and air conditioning (HVAC) system. Another barrier is the considerable distance between the fourth-level vault and most FB-Line operations. Exhaust air for the HVAC system is filtered and monitored before release to ensure that on-site workers and the public are not exposed to airborne radioactive contamination above designated limits. In addition to these physical barriers, the site employs a number of administrative barriers, such as training and qualification programs, lessons-learned programs, and surveillance and monitoring programs, to ensure that the workers, the public, and the environment are protected.

Identified ES&H Vulnerabilities

The SRS SAT identified no new HEU vulnerabilities in connection with the HEU stored in the FB-Line fourth-level vault. It concluded that any such material had been addressed in the Plutonium Vulnerability Assessment, since all of the HEU stored in the vault is commingled or collocated with plutonium. The WGAT agrees with this conclusion.

2.1.3 Working Group Assessment Team Evaluation

Facility Walkdowns

The WGAT determined that all of the HEU in the FB-Line facility is commingled or collocated with plutonium and had been evaluated during the Plutonium Vulnerability Assessment. This determination was based on a careful review of FB-Line inventory information. As is the case for the HEU Vulnerability Assessment, the Plutonium Vulnerability Assessment included an initial assessment by a SAT and an independent validation by a WGAT. On the basis of these evaluations, the WGAT determined that it was not necessary to perform any new facility walkdowns and chose to focus its efforts on those facilities and HEU materials that had not been previously evaluated. This determination is further supported by the information provided below.

Tabletop Discussions

Vulnerabilities previously identified for the FB-Line during the Plutonium Vulnerability Assessment and applicable to HEU are indicated by asterisks next to the appropriate items in Table F-2 of Appendix F.

To ensure that HEU materials were adequately addressed, several tabletop discussions were conducted with managers from the Nuclear Material Stabilization Program, FB-Line Operations Managers, and FB-Line Separations Engineering support personnel. These discussions focused on determining if there were any HEU materials in FB-Line that had not been previously evaluated. Significant attention was given to the material stored in the fourth-level vault. Moreover, past facility operations, especially those associated with special recovery operations, were evaluated to

determine the likelihood of HEU holdup in the process lines or exhaust ducts. On the basis of these discussions, the WGAT came to the following conclusions: all of the HEU material in the fourth-level vault was evaluated during the Plutonium Vulnerability Assessment; HEU material stored in the fourth-level vault is the result of off-site shipments associated with the Central Scrap Management Office program; there is no evidence that this material, or any other HEU material, was ever processed in the F-Canyon or FB-Line facilities; and HEU holdup in FB-Line does not represent a new vulnerability and thus is not a new concern.

The WGAT concurs with the SAT conclusion that no new HEU vulnerabilities exist and that the vulnerabilities identified in the Plutonium Vulnerability Assessment encompass any involving HEU. The WGAT further concurs with the SAT conclusion that all HEU involved in a plutonium vulnerability is being addressed by *The Savannah River Site Corrective Action Plans*, WSRC–TR–94–0515, dated November 21, 1994, or the *Integrated Program Plan: Implementation Plan*, DNFSB 94–1, the dated February 28, 1995.

2.2 Building 235–F

2.2.1 Facility Description

Building 235–F, a reinforced-concrete, blas resistant structure in the northeast quadrant F-Area (Figure 2.2–1), was constructed in

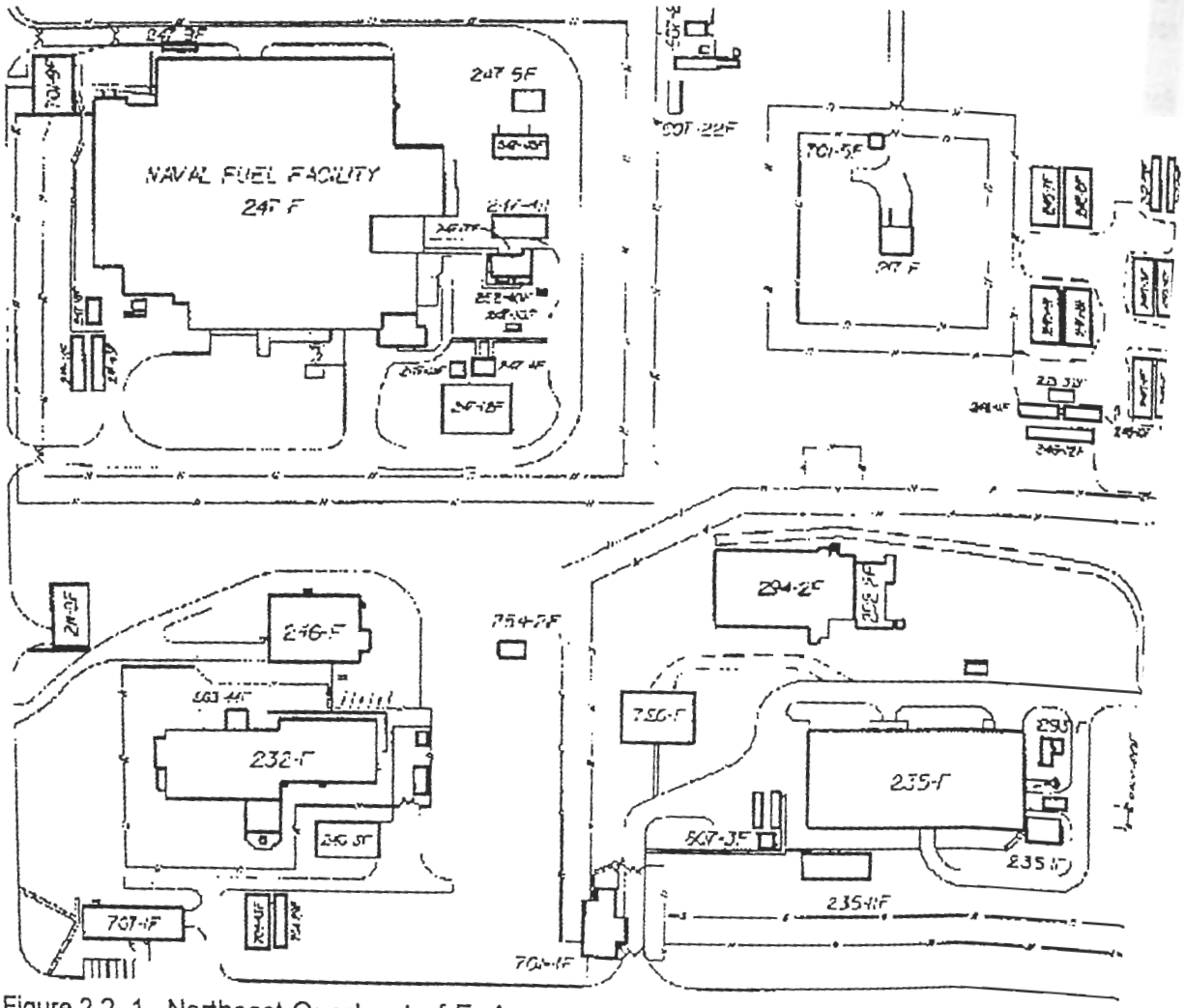


Figure 2.2–1. Northeast Quadrant of F–Area

early 1950s. It has since been evaluated and meets current design basis tornado (DBT) and design basis earthquake (DBE) criteria. An external view of the building is presented as Figure 2.2–2.

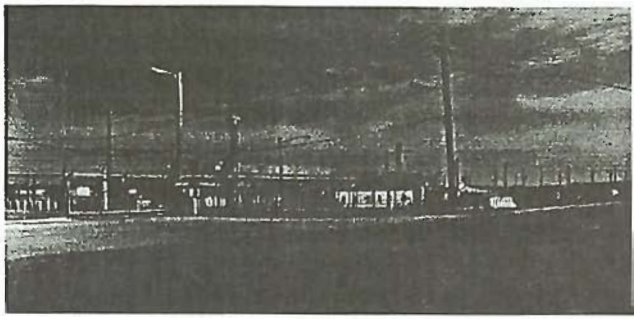


Figure 2.2–2. Exterior View of Building 235–F

Building 235–F houses several former operational areas (sometimes called facilities), including the Plutonium Fuel Form (PuFF) Facility; an old metallography glovebox line (Met Lab), which supported the PuFF Facility; and the Plutonium Experimental Facility (PEF). These facilities were once used to fabricate heat sources from plutonium 238 oxide powder for space program applications. A new metallurgical laboratory was built to support operations in the PuFF Facility and the PEF, but was never operated. Another facility, the Actinide Billet Line, was built and used to fabricate billets of neptunium 237, uranium 235, and plutonium 239 and 242. Building 235–F also houses three operational storage vaults. There are no plans to reactivate these facilities, and the new Building 235–F Safety Analysis Report scheduled for submittal to DOE in August 1996 is based on the assumption that the Actinide Billet Line, PuFF Facility, PEF, and Met Lab will continue to satisfy the restrictions associated with the "cold standby mode," as defined in the associated Technical Safety Requirements (TSRs).

A standby diesel generator provides backup electric power to the HVAC system in the event of an area electrical outage. Building 235–F has a dedicated sand filter and a continuously monitored stack exhaust system, installed in the 1980s. Process rooms are also monitored for contamination releases by permanently installed or portable equipment. The ventilation tunnel and sand filter are seismically qualified.

Building 235–F was operated primarily as a plutonium facility. Over the years, however, it has received a variety of solid fissile materials, including plutonium and HEU, as part of the Central Scrap Management Office program. One of the remaining building missions is the storage of special nuclear material in its three storage vaults.

Highly enriched uranium materials occur in three configurations:

- Mostly plutonium with commingled HEU
- Mostly HEU with commingled plutonium
- Highly enriched uranium alone

Materials containing plutonium, including plutonium/HEU mixtures, were assessed in the Plutonium Vulnerability Assessment. Six vulnerabilities were identified for these materials during that assessment. Therefore, the HEU portions were considered but not reassessed.

2.2.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses and the ES&H vulnerability for Building 235–F (SRS/235–F/SAT/001).

Question Set Responses

For purposes of this assessment, Building 235–F was divided into three partitioned areas: the vaults, the PEF material balance area, and the process areas/ventilation system. The WGAT concurs in the way the SAT partitioned the building.

Plan views of Building 235–F, first and second levels, are presented as Figures 5.2–16 and 5.2–17, respectively, of the *Safety Analysis - 200–F Area Savannah River Site, Building 235–F, Final Safety Analysis Report*, WSRC–RP–89–575, Volume 1, Rev. 0, April 1995.

Because much of the HEU material had been assessed in the Plutonium Vulnerability Assessment, there were numerous discussions between the WGAT and facility personnel about how to present HEU information in response to Question 3 of the HEU Vulnerability Assessment Question Set. The WGAT cross-checked the material groupings of the Plutonium Vulnerability Assessment SAT Report against the groupings contained in inventory information provided by facility staff to confirm what had and had not been previously assessed. It was agreed that, for completeness, plutonium/HEU mixtures would be included with HEU items in the Question 3 table, even though previously assessed HEU items were not reassessed. This was requested by the WGAT in a memo to facility staff, which is provided in Appendix D.

The WGAT reviewed and agrees with the SAT Report responses to the Question Set for this facility.

Identified ES&H Vulnerabilities

The Plutonium Vulnerability Assessment yielded six vulnerabilities for Building 235–F. They concerned (1) holdup material in the HVAC ductwork (SR–B235–1); (2) material-packaging uncertainties (SR–B235–2, SR–B235–3, SR–B235–4, and SR–B235–5); and (3) helium buildup in, and pressurization of, plutonium 238 capsules due to radioactive decay (SR–B235–6). The titles are listed in Table F-2 of Appendix F with double-asterisks indicating applicable vulnerabilities.

With regard to item 1, HEU is commingled with the material holdup in the building's HVAC ductwork. However, the ES&H consequences of the holdup are dominated by the plutonium component. The SAT determined that no new vulnerability specific to the HEU component was needed, because the corrective action for the plutonium vulnerability will also address the HEU. The WGAT agrees with this determination. The WGAT identified an additional vulnerability concerning the leaking vault roof and corrosion of a shipping container in the vault (SRS/235–F/WGAT/001).

For the same reason, new material-packaging vulnerabilities were not developed for plutonium/HEU mixtures, which are covered by item 2. Corrective actions for material-packaging vulnerabilities SR–B235–2, SR–B235–3, SR–B235–4, and SR–B235–5 will also address the HEU commingled with plutonium.

During this assessment, the SAT identified one HEU vulnerability (SRS/235–F/SAT/001) for Building 235–F: the fact that some HEU is not completely characterized, some packaging configurations are unknown, and some packaging configurations are suspect. Table 2 presents information on these materials and packages, which were not assessed during the Plutonium Vulnerability Assessment. In numerous discussions with facility staff, the WGAT stressed the need for specificity in the VAF as to the containers and items covered by this vulnerability. It was determined that 29 containers with a total of 91 items in 12 defined SRS Material Groupings are associated with this vulnerability. At the SRS, the Nuclear Material Stabilization Program (NMSP) has defined over 100 Material Grouping categories that reflect how material in that grouping will be stabilized.

The WGAT agrees with and validates this vulnerability.

Table 2. Assessed HEU Materials and Packages

SRS Material Grouping	Material Description	Approx Age (yr)	Potential Adverse Condition	No. Of Pkgs	Package Description	Container Description
219/420	HEU, Pu-242, U-233	15–10	Oxidation, power	4	Can/can/bag/ can/6M-2R	55-gallon drum
437	Plate from unirradiated fuel	10–15	Material in contact with plastic	1	Plastic sheets	5-gallon pail
217	HEU-C-P-S, Pu contaminated	>20	Oxidation of metal	1	Can/bag/can	5-gallon pail
197	HEU alloy, Pu contaminated	15–20	Oxidation of material	9	Can/bag/can	55-gallon
186	HEU-Zr alloy, Pu contaminated	>20	Oxidation of material	2	Can/bag/can	5-gallon pail
-	HEU metal	-	Oxidation	1	Can/6M-2R	55-gallon drum
176	HEU high-fired oxide, Pu contaminated	15–0	Large surface area of material	9	Can/bag/can	10-gallon drum
860	HEU-Pu oxides	>20	Large surface area of material	24	Unknown	30-gallon drums
168	Pu-HEU oxide	15–0	Large surface area of material	4	Can/bag/can	55-gallon drum
427	HEU standards	5–10	Material in contact with plastic	2	Plastic bottle	5-gallon pail
212	HEU standards	5–10	Material in contact with plastic	2	Plastic bottle	5-gallon pail
319	HEU standards	10–15	Material in contact with plastic	31	Plastic container/ cardboard carton/bag	5-gallon pail

2.2.3 Working Evaluation

The WGAT walk
partitioned areas
conducted tabletop
staff.

Facility Walkdown:

Plan views of all vaults
Figures 5.2-16 and 5.2
Analysis -200-F Area Savannah Riv
Building 235-F, Final Safety Analysis
WSRC-RP-89-575, Volume 1, Rev.
1995.

The WGAT walked down two of the three vaults in Building 235-F. One vault was excluded because it contains only one shipping container of a plutonium/HEU mixture, and that had been addressed in the Plutonium Vulnerability Assessment.

In another vault, shipping containers of plutonium and plutonium/HEU mixtures are collocated in labeled storage locations in the west, east, and south storage racks, and in a floor storage array. A unique bar code identifier appears on the seal integrity tape of each container. Most of these materials had been addressed by the Plutonium Vulnerability Assessment. Three containers on the west room storage rack had not been previously assessed and were within the scope of this assessment.

Radiological Controls personnel were observed conducting the monthly smears and swipes of the 55- and 30-gallon containers stored in the vault to detect conditions indicative of leakage. Results of this survey revealed maximum transferable contamination levels of less than 20 disintegrations per minute (dpm) alpha and less than 200 dpm beta/gamma per 100 square

longer in
a potential source of water to t
the expansion tank and piping
water. The WGAT consider
which the chilled-water system
introduced into the vault, caus
criticality. However, the WGA
discussions with facility staff t
to this scenario is not likely
reasons: (1) SRS Nuclear Crit
Evaluation 93-08, *Nuclear Critic*
General Storage of Vario
Containers, dated March 9, 1993,
water in the interstices of the contai
pose no criticality concern; (2) the
sump with an operational sump-level
thus the operators would be alerted; a
vault door is not water-tight, and
would likely leak out of the vault from
door. This issue is therefore closed

Observations of other systems - e.g.,
redundant nuclear incident monitors (N
high-volume air monitors, the
system - operative within the vault yielde
evidence of weaknesses that would jeopa
the materials therein or create a vulnerab

The team also toured the third vault
contains 30- and 55-gallon shipping
and 5- and 10-gallon metal pails. Th
55-gallon shipping containers provide th
sealed with bolted metal bands; the
gallon metal pails have lids that
sealed and taped. Multiple pack
scope HEU are stored in som
containers. A plan view of t
presented as Figures 5.2-16 an
Safety Analysis -200-F Area Savan
Site, Building 235-F, Final Safe

Report, WSRC–RP–89–595, Volume 1, Rev. 0, April 1995.

Shipping containers and pails of plutonium, HEU, and plutonium/HEU mixtures are located in drums in vertical floor storage arrays and storage racks. Many of these materials were addressed in the Plutonium Vulnerability Assessment. The WGAT cross-checked the material groupings of the Plutonium Vulnerability Assessment SAT Report against vault inventory information supplied by the facility staff. Those materials not covered by the Plutonium Vulnerability Assessment were addressed by the SAT and WGAT.

Makeshift plastic coverings were observed on several 30-gallon drums containing in-scope HEU materials in the vertical floor storage arrays near the north wall of the vault (storage positions in rows 80, 90, and 100), and on several 5- and 10-gallon pails on the top of the storage racks near the center of the vault (storage positions in rows A, B, and C). Facility staff reported that the vault roof had been leaking and that a roofing contractor had been called in several times to repair the leaks. It is not known if the latest repair effort has been successful. The plastic coverings were over the drums to protect the containers from the leaky roof. Noticeable corrosion of the 30-gallon drums was observed; one drum in particular had a lid covered with rust (see Figure 2.2–3). Nevertheless, the general integrity of the containers was intact. A few water spots were also noticed on the vault floor where water had dried, but no moisture was observed in the vault. More importantly, there is a potential for corrosion of one of the primary container barriers. This breakdown of facility and container barriers will accelerate and exacerbate the vulnerable packaging configuration weaknesses identified in SRS/235–F/SAT/001. In combination, material packaging weaknesses, degraded shipping containers, and a roof leak make this storage situation more serious. The WGAT identified this as vulnerability (SRS/235–F/WGAT/001). The WGAT does not have a flooding or criticality concern.

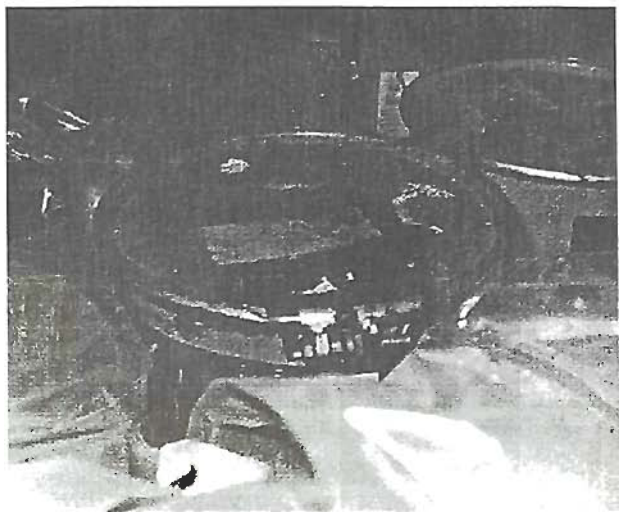


Figure 2.2–3. Corrosion on Storage Drum

The interior vault walls are constructed of block material surrounded by a steel mesh security screen. In addition, a steel liner is provided on the inner face of the block wall to prevent the wall from crumbling and falling (inward) onto the storage racks as the result of a seismic event. A seismic evaluation is contained in contractor report SAIC 92/1180, dated August 26, 1992.

Radiological Controls personnel were observed conducting the monthly smears and swipes of the shipping containers and 5- and 10-gallon pails. Results of this survey revealed maximum transferable contamination levels of less than 20 dpm alpha and less than 200 dpm beta/gamma per 100 square centimeters. Area radiation levels in the vault are approximately 25 mrem/hr.

Current operational surveillances include visual inspections and contamination control monitoring. All vault storage areas are continuously monitored for airborne contamination, and personnel perform monthly contamination smears of storage container

seals and storage locations to evaluate potential leakage. Containers are selected at random for monitoring. Visual inspection of containers for deformation and deterioration is conducted as part of the bimonthly security seal checks. Current safety documentation does not permit opening containers for inspection within Building 235–F.

Most facilities in the process areas of Building 235–F are shut down, but there is a mixture of special nuclear material holdup, mainly plutonium, in the process exhaust ductwork. The holdup in the ductwork of Building 235–F was evaluated during the Plutonium Vulnerability Assessment. Results of that survey are contained in the WSRC report NMP–SPF–92–32, *Holdup Monitoring of the 235–F Process Exhaust System*, dated November 9, 1992. A review of this report by the WGAT disclosed that all appropriate process areas within Building 235–F had been assayed and that uranium 235 was one of the assayed isotopes. Amounts of HEU found in the process exhaust ductwork were small—so the team concluded that no new vulnerabilities had been introduced. The WGAT determined that, in fact, the corrective action plan for plutonium vulnerability SR–B235–1 addresses HEU holdup.

The WGAT walked down the partitioned PEF material balance area and observed shipping container assay activities. Sources stored in a locked cabinet, some from Building 247–F, are the only HEU materials in this area. Discussions with the custodian of these materials indicate weaknesses in the source control program, which is covered by a WGAT vulnerability (SRS/HBL/WGAT/001).

The team also evaluated conduct-of-operations practices in Building 235–F, in particular the records and procedures necessary for implementing conduct of operations. It reviewed a variety of pertinent records, including shift turnover checklists, the a status book, log books, status boards, orders, standing orders, alarm resp procedures, and round sheets. It also obse activities inside the Shift Ope Base—communications practices, proce for control of personnel access, respons actual alarm conditions, and a routine fir drill. An interview with the operator assig the Shift Operating Base focused familiarity with the foregoing record procedures and his understanding implementation of conduct of operation Building 235–F. As a result of its obser the WGAT concluded that an appro conduct-of-operations program had established at Building 235–F and tha program will assist in the early identificatio investigation of events that might contribu HEU vulnerabilities.

Tabletop Discussions

The WGAT reviewed the critica EPD–NCS–950018, *Nuclear Critica Evaluation 95–6—Fissionable Transfers in 235–F (U)*, dated March 30, That analysis basically covers the move pails of material in the building; it estab the maximum and 1/3 maximum unit m that can be stored in the pails, and the nu of pails that can be moved at one time wi a criticality concern. Materials movem also addressed in a review of 235–F–8060A, *Receipt, Relocation, Mov or Transfer of Accountable Nuclear Ma*

Also reviewed were 11 Noncon Reports for the Building 235–F HVAC s submitted in 1992. These reports, ge relating to lower-than-normal airflow ductwork, were recently (April 1996) res Airflow was determined to be acceptab thus the systems were certified for use. Accordingly, the WGAT concluded that

are no vulnerabilities in connection with these systems.

Finally, the WGAT reviewed WSRC–TR–94–0515, *The Savannah River Site Corrective Action Plans*, dated November 21, 1994, and DNFSB 94–1, *Integrated Program Plan: Implementation Plan*, dated February 28, 1995, to verify that all previously assessed HEU is addressed by corrective action plans. The WGAT concludes that these corrective action plans do encompass all previously assessed HEU materials.

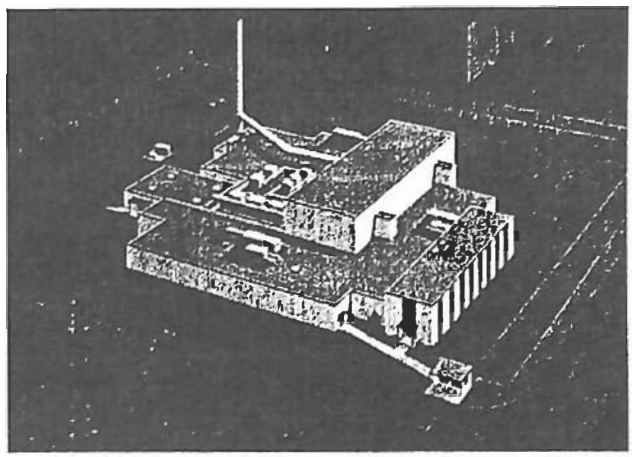


Figure 2.3–1. Aerial View of Building 247–F

2.3 Building 247–F

2.3.1 Facility Description

The Fuel Material Facility, Building 247–F, is in the northern part of F-Area (see Figure 2.2–1) approximately 10 kilometers from the nearest site boundary and approximately 1.6 kilometers from the nearest site stream. The building, constructed in the early to mid-1980s, is a steel frame structure with concrete slab floors and exterior walls of foam-filled metal sandwich panels. Original roofs are a composite consisting, successively, of a metal base, a layer of foam insulation, an elastomeric membrane, and an outer cover of stone or concrete. Concrete roofing is typical in areas where equipment is installed. Recently, major areas of the elastomeric membrane roofing were replaced with a bitumen roofing system. The administrative wing is of standard two-story construction. Part of the main process area also has two stories, each approximately 20 feet high. There are 27,800 square feet of space on the first level and 12,000 square feet on the second. The balance of the building is one story. An aerial view of the building is presented as Figure 2.3–1.

DuPont, DOE, and commercial industry standards were used in the design of the facility. A listing of these standards is included in Section 3.1 of the facility-specific Safety Analysis Report (SAR). Building construction was in accordance with a wind design criterion of 100- rather than 1000-year wind speeds.

The outside recovery facilities are high resistance per Site Specification 7096, Section 11, page 4. High-resistance criteria include gravity loads per the Standard Building Code, a 100-year wind loading, and a seismic loading. Other areas are of standard construction, except for enhancement consistent with the 100-year wind criterion.

Uranium processing was formerly conducted in the processing rooms of the manufacturing building, which were designed for contamination control. Parallel lines of containment cabinets are separated by alternating operating and maintenance aisles or rooms. Included are wet- and dry-processing cabinets or glovebox enclosures that contain closed vessels, processing equipment, and fume hoods.

Building ventilation air is designed to flow from the cleanest to the more contaminated areas. Outside air enters the operating aisles, passes through the maintenance aisles, processing

cabinets, and the high-efficiency particulate air (HEPA) filters, and then is vented through the stack. Ventilation interlocks shut down supply fans on indication of a loss of exhaust.

An exceptionally level ground floor provides for uniform dispersal of spills, thereby preventing the pooling of spilled solutions that could result in criticality. Sloping of the floor on the second level is such that spilled liquids will flow onto the stairs and ultimately to the geometrically favorable ground floor.

Halon fire suppression is provided in cabinets where chemical fuels were once stored. For areas outside containment, fire suppression is provided by building water sprinkler systems. Additionally, manual fire extinguishers are provided throughout the facility.

The former mission of Building 247–F was to convert uranium feedstock into usable fuel material in support of the U.S. Navy's Nuclear Propulsion Program. With the conclusion of this mission in September 1989, facility operations were shut down.

On October 31, 1989, a Shutdown Plan and a letter of authorization to proceed with shutdown were issued for the facility. Conditions of shutdown were to include placement of the facility in an environmentally sound, nonoperational status and to ensure that it was capable of restart. The shutdown was completed per the plan, and the process systems were taken out of service. Facility support systems, including HVAC, instrument air, diesel generator, utility, and various monitoring systems, remain in operation. The electrical and mechanical shop areas, lunchroom, computer rooms, administrative offices, and other nonprocess areas are being used by NMSP personnel. Equipment modifications were made to accomplish individual system layups. Wastes generated as a result of the shutdown were disposed of, and environmental permits were updated to new facility conditions. Hazardous [illegible] were removed from the facility and [illegible] systems were flushed, drained, and [illegible] be at or below Shutdown Plan [illegible] Assays performed on all process [illegible] end of the shutdown effort (January August 1990) indicated that a [illegible] quantity of uranium was potentially [illegible]

The current HEU material in Building 247-F consists of nondestructive analysis (NDA) sources and standards, unrecoverable material remaining in the process equipment holdup material in the process area ventilation ducts, and HEU-contaminated [illegible]

The SAT assessed two categories of HEU materials in Building 247–F: the [illegible] standards, and the holdup material in the process equipment and ventilation exhaust ducts. Results of a very comprehensive [illegible] assessment and nondestructive test [illegible] indicated that the holdup in the process equipment and ventilation exhaust ducts is the only material that could pose any [illegible] to the worker, the public, or the environment.

2.3.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses and the ES&H vulnerabilities for Building 247–F.

Question Set Responses

The SAT divided Building 247–F into six partitioned areas: the process core and the waste assay/storage area. The WGAT concurs that these partitions can be used to adequately characterize the facility.

The process core consists of the operating floor, maintenance aisles, all cabinets and gloveboxes contained within these aisles, and

the regulated room, cabinet, and vessel exhaust systems up to and including the HEPA filters. Highly enriched uranium material within this partition consists of the holdup left in the process equipment and exhaust systems after cleaning and flushing in connection with shutdown.

The waste assay/storage partition contains the standards used to calibrate and check operation of the low-density waste assay system. Existing ES&H barriers include the boundary provided by the standard packaging (bags, cans, or pipe for sources), the building structure, and the ventilation system.

The WGAT also concurs with the descriptions that are included the Building 247–F SAT Question Set response.

Identified ES&H Vulnerabilities

Building 247–F will not withstand a DBE or DBT without sustaining some level of damage. Damage resulting from these accidents could compromise barriers between the holdup material remaining in the facility and workers, the public, and the environment.

Accordingly, the SAT originally identified, as a single vulnerability, the release of holdup material through a breach of building structural integrity by a DBE and a potential for criticality. On the recommendation of the WGAT, (see memo, Appendix D), however, the SAT split this into two vulnerabilities: material release due to design basis accident (DBA), and criticality due to DBA. However, based on newly developed information, the criticality vulnerability has been deleted.

Further, information developed during the facility walkdowns identified an additional condition associated with the absence of fire suppression water containment/collection. This was not developed as a vulnerability.

2.3.3 Working Group Assessment Team Evaluation

Facility Walkdowns

In several walkdowns of the process areas of Building 247–F, the WGAT evaluated the material condition of the process cabinets and gloveboxes and the processing equipment they contain. A typical cabinet and its contents is depicted in Figure 2.3–2. Uranium oxide dust was noted in some cabinets. This dust was accounted for as part of the facility holdup and thus no additional vulnerabilities were identified. After thorough evaluation and discussion, the members of the WGAT concurred in the SAT's conclusions with respect to this material.

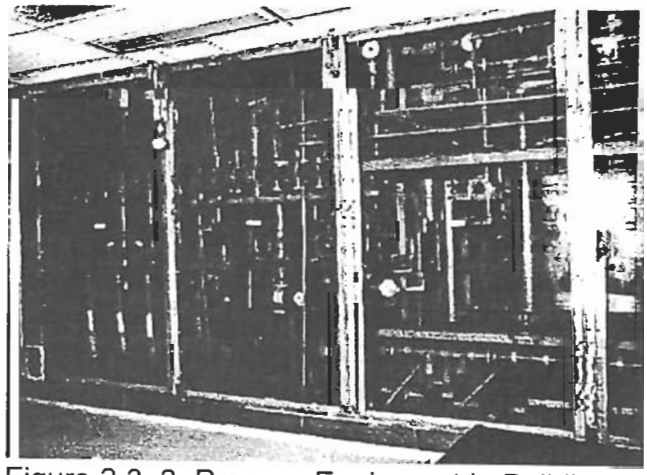


Figure 2.3–2. Process Equipment in Building 247–F

Many of the process core areas, are contaminated, and protective clothing is required for entry. Some are high-contamination areas having more than 2,000 dpm alpha and more than 100,000 dpm beta/gamma. All contaminated areas contain transferable as well as fixed contamination. Requirements for access to these areas are stipulated on Radiation Work Permits.

The WGAT was concerned with the extent and level of contamination in the process core.

around the plenum to confine the release of contamination in the event of a bag rupture. The WGAT decided that the ductwork will adequately confine the holdup, and that except for the DBA vulnerability listed by the SAT, no new vulnerability is indicated.

The WGAT observed the single, non–safety class, standby diesel generator set in a small room to the south of the building. This diesel generator is used to power the HVAC system in case of a power failure. It was in preheated, standby status when observed, and appeared to be in good condition. Building engineering personnel indicated that it has started normally when required.

The WGAT reviewed Occurrence Report SR–WSRC–S247–1994–0006, which documents an exhaust ventilation flow reversal that occurred in one of the radiological buffer area rooms of Building 247–F in 1994, and discussed the occurrence with Facility Engineering. The reversal was caused by shutting down a supply fan for maintenance. This resulted in a positive 0.04-in.-w.g. pressure in a radiological buffer area room that is to be maintained at a negative pressure at all times. The area of the building where this occurred has no ventilation control system to automatically adjust and maintain the negative room pressures during system upsets. No contamination was released, and a procedure to mitigate a recurrence has been adopted.

Conduct-of-operations practices were evaluated in Building 247–F. Included was a review of various procedures and records necessary for implementing conduct of operations—e.g., turnover checklists, lockout/tagout log book, status boards, shift orders, standing orders, alarm response procedures, operable round sheets. It also toured the building with the building surveillance operator to assess her understanding of the conduct-of-operations program and her familiarity with the facility and with the aforementioned program records and procedures. The WGAT conducted a tour of the building with the building surveillance operator to assess her familiarity with the facility and the round sheets. The tour also included reviews of the alarm panels and alarm response procedures in the health physics monitoring room, the equipment status board in the central monitoring room, and the remote control panels for the process exhaust ventilation system, as well as observation of the locations at which differential ventilation pressures are measured to verify the performance of the process exhaust and cabinet exhaust ventilation systems. On the basis of these activities, the WGAT concluded that an appropriate conduct-of-operations program is in effect in Building 247–F, and that this program will allow for the early identification of abnormal events that might otherwise contribute to HEU vulnerabilities.

Holdup in Building 247–F, including that in the process equipment and the ventilation exhaust systems, has been thoroughly surveyed and characterized by the WSRC. The survey results are summarized in a WSRC calculation entitled *Supporting Information for 247–F Hazard Category Determination,* G–CLC–F–00057, dated May 1, 1996. A review of this calculation by the WGAT disclosed that the scope of the characterization effort was appropriate for the facility, and verified the legitimacy of the conclusions of the SAT Report regarding the vulnerabilities posed by holdup.

Tabletop Discussions

The WGAT reviewed portions of the facility Shutdown Plan, along with several process-specific Shutdown Plans, and discussed them with the cognizant facility engineer. These documents provide adequate evidence that the facility has been deinventoried, and that the only material of concern in the building is that associated with residual quantities of holdup in

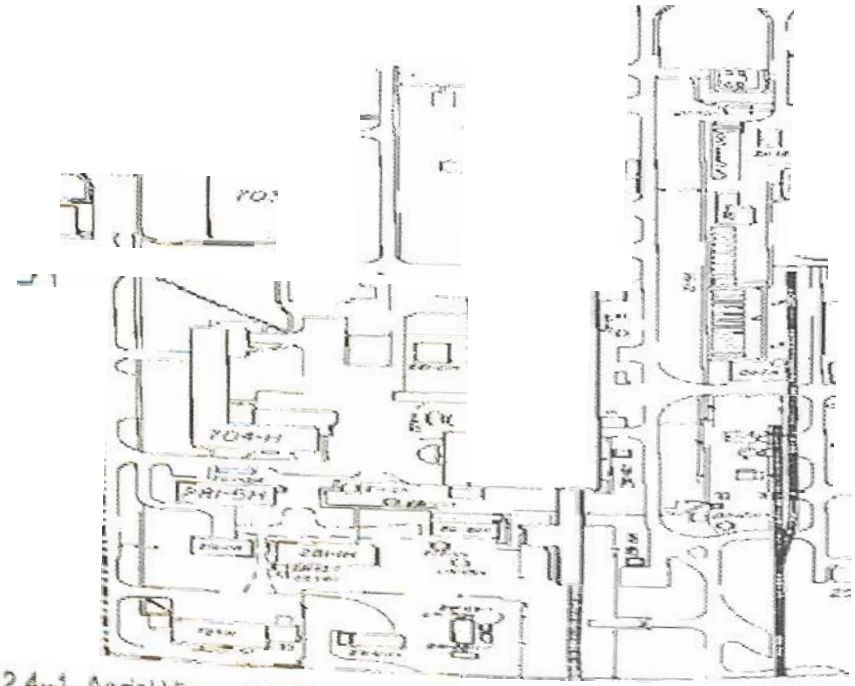


Figure 2.4--1. Aerial View of H- Canyon Area

Building 221–H is a large, reinforced-concrete structure 835 feet long, 122 feet wide, and 66 feet high. As it extends 14 feet below grade, 52 feet of the structure is visible above ground. It contains two parallel processing galleries, one on each side (the "hot side" and the "warm side") that are open from floor to roof (see Figure 2.4–2). The hot side is where irradiated reactor materials enter the canyon and where operations involving high radiation levels are conducted. Final stages in material processing occur in the warm side.

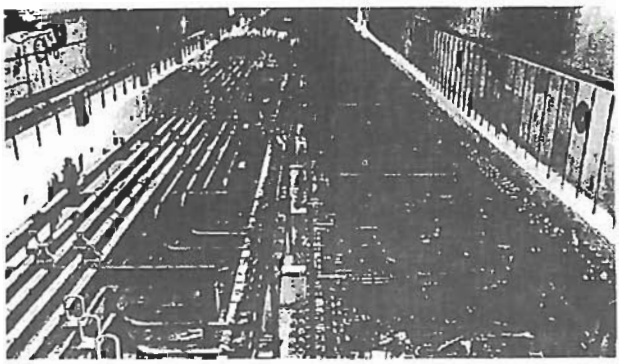


Figure 2.4–2. H–Canyon, Hot Processing Gallery

Control rooms and office space are housed in the center section of the building. Processing within the building is performed by remotely controlled cranes whose operators use closed-circuit television to monitor crane movement. No personnel enter the hot-side gallery, and only rarely does anyone enter the warm side. The processing cells within each of the galleries have sloped floors with sumps located at the low points. These cells are separated from each other by curbing that is designed to contain spills of typical volume or overflow from the tanks in the cell. Each cell has a concrete cover which is removed only for piping changes, equipment replacement, or other required maintenance. Connections between the tanks in each cell and permanently installed process piping within the gallery are via a series of "jumpers" that allow for remote installation and removal as required by the process configuration.

A typical process tank measures approximately 10 by 11 feet and is constructed of 0.5-inch-thick 304 stainless steel. All tank penetrations are on the top of the tank. A typical process tank is depicted in Figure 2.4–3.

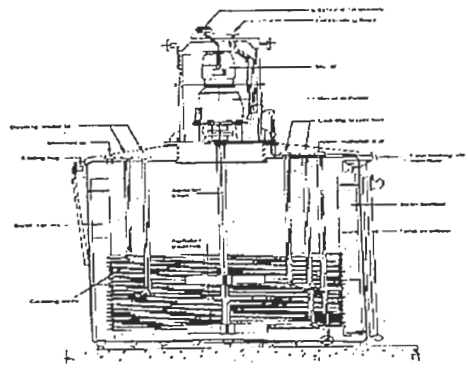


Figure 2.4–3. Typical Process Tank at the Savannah River Site

The outer walls of the building and the walls separating the processing galleries from the control rooms/office space are concrete several feet thick. A simplified cross-section of the building is presented as Figure 2.4–4. The building was designed to withstand an external pressure of 1000 lb/ft^2. Its structural performance under design basis loading for events such as earthquakes and high winds has recently been evaluated against the criteria stipulated in current DOE standards. Because the building's original design called for a flexible chemical-processing facility, the process modifications described above did not affect the overall building structure.

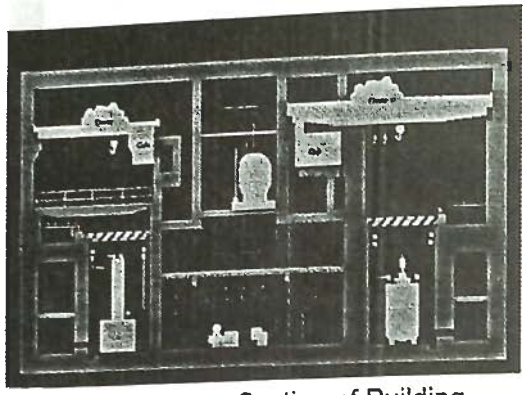


Figure 2.4–4. Cross-Section of Building 221–H

H-Canyon is continuously ventilated by a system that draws in fresh air to the occupied center section, routes the air through the processing cells, and finally draws it out through tunnels that line the outer walls of the processing galleries. The tunnels direct the ventilation flow from three of the four ventilation units to large sand filters, which discharge the filtered and monitored air to the atmosphere through the 200-foot-high 291–H stack. The airflow up the stack is normally 267,000 cfm; that through the filters is 190,000 cfm. Radioactive loading of the filters is measured annually by making a vertical radiation profile over the height of the column of filter materials. The measurement program is described in Radiation Procedure 5Q1.2.

Airborne emissions from the stack are continuously sampled by way of a multi-inlet probe sample pipe which extends across the 10-foot inside diameter at the +195-foot elevation. The sampled air is supplied to an alpha sampler, a stack "sample of record" sampler, a fission product sampler, a radioiodine sampler, and a backup radioiodine sampler. These sampler stations are located inside Building 292–3H. A similar second multi-inlet probe sampler at the +50-foot elevation supplies sampling air to a backup stack filter air sampler (3-inch Gelman-type AE fiberglass or equivalent). The sampler station is located inside the Building 292–H HB-Line filter room.

All stack monitors are linked to the 773-A Meteorological Center weather information and display system by a telephone modem located behind panels DC and DD in the fourth-level control room of Building 221–H. They are described in RC&HP Manual 5Q1.5. The modem provides for the transmission of real-time stack monitor data for emergency management assessment.

A new isokinetic sampling system with a dual isokinetic sampling probe has been installed at the 100-foot elevation of the 291–H stack. Operation of this system is described in RC&HP Manual 5Q1.5.

The process airflows and stack sampler locations are shown schematically in Figure 2.4–5.

Also pertinent to the HEU Vulnerability Assessment is certain equipment—i.e., tanks, pumps, piping, utilities, process instrumentation—within the 211–H Outside Facilities area adjacent to Building 221–H. This equipment is devoted to uranyl nitrate storage, bulk chemical storage, water handling, acid recovery, general purpose evaporation, and solvent segregation. The area also encompasses a Control Room Building (211–H) from which all transfers into and out of the Outside Facility tanks are controlled, as well as the monitoring displays for all process parameters. Components in the 211–H Outside Facilities area of greatest interest from an HEU standpoint are Tank E–1–1, Tank F–1–5, and the Enriched Uranyl Nitrate Storage (EU-S) Tank.

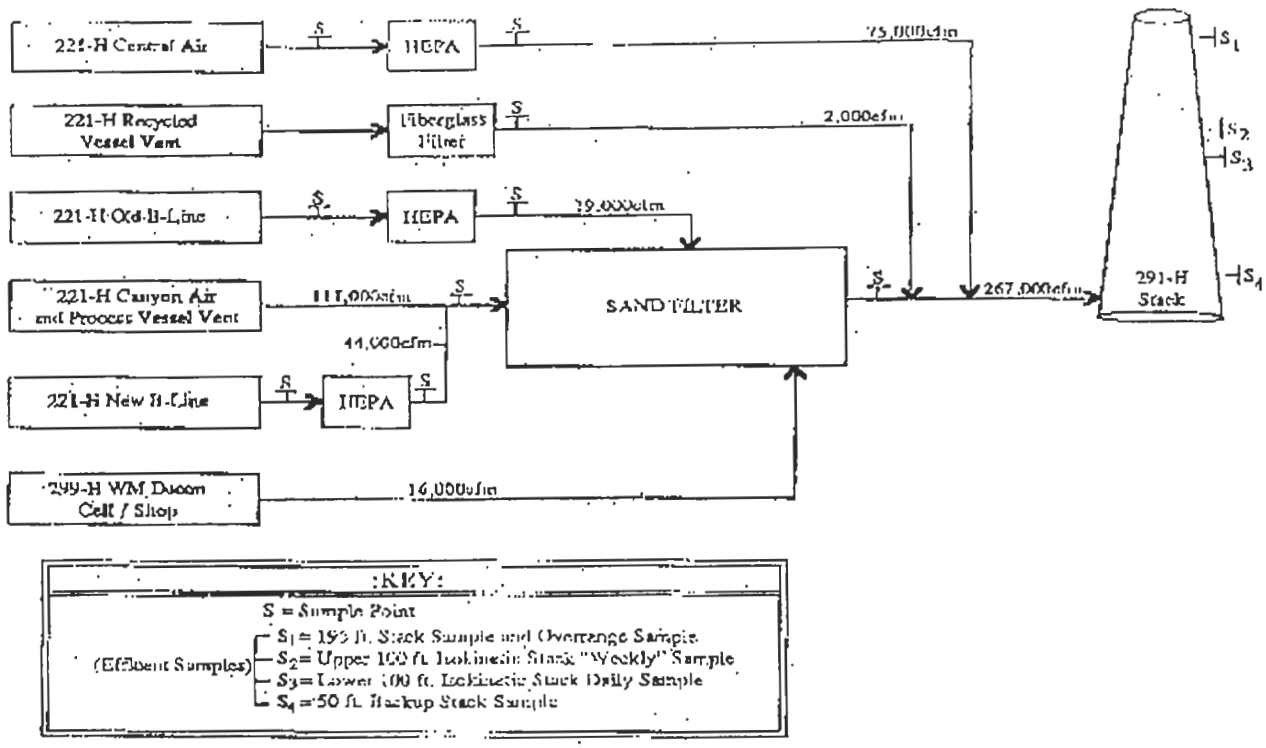


Figure 2.4–5. Process Airflow and Stack Sampler Locations

Most of the HEU inventory in the H-Canyon area is stored in the EU–S Tank located in 211–H Outside Facilities area. This recently constructed tank was specially designed for HEU storage per DOE 6430.1A design criteria. The EU–S Tank has double walls with monitored annular space, is designed for criticality control and spill containment, and is seismically qualified. At the time of the assessment, about 70,000 gallons of solution was stored in the tank.

2.4.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses and ES&H vulnerability for H-Canyon and the H-Canyon Outside Facilities.

Question Set Responses

The SAT Report defines five partitioned areas for H-Canyon: the hot canyon—i.e., the hot-side processing gallery mentioned above; the warm canyon—i.e., the warm-side processing gallery; the receiving and storage area; the 211–H Outside Facilities; and the ventilation system. It includes a description of each of the partitioned areas and area-specific details such as material holdings, staff experience levels, material transfer activities, and the types of barriers used to protect workers, the public, and the environment. The WGAT agrees with the partitioning recommended by the SAT.

Extensive information on barrier types and material holdings is also included in the SAT's response to questions two and three of the HEU Vulnerability Assessment Question Set. The

WGAT also concurs in the barrier and material information contained in the SAT Report.

Identified ES&H Vulnerabilities

The WGAT validated SAT vulnerability SRS/H-Canyon/SAT/001. It agrees that inadvertent transfers, aging and degradation, equipment failure, corrosion or embrittlement, chemical reaction, radiolysis, and hydrolysis all could adversely affect vulnerability barriers. Where parameters are controllable, however, mitigative measures at the site are adequate.

2.4.3 Working Group Assessment Team Evaluation

Facility Walkdowns

Two H-Canyon walkdowns were conducted, the first concentrated on the accessible areas in Building 211–H, and the second on equipment in the 211–H Outside Facilities area. As the hot canyon, warm canyon, and receiving and storage areas were inaccessible, the team concentrated on activities in the control room and crane operator room. H-Canyon control room operations staff and crane operations control room staff accompanied the WGAT members during this walkdown. The team observed only one area of weakness, and this during its walkdown of the H-Canyon control room. That weakness concerned administrative control of the installation of canyon jumpers and the maintenance of facility configuration control. A procedural deficiency and noncompliance with procedures were determined to be the causes. An occurrence notification was prepared as a result of the team's identification of the issue, and subsequently all pertinent deficiencies were addressed and corrected. The WGAT does not feel that a new vulnerability is at issue here; however, this does highlight and reinforce the SAT-identified vulnerability SRS/H-Canyon/SAT/001.

The WGAT also conducted a walkdown and review of documents associated with the new EU–S Tank located in the 211–H Outside Facilities A-Line area. Included in the walkdown were the Building 211–H control room; Tanks E–1–1 and F–1–5; piping connecting various components; the heat exchanger, HEPA filters, and other components on top of the EU-S Tank; and the EU–S Tank itself. The EU-S Tank contains more than 99 percent of the HEU located in the partitioned H-Canyon Outside Facilities area reviewed by the team. Assessment centered on seismic qualification, operations, radiological, criticality, and safety documentation aspects of the tank installation. Accompanying the team members during the walkdown were the Outside Facilities area Operations Manager and the Outside Facilities area Engineering Manager. During the walkdown, an issue related to potential criticality of the EU–S Tank that was not addressed in the SAT Report was raised. That issue was examined in detail in the tabletop discussions described later.

Also discussed during this walkdown was the NIM Program. There are two NIMs at each of two locations in the 211–A Line, two near the sump for the EU–S Tank and the other two near the sump at Tank F–1–6. They are functionally tested quarterly and are spaced such that a criticality involving either of them would be detected by both. Installation support structures observed during the walkdown appear to be designed to sustain seismic or tornadic winds although according to the Outside Facilities Engineering Manager, they are not required to be seismically qualified.

During the walkdown of both Building 221–H and the Outside Facilities area, the general condition of equipment anchorage was observed. It was noted that equipment mounted on the roof of Building 221–H is well anchored, and that there are no missing or obviously loose anchor bolts. Similarly, piping

runs, the EU–S heat exchanger, and the HEPA filters mounted on top of the EU–S Tank are well supported. The team noted; however, that the A-Line storage tanks (e.g., E–1–1 and F–1–5) are not anchored to their concrete support saddles.

The WGAT observed routine control room operations and reviewed the H-Canyon operations narrative and process logs. During the observation period, it was determined that alarm acknowledgment and control room formality are adequate to ensure the safe operation of process equipment. Moreover, the operations logs (review period: June 1–11, 1996) are complete and accurate in their reflection of the status of facility process changes and responses to required actions. The narrative and process logs are also appropriately reviewed by operations management and the relieving operations crews. A review of the shift turnover logs was also positive; the recorded information, facility status, and upcoming evolutions are conducive to a smooth turnover of the facility to the oncoming operations shift. The WGAT identified no deficiencies in H-Canyon conduct of operations that would result in HEU vulnerabilities.

The WGAT walked through emergency operating procedure (EOP) 221–H–0055, Revision 1, *Increased Activity in Segregated Cooling Water System*, dated September 28, 1995, with on-shift H-Canyon operations personnel, including the control room day shift manager and H-Canyon Outside Facilities operators. Evaluation focused on the ability of the operating crew to mitigate abnormal and emergency conditions affecting H-Canyon. Actions in response to a simulated process upset and a discussion of the procedural requirements yielded no evidence of vulnerabilities in abnormal and emergency operations for H-Canyon and the H-Canyon Outside Facilities.

During the walkdown of the EOP actions associated with H-Canyon Outside Facilities, the team was informed by facility management that not all of the authorization basis requirements had been identified as being nuclear safety related; however, the requirements were incorporated in all of the in-use operating procedures. Nuclear safety requirements can be negated when procedures are modified if actions consistent with those requirements are not specifically identified by some unique marking and controlled by a procedural modification process. On further investigation, the team determined that all operations procedures for H-Canyon and H-Canyon Outside Facilities undergo unreviewed safety question (USQ) screening to ensure that authorization basis safety requirements are not affected and thus that operations outside the authorization basis do not occur. Therefore, no authorization basis vulnerabilities were observed in operations or control of operations related to HEU processes at H-Canyon and H-Canyon Outside Facilities at the time of this assessment.

Tabletop Discussions

Numerous tabletop discussions were held regarding field observations and reference material reviewed by the WGAT for this assessment. Included was a discussion of the results of a review of the configuration control scroll of H-Canyon facility piping to determine if administrative controls described in the SAT Report are in place. The review disclosed that the last jumper move had been completed at 0115 on June 4, 1996, and that as of 1300 on June 5 the correct installation of the jumper and posting of the move on the control room canyon scroll had not been independently verified. In discussions with the facility crane operations supervisor, it was determined that the procedure for this jumper appears to be incorrect in that the move does not require independent verification. When the team asked

if this jumper could physically be connected to a position other than the one required for pumping out the cell 7 sump, it was advised that it could be. This particular jumper is a flexible type, not a rigid point-a-to-point-b type, [illegible] cannot readily be misconnected. Fa[illegible] management was asked to review what the team had discovered and to pull together the documents governing jumper installation and facility configuration control in order to determine that the controls necessary to preclude improper tank transfers, which are potential vulnerabilities, are in fact adequately addressed. An occurrence notification was prepared and submitted as a result of the team's identification of this issue. Subsequently, all deficiencies associated with this issue were addressed and corrected. The team does not feel that a new vulnerability is at issue; the condition does, however, highlight and reinforce the SAT-identified vulnerability concerning improper transfers previously discussed (SRS/H-Canyon/SAT/001).

A tabletop discussion was held with the 211-H A-Line radiation control operation supervisor concerning the A-Line NIMs. As a result of that discussion, it was concluded that the NIMs—there are four covering the outside storage tanks—would provide adequate coverage in the event of a criticality. It was also concluded, however, that neither of the pair would survive the seismic DBA event. Criticality during the DBE, however, is not a concern.

Several documents pertinent to the Building 211-H Outside Facilities area were reviewed by WGAT members. The Operational Safety Requirements (OSRs) document (WSRC-RP-90-568, *Operational Safety Requirements, Separations Area Operations, Building 211-H Outside Facilities, Uranyl Nitrate Storage Facility*, September 1992) was reviewed to gain a more complete understanding of various operational

ptember 4,

requirements for the FU-S Ta[illegible] 2.4-6). Appropriate document[illegible] reviewed to verify the safet[illegible] (safety related or safety s[illegible] structures, systems, and compr[illegible] Canyon area. Inc[illegible] NMS-ENG-95-0011, Rev. 3, *Safety Significant Systems f[illegible] Facilities* (a document applicat[illegible] Canyons, F- and H8-Lines, and [illegible] and 247-F facilities), and N[illegible]

[redacted]

[illegible] December 15, 1988) were also reviewed.

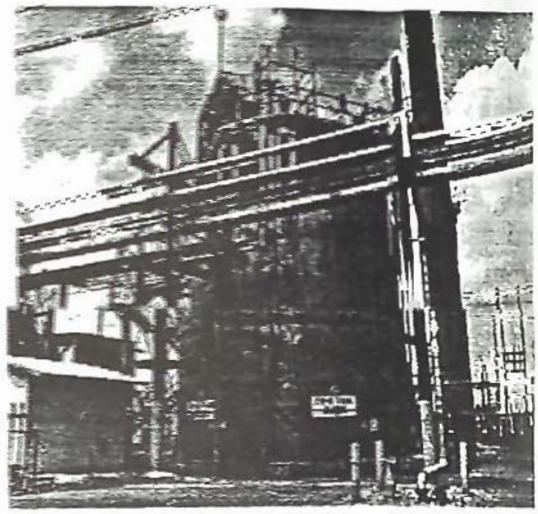


Figure 2.4-6. FU-S Storage Tank

however, it was noted by the Engineering Manager th[illegible] qualifications of the FU-S [illegible] process of being updated to i[illegible] more recent seismic input. Th[illegible] calculations are being perform[illegible] Sitewide Structural Qualifi[illegible] (SQP).

During discussions with the [illegible] Operations Manager and Engi[illegible] it was determined that freez[illegible] portion of the uranyl nitrate in

Canyon process. It consists of three separate facilities: the Scrap Recovery Facility, the Neptunium Oxide Facility, and the Plutonium Oxide Facility. The Scrap Recovery Facility is designed for dissolving local and off-site scrap to a nitrate solution for transfer to H-Canyon for further processing. Although currently used in the first-stage recovery of plutonium 238, the facility may also be used to recover uranium 235, plutonium 238, plutonium 239, and neptunium 237. The Neptunium Oxide Facility is used to produce neptunium oxide powder by precipitation and calcination from nitrate solutions of neptunium 237. It may also be used for the precipitation of plutonium 239 nitrate solutions. In the Plutonium Oxide Facility, plutonium 238 oxide is produced by precipitation and calcination of nitrate solutions of plutonium 238. Included in the original design of HB-Line was a Waste Handling Facility to be used in processing and packaging the radiological waste generated. That facility has been converted to a multipurpose facility, primarily an analytical laboratory in which samples required for HB-Line operations are processed. HB-Line is currently producing plutonium oxide to be used as heat sources for thermoelectric generators for National Aeronautics and Space Administration missions.

The HB-Line facility is a reinforced-concrete structure constructed in the early 1980s and designed to withstand a DBE or DBT. Process equipment is stainless steel throughout, and all process transfers are by vacuum jet through jacketed piping outside the gloveboxes. Containment and shielding are provided by the gloveboxes, which are exhausted through two stages of DOP-testable HEPA filters. Process services (electrical, HVAC, air, water, and instrumentation and control) are designed fail-safe to preclude the escalation of any abnormal events.

2.5.2 Site Assessment Team Repo Evaluation

The WGAT evaluated the Question S responses for HB-Line.

Question Set Responses

The SAT Report provides additional det regarding HB-Line's mission, current activitie material holdings, and authorization bas documents. For the HEU Vulnerabil Assessment, only one partitioned area, t Scrap Recovery Facility, was defined. description of the partitioned area and oth pertinent details such as material holdings, st experience levels, material transfer activiti and the barrier types used to protect worke the public, and the environment are include

The WGAT reviewed the information regard barrier types and material holdings containe the SAT's response to Questions 2 and 3 of HEU Vulnerability Assessment Question S The WGAT concurs in the partitioning barrier information contained in SAT Repo

Identified ES&H Vulnerabilities

No vulnerabilities were identified by the SA HEU materials stored in HB-Line. Inform developed during the HB-Line walkdowns tabletop discussions led the WGAT to dis with this conclusion.

2.5.3 Working Group Assessment Evaluation

Facility Walkdowns

The WGAT was informed that a storage HB-Line contains sources and sta containing HEU and other collocate commingled isotopes (see Figure 2.5-1

members then performed a visual inspection of the materials contained within the safe to determine if any vulnerabilities are associated with the sources and standards.

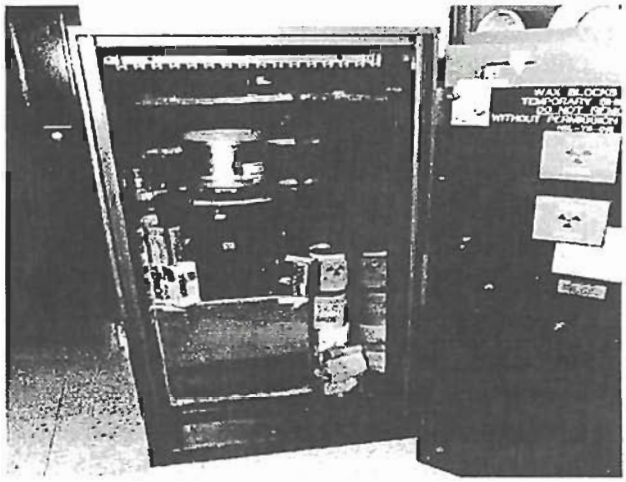


Figure 2.5–1. HB–Line Source/Standard Safe

During this walkdown, it was learned that the original list supplied to the team was incomplete; it reflected only sources and standards reviewed by the SAT. The WGAT then requested a complete listing so that its verification of the contents of the safe would require only one entry into the controlled area and time in the area could be kept to as-low-as-reasonably-achievable (ALARA) levels. Entry by the team into the radiation area was ultimately found to be unnecessary, for the material could be accounted for and its condition determined through a window between the HB-Line control room, a non–radiologically controlled area, and the room in which the storage safe is located. Thus, exposures incidental to completion of the walkdown were further reduced. The HB-Line radiation controls professionals were cautious and displayed concern for ALARA considerations for entry into the storage safe. The materials assessed are contained in opaque plastic screw-top jars, ice cream–type containers, metal slip-top cans, plastic bags, paint-type cans, and a 5-gallon metal container. Such packaging (see Figure 2.5–2) does not permit monitoring for the degradation of package contents. The WGAT concluded, as a result of the source inspection and inventory activity, that the inability to establish the actual condition of the sources and standards in the HB-Line safe constitutes a vulnerability. This vulnerability was formally documented as SRS/HBL/WGAT/001. A similar vulnerability (SRS/235–F/SAT/001) was identified for Building 235–F in the SRS SAT Report.

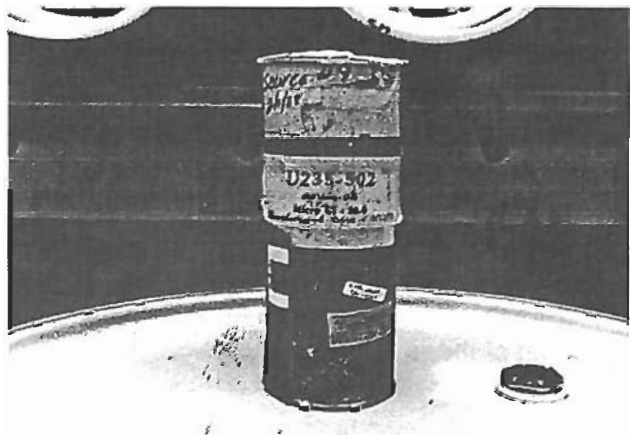


Figure 2.5–2. Unknown Packaging of HEU Standard

Tabletop Discussions

Previous vulnerabilities identified during the Plutonium Vulnerability Assessment include SR–HB–3, *Uncertainties in packaging materials for non-Pu standards and other miscellaneous sources in HB-Line.* The WGAT held discussions with the radioactive source control custodians for the SRS and the technical advisor to the Health Physics Technology Group regarding the SRS Radioactive Source Accountability and Control Program. This program, described in the SRS/WSRC 5Q1.1 Manual, Procedure 502, *Radioactive Source Accountability and Control*, Rev. 2, dated August 1, 1995, is explicit. Fundamentally, it establishes requirements for inventories, integrity tests, and source procurement and

ionsibilities
Under this
sts must be
exemption
custodians
sfying pro
untability,
no formal
am for the SRS
ation of 5Q1.1

sight function of the
, an audit must be
t once every 3 years. As
the WGAT, the audit does
ission. This information is
because of the additional
WGAT identified during its
B-Line and Building 773–A.
cilities have source inventories
J collocated or commingled with
storage safes that were not
ng the Plutonium Vulnerability
vulnerability

install

criticality safety
designed to wit
winds.

Commissioned
manufacturing facility in 1957,
provided assemblies for the
production reactors and offs
reactors. Major activities while
operation included uranium-alu
casting; casted-alloy machining; bi
extrusion, segmenting, and ma
drawing to final dimensions; assem
inspection, and reactivity delem
final fuel-target assembly. More r
alloy recasting and deinventory op
been conducted there. Current
limited to routine facility surveilla
for ventilation and radiological
waste handling, including NDA

2.6.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses and the single SAT vulnerability for Building 321–M.

Question Set Responses

For the purpose of this assessment, Buildings 321–M and 322–M were defined as a single partitioned area. The WGAT considers this definition acceptable, even though no HEU holdings are located in Building 322–M. Building 321-M was the focus of this assessment.

Barriers protecting the workers in contamination areas include ducts, rooms, distance, protective clothing and, as appropriate, respiratory protection. Walls enclosing contamination areas provide an additional barrier for workers in the balance of the facility. Barriers to criticality are provided by limitation of the mass to the current holdings and the distribution thereof in small deposits in distinct, well-spaced equipment and ventilation components. Administrative barriers designed to protect workers, the public, and the environment include surveillance and maintenance procedures, material limits, quality assurance, conduct of operations, and the authorization basis. The WGAT confirmed barrier characterizations during the walkdowns.

Potential causes of barrier failure include a tornado, straight winds, or a seismic event; such phenomena could conceivably release material from exhaust ducts located on the roof. Nevertheless, no specific facility or material/packaging failures are cited in the SAT Report. The SAT in fact conservatively took no credit for material confinement and assumed that the entire source term is subject to environmental dispersal. This release was calculated in the SAR to result in a radiological dose to facility workers in the "low" severity class and contamination of on-site personnel and objects 100 meters downwind of the facility in the "medium" severity class. No off-site impact was indicated.

Identified ES&H Vulnerabilities

One Building 321–M vulnerability was identified in the SAT Report: SRS/321–M/ SAT/001, *Release of holdup material from exhaust ducts and equipment in Building 321–M*. In general, the WGAT agrees with that vulnerability.

Currently, quantities of combustible materials accumulating in Building 321–M owing to the temporary suspension of contaminated-waste transfers (see Figure 2.6–1). This was identified as a vulnerability (SRS/321M/WGAT/001) by the WGAT.

Figure 2.6–1. HEU–Contaminated Combustible Waste

2.6.3 Working Group Assessment Team Evaluation

Facility Walkdowns

Members of the WGAT toured the Building 321–M HEU-manufacturing facilities and roof area (ventilation systems). Manufacturing or process facilities included radiological contamination areas. In most respects, this walkdown confirmed the facility condition, HEU

holdings and packaging, barrier descriptions, and barrier failure modes and consequences conveyed in the SAT Report. The walkdown and related discussions also verified SRS/321M/SAT/001 identified in the SAT Report. Members of the WGAT expressed the belief, however, that clarification with respect to the fire release scenarios is warranted. The VAF statement "Only limited quantities of combustible materials are permitted in the facility" is offered as evidence of compensation for the material release vulnerability. However, WGAT members found that numerous plastic bags and cardboard boxes containing contaminated, combustible waste are "stranded" within the radiological contamination area awaiting implementation of new SRS waste management procedures and new metal overpack boxes. This vulnerability is documented in SRS/321–M/WGAT/001.

Additionally, an outdoor oil-cooled electrical transformer is close enough to the exterior of the facility wall that its oil could leak through, providing fuel (perhaps preignited by a short in the transformer itself) for a fire within the facility. No containment or drainage system is provided for the transformer.

An impact not explicitly delineated in the SAT Report is the spread of contamination into the ground beyond the facility walls in firefighting water runoff. Members of the WGAT noted that such a release is possible for any contaminated facility having no collection or containment features. They also acknowledged, however, that given the low quantities of the material at risk in Building 321–M, the consequences of a release of contaminated firefighting water from that facility would be low.

Tabletop Discussions

Members of the WGAT discussed material and facility conditions with the Operations Manager and two senior engineers for Building 321–M. Topics included HEU characteristics, systems and components, natural phenomena and fires, electric power supply systems, routine operations, and the authorization basis. In follow-up discussions, team members discussed techniques used in holdup determinations with a Technical Support Group staff engineer, and staffing, training, and deactivation plans with the Facility Manager.

Diminishing experience levels of operating personnel was cited (VAF SR–GEN–1) in the Plutonium Vulnerability Assessment. For Building 321–M, outdated surveillance procedures do not provide sufficient detail or guidance to compensate for the diminishing facility-specific experience that personnel retirements and reassignments have imposed and will continue to impose on facility staffing. For example, the procedure for daily rounds (SOP–300–33) only instructs operators to "verify that the ventilation systems are working properly," giving no indication of what constitutes proper or improper operation or where such indications may be found.

2.7 105–K Assembly Area

2.7.1 Facility Description

The 105–K Assembly Area, 8.8 kilometers from the nearest site boundary, was constructed in 1954. It was designed to receive, assemble, inspect, and stage new fuel assemblies, unirradiated targets, and reactor components so as to ensure that they are in a critically safe configuration before they are used in K-Reactor. The primary authorization basis document for the 105–K Assembly Area is a Basis for Interim Operation (BIO), WSRC–TR–93–500, Rev. 1, June 1995, supported, as appropriate, by the following documents:

- *Savannah River Site Production Reactor Safety Analysis Report, K Production Reactor*

WSRC–SA–10003, Amendment 4, November 8, 1992

- *Savannah River Site Production Reactor Technical Specifications, K Production Reactor*, WSRC–TS–10003, Rev. 23, December 12, 1995

- *K-Reactor Cold Standby Basis for Interim Operation (BIO)*, WSRC–TR–94–207, Rev. 0, February 1995

Designed to Uniform Building Code 1946 and its supplements, the facility consists of a steel frame, single-story structure with a basement under a portion thereof. The roof consists of 2-inch concrete slabs on steel joists, and the exterior walls are of corrugated asbestos on steel frame. The final storage area, slug vault, and presentation room are all Seismic Category I structures with reinforced-concrete roofs, walls, foundations, and monorail systems. Although the portion of the facility in which the borated-concrete storage racks are located is not Seismic Category I, the 18-inch-thick reinforced-concrete walls along the backs of the storage racks, approximately the same height as the racks, provide protection during high wind and seismic events. Security cages at the front of the borated-concrete storage racks protect the fuel from unauthorized removal and also provide protection against fuel ejection from the racks during high wind and seismic events.

The facility currently serves as a staging area for the site inventory of unirradiated enriched uranium material in such a manner as to provide asset and criticality protection. Staging of this material there will continue until final approval is received for its transfer to a permanent storage repository (e.g., Oak Ridge Site). All HEU at the 105–K Assembly Area originated at the Fuel Fabrication Facility (Building 321–M).

Substantial quantities of HEU are being stored within the 105-K Assembly Area. Included are 1852 fuel tubes and assemblies, 6350 deinventory ingots/skimmings (from Building 321–M), and 469 other HEU forms, such as floor sweepings and filters (see Figures 2.7–1 and 2.7–2). These holdings constitute the vast majority of all the unirradiated HEU at the SRS.

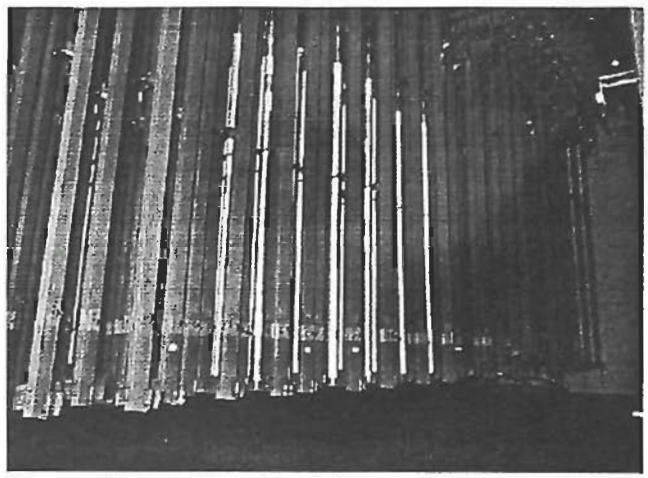


Figure 2.7–1. New Fuel Assemblies in K Assembly Area

2.7.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for the 105–K Assembly Area.

Figure 2.7–2. HEU Storage Drums in K Assembly Area

Question Set Responses

The SAT separated the 105–K Assembly Area into three partitioned areas: the floor storage area, the borated storage racks, and the final storage area. The WGAT agrees that, given the type of storage and the physical locations of materials within the facility, this partitioning scheme was appropriate for the HEU Vulnerability Assessment.

For each of the partitioned areas, the barriers identified and described by the SAT are judged by the WGAT to be appropriate. Likewise, the holdings and packaging listings and descriptions provided in the question set for each of the partitioned areas are appropriate and complete. For the most part, the causes, effects, and consequences of barrier failure (questions 4, 5, and 6) are complete and appropriate. The selected external causes of earthquakes, winds, aircraft crash, and vehicle accident are agreeable to the WGAT. For the final storage partitioned area, moreover, the facility causes (i.e., water sources, human error, and fire) and descriptions of effects and consequences provided by the SAT are appropriate and thus concurred in by the WGAT.

Identified ES&H Vulnerabilities

The SAT identified no ES&H vulnerabilities associated with the HEU currently stored within the 105–K Assembly Area. The WGAT concurs in this conclusion.

2.7.3 Working Group Assessment Team Evaluation

Facility Walkdowns

The WGAT toured the three designated partitioned areas of the 105–K Assembly Area—the floor storage area, the borated racks, and the final storage area. During these walkdowns, discussions were held with facility operations personnel to get a clear understanding of current and planned operations and concerns. Observations were made relative to general facility conditions, potential ES&H concerns and vulnerabilities, and operating practices and procedures. Although the team did not gain access to the final storage area—it would have required substantial human safeguards and security resources and raised ALARA concerns—members did view the area through the access door window. The Mark 22 modules with neptunium in this area were clearly seen to be in a seismically qualified, hanging configuration and wrapped in clear plastic in a seismically qualified vault. On questioning, the facility representatives indicated that the plastic wrapping is to protect workers from the contamination on the assemblies. Materials in the floor storage area were observed to be properly spaced, and the containers to be in excellent condition and to have appropriate labels. The borated-concrete storage racks are also in excellent condition, and the materials stored therein orderly, neat, and in good condition. Some of the storage rack locations contain aluminum cans. On questioning the personnel advised that these cans contain MK–22 fuel assemblies contaminated with small amounts of tritium. It was noted that the contamination is in an oxide form, affixed to the outer oxide layer as Al_2O_3-HTO. The WGAT also observed, during the walkdowns, that the 105–K Assembly Area, like several other facilities at the SRS, has no provisions for containing or redirecting firefighting water runoff. Given the low levels of HEU that would be contained in firewater runoff, however, this was not cited as a vulnerability.

Tabletop Discussions

Authorization basis documents and safety materials were reviewed to determine the hazards considered and analyses performed to

identify resulting operational limits and constraints. A revision to the current BIO addressing a planned reconfiguration of drum storage at this facility is in the review process. Although the 105–K Assembly Area is currently being operated as a storage facility, plans call for its conversion to a processing and shipping facility. A new BIO is being prepared to support this mission change.

The SAT reported that other than the exterior asbestos walls, there are no significant amounts of any other hazardous material collocated or commingled with HEU holdings at the 105–K Assembly Area. With the exception of the issues of collocated Np–237 and tritium contamination, the WGAT concurs in this conclusion.

Np–237 reactor targets are located in the final assembly area in the vicinity of the unirradiated fuel. This material is the source of a 1 rem/hr radiation field creating the possibility of increased worker exposure.

A total of 864 tritium-contaminated fuel assemblies are stored in the borated-concrete storage racks in the facility. Contamination is the result of these assemblies having been stored in K- and L-Basins after being discharged, unirradiated, from K- and L-Reactors. The WGAT investigated the potential for contamination of workers who will actually have to handle these fuel assemblies after plans for their disposition have been finalized and approved. Further discussions were held with WSRC engineering and operations personnel on this subject. It was learned that the tritium contamination is in the form of oxide (smearable and nonsmearable) in the outer layers of the aluminum cladding. Reviews were conducted of analyses previously performed by the WSRC to quantify the contamination levels and to determine experimentally the effectiveness of the proposed decontamination method (heating, to drive the tritium out of the aluminum cladding). Through these interviews and document reviews, the WGAT determined that the contamination levels are very low and could, if desirable, be reduced further by about 95 percent. Operations personnel have already developed procedures and specific precautions, commensurate with the expected risk, to protect workers who will ultimately be responsible for handling the assemblies. The WGAT concluded that the tritium contamination on the MK–22 fuel assemblies currently in the 105–K Assembly Area does not constitute an ES&H vulnerability or concern.

The WGAT explored the possibility of DBE-induced criticality at the 105–K Assembly Area. Questions were asked of WSRC operations and engineering personnel to determine how materials are handled, packaged, and stored, and applicable portions of 105–K Assembly Area authorization basis documents were reviewed to determine the rigidity of the facility's structural components and storage racks. The WGAT concluded that, considering the operating and storage configurations and facility design features, this event has been adequately analyzed and poses no additional ES&H vulnerabilities or concerns.

2.8 K-Reactor Disassembly Basin

2.8.1 Facility Description

The K-Reactor Disassembly Basin is within Building 105–K, which houses the production nuclear reactor constructed in the early 1950s and which is 8.8 kilometers from the SRS boundary. Originally the basin was a receipt and processing location for irradiated-fuel tubes discharged from the reactor. Once received, the fuel was permitted to decay for some time. Metal-cutting operations were performed to prepare the tubes for accumulation into handling units called bundles. The bundles were stored, and then packaged into casks for rail transfer to the fuel-reprocessing site. All

these activities were conducted remotely while the fuel was under water, which provided radiation shielding for the workers. The Disassembly Basin contains 3.4 million gallons of water in a series of interconnected basins varying in depth from 17 to 50 feet and constructed of concrete ranging in thickness from 2.5 to 7 feet. Included are the Vertical Tube Storage (VTS) area; the Machine Basin, further subdivided into the Dry Cave, Emergency Disassembly, and Horizontal Bundle and Bucket Storage HBBS areas; and the Transfer Area, where casks were loaded with fuel. Discharged fuel tubes were stored vertically in the VTS area and were disassembled in a horizontal orientation in the Machine Basin. Later the disassembled tubes were collected in bundles (up to four per bundle) and the bundles were stored horizontally in aluminum racks. Up to three bundles were placed into a 70-ton cask, which was removed from the basin and transported on a specially designed rail car to the reprocessing facility. Other items such as target assemblies, control rods, source rods, and reactor internals were also processed through the basin. The current mission of the K–Reactor Disassembly Basin is to store various irradiated materials, including those containing HEU, pending a decision on their disposition. Fuel containing HEU is currently stored in the VTS and HBBS areas.

2.8.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for the K-Reactor Disassembly Basin.

Question Set Responses

The K-Reactor Disassembly Basin was included in the SNF Vulnerability Assessment. Some of the HEU present in the basin may have been in either the L-Reactor or the P-Reactor Disassembly Basin at the time of t assessment and subsequently shuffled at as part of consolidation efforts. Only the three questions of the HEU Vulnerab Assessment Question Set were executed the facility. The facility was partitioned into area for the evaluation, and such a partitio is reasonable. The barrier types selected also reasonable.

Identified ES&H Vulnerabilities

No VAFs were executed for the K-Rea Disassembly Basin. All of the materials st therein were assessed under the S Vulnerability Assessment and are thus o the scope of the HEU Vulnerability Assessm

Certain design basis weaknesses w identified in the SAT Report:

- An earthquake might cause cracks in the resulting in leaks of contaminated wate an uncontrolled area and exposu personnel to unshielded irradiated mater
- A shipping cask drop from a high elev could cause damage to the basin fa resulting in consequences similar to th attributable to an earthquake.
- Fuel cladding could corrode, result radionuclide release and subsequ contamination of basin water.

These weaknesses were identified by the Vulnerability Assessment.

2.8.3 Working Group Assessment's Evaluation

Facility Walkdowns

The WGAT walked down the K-Re Disassembly Basin with SRS personne impressions were that housekeeping s

various pipes and equipment items are well labeled, and evacuation signs are posted. Two radiation-monitoring systems are in place, one (the NIM system) for the detection and alarm of a nuclear criticality accident and the other (the health-monitoring system) for the detection of generally high radiation levels. Furthermore, the evacuation routes for the NIM system alarm response are well marked. Fuel is currently stored in the VTS and HBBS areas, and the basin will receive some more fuel for storage on deinventory of the P-Reactor Disassembly Basin. In the VTS area, corrosion at the stainless steel hanger–fuel tube interface is evident, as reported in the SNF Vulnerability Assessment. No corrosion is evident in the HBBS area, although the top of the racks exhibit a "warty" or "barnacled" appearance that may simply be sediment.

The HBBS racks can accommodate up to three bundles per rack but currently only contain two. These racks are located in an open basin. Water clarity is good even at the low illumination levels, although occasional floating debris (e.g., a glove, a piece of cardboard) is observable. The Transfer Area where fuel casks are handled was not visited. Since the SNF Vulnerability Assessment, there have been improvements such as removal of basin sludge, reduction in basin water conductivity, and improvement in basin water chemistry surveillance to minimize fuel corrosion.

The walkdowns confirmed the weaknesses identified in the SAT Report and the continued validity of the vulnerabilities to reactor disassembly basins identified in the SNF Vulnerability Assessment. No new vulnerabilities were identified.

Tabletop Discussions

Tabletop discussions with SRS personnel were conducted, and several relevant documents were obtained and reviewed. In addition to relevant sections of the HEU SAT and SNF Vulnerability Assessment Reports, the following documents were examined to provide verification and confirmation of various points:

- *105–P, K, and L Disassembly Basin Cask Support Frame Final Report*, ELS–CES–96–0020, April 24, 1996

- *100 Area Irradiated Fuel Consolidation and Horizontal Storage Criticality Concerns (U)*, SRT–CMA–930074, Rev. 0, January 1994
- *Horizontal Tube Storage Limits Revision*, Technical Specification Change Request 94–0004, May 1994

- *Project S5839 FPR for Fuel Storage Rack*, Unreviewed Safety Question Determination 94–0074, July 5, 1994

Review of the nuclear criticality safety of HBBS under normal and abnormal operating conditions confirmed subcriticality.

2.9 L-Reactor Disassembly Basin

2.9.1 Facility Description

The L-Reactor Disassembly Basin is within Building 105–L, which houses the production nuclear reactor constructed in the early 1950s and which is 8.8 kilometers from the SRS boundary. Originally the basin was a receipt and processing location for irradiated-fuel tubes discharged from the reactor. Once received, the fuel was permitted to decay for some time. Metal-cutting operations were performed to prepare the tubes for accumulation into handling units called bundles. The bundles were stored, and finally they were packaged into casks for rail transfer to the fuel-reprocessing site. All these activities were conducted remotely while the fuel was under water, thereby shielding the workers from radiation. This Disassembly Basin contains 3.4 million gallons of water in a series of interconnected

basins varying in depth from 17 to 50 feet and constructed of concrete ranging in thickness from 2.5 to 7 feet. Included are the VTS area; the Machine Basin, further subdivided into the Dry Cave, Emergency Disassembly, and HBBS areas; and the Transfer Area, where casks were loaded with fuel. Discharged fuel tubes were stored vertically in the VTS area and were disassembled in a horizontal orientation in the Machine Basin. After the disassembled tubes were collected in bundles (up to four per bundle), the bundles were stored horizontally in aluminum racks. Up to three bundles were placed into a 70-ton cask, which was removed from the basin and transported on a specially designed rail car to the reprocessing facility. Other items such as target assemblies, control rods, source rods, and reactor internals were also processed through the basin.

Currently the basin is being modified to accommodate a change of mission. The most evident change is replacement of the stainless steel hangers in the VTS area with racks to be used for the vertical storage of aluminum bundle tubes similar to those used in the RBOF. The purpose of the revisions is to permit the L-Reactor Disassembly Basin to be used for the storage of foreign and domestic research reactor fuels, thus providing capacity beyond that of the RBOF. Total capacity of the L-Reactor Disassembly Basin will increase by 50 percent.

2.9.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for the L-Reactor Disassembly Basin.

Question Set Responses

The L-Reactor Disassembly Basin was included in the SNF Vulnerability Assessment. Some of the fuel currently in the basin may have been in either the K-Reactor or P-Reactor Disasse Basin at the time of that assessment subsequently shuffled about as pa consolidation efforts. Only the first questions of the HEU Vulnerability Assess Question Set were executed for the facility. facility was partitioned into one area fo evaluation, and such a partitioning reasonable. The barrier types selected are reasonable.

Identified ES&H Vulnerabilities

No VAFs were executed for the L-Re Basin. All of the materials stored there assessed under the SNF Vulner Assessment and thus are outside the sc the HEU Vulnerability Assessment.

Three design basis weaknesses were id in the SAT report:

- A earthquake might cause cracks in its resulting in leaks of contaminated wa an uncontrolled area and the expo personnel to unshielded irradiated fu
- A shipping cask drop from a high le could cause damage to the bas resulting in consequences simila attributable to an earthquake.
- Fuel cladding could corrode, res radionuclide release and sub contamination of basin water.

These weaknesses were identified by Vulnerability Assessment.

2.9.3 Working Group Assessm Evaluation

Facility Walkdowns

The WGAT walked down the L Disassembly Basin with SRS person

impressions were that housekeeping is good, various pipes and equipment items are well labeled, and evacuation signs are posted. Two radiation-monitoring systems are in place, one (the NIM system) for the detection and alarm of a nuclear criticality accident and the other (the health-monitoring system) for the detection of generally high levels of radiation. The evacuation routes for the NIM system response alarm are well marked. Fuel is currently stored in the VTS area, which will receive more fuel on deinventory of the P-Reactor Disassembly Basin. New vertical storage racks similar to those used in the RBOF were observed in the VTS area. Receipt and storage of fuel will be counter to the historical material flow through the facility, but facility management is confident that the new mission can be accomplished.

For nuclear criticality protection, recent changes have been effected in the HBBS area an open basin. Storage capacity of each rack has been increased from three to four bundles, and a physical barrier has been installed on top of the racks to prevent a dropped bundle from coming too close to the bundles in storage.

In the Transfer Area, where fuel casks are loaded and unloaded in a basin, metal fixtures are used for removing the cask lid. During the WGAT walkdown of the P-Reactor Disassembly Basin, it was reported that a portion of these fixtures had recently collapsed while in use. Follow-up of this report revealed that the event had prompted an engineering evaluation of the condition of the fixtures at the K-, L-, and P-Reactor basins. Evaluation of the L-Reactor basin fixtures was not completed because some of the carbon steel fasteners were covered with sediment and their condition could not be determined. Facility management indicated that it is their intent to remove the fixtures entirely, provide suitable protection for the floor of the basin, and let casks rest on the floor of the basin. Some operational delays will be introduced, but flexibility will be improved.

Since the SNF Vulnerability Assessment, there have been improvements such as the removal of basin sludge, reduction in basin water conductivity, and improved basin water chemistry control to minimize fuel corrosion.

Tabletop Discussions

Tabletop discussions with SRS personnel were conducted, and several relevant documents were obtained and reviewed. In addition to relevant sections of the HEU Site Assessment Team and SNF Vulnerability Assessment Reports, the following documents were examined to provide verification and confirmation of various points:

- *105–P, K, and L Disassembly Basin Cask Support Frame Final Report*, ELS-CES-96-0020, April 24, 1996
- *100 Area Irradiated Fuel Consolidation and Horizontal Storage Criticality Concerns (U)*, SRT–CMA–930074, Rev. 0, January 1994
- *Horizontal Tube Storage Limits Revision*, Technical Specification Change Request 94–0004, May 1994
- *Project S5839 FPR for Fuel Storage Rack*, Unreviewed Safety Question Determination 94–0074, July 5, 1994

Review of the nuclear criticality safety of increased HBBS under normal and abnormal operating conditions confirmed subcriticality.

2.10 P-Reactor Disassembly Basin

2.10.1 Facility Description

The P-Reactor Disassembly Basin is within Building 105–P, which houses the production nuclear reactor constructed in the early 1950s and which is 7.2 kilometers from the SRS boundary. Originally the basin was a receipt

fissile material to the K- and L-Reactor basins. In a walkthrough of the deinventory process flow, several "what could go wrong" avenues were explored. Operating personnel are knowledgeable about the facility and very open. As fuel is removed from the VTS area, cladding corrosion should diminish because much of the corrosion is caused by the galvanic couple formed at the stainless steel hanger–aluminum fuel tube interface. The fuel tubes are bundled into aluminum holders, which are stored on aluminum racks, and thus no galvanic couples should be formed.

In the Transfer Area, where the casks are handled in a basin, metal fixtures are used for removing the cask lid. The fixtures are attached to structural members embedded in the concrete basin wall. It was reported that a portion of the fixtures at the K-Reactor Disassembly Basin had recently collapsed while in use. Follow-up of this report revealed that the K-Reactor cask-loading basin event had prompted an engineering evaluation of the condition of the fixtures at the K-, L-, and P-Reactor basins. The P-Reactor basin fixtures were found to be adequate for immediate use for 6 months, beginning in April 1996, and recommendations for longer term use are to be made.

In a WGAT observation of part of the operation involving the loading of a cask onto the specially designed rail car, it was noted that the rail car had been built in 1953. In subsequent discussions with facility management personnel, the preventive maintenance and refurbishment of the rail cars was described. Management recognizes that the cars are old, and efforts are being made to maintain them.

Since the SNF Vulnerability Assessment, there have been improvements such as the removal of basin sludge, reduction in basin water conductivity, and improved basin water chemistry surveillance to minimize fuel corrosion.

The walkdowns generally confirmed the weaknesses identified in the SAT Report on HEU and the continued validity of the vulnerabilities of the reactor disassembly basins identified in the SNF Vulnerability Assessment. No new vulnerabilities were identified. The fuel corrosion weakness should diminish as fuel is processed into bundles. The cask drop and seismic weaknesses will diminish and disappear, as far as HEU is concerned, as the reactor basin is deinventoried.

Tabletop Discussions

Tabletop discussions with SRS personnel were conducted and several relevant documents were obtained and reviewed. In addition to relevant sections of the Site Assessment Team's HEU and SNF Vulnerability Assessment Reports, the following documents were examined to provide verification and confirmation of various points:

- *105–P, K, and L Disassembly Basin Cask Support Frame Final Report*, ELS–CES–96–0020, April 24, 1996
- *100 Area Irradiated Fuel Consolidation and Horizontal Storage Criticality Concerns (U)*, SRT–CMA–930074, Rev. 0, January 1994
- *Horizontal Tube Storage Limits Revision*, Technical Specification Change Request 94–0004, May 1994
- *Project S5839 FPR for Fuel Storage Rack*, Unreviewed Safety Question Determination 94–0074, July 5, 1994

Review of the nuclear criticality safety of HBBS under normal and abnormal operating conditions confirmed subcriticality.

RBOF is located on approximately 9.6 kilom... site boundary. Building 24... building. Placed in service in ... was assessed in the 1993 S... Assessment. The primary authori... documents for the RBOF are *B*... WSRC-TR-94-0287, Rev. 1, effective August 31, 1995, and *Technical Safety Requirements—RBOF*, WSRC-TS-95-11, Rev. 0, also effective August 31, 1... documents are supported, as necessary, by a SAR approved by DOE in 1987; a SAR Addendum approved by DOE in June 1994; and approximately 200 Nuclear Safety Data Sheets of various dates, which address nuclear safety concerns relative to specific materials stored in the basins. The TSR document, developed in conformance with DOE 5480.22, replaced OSRs and Technical Standards previously in effect.

Although designed to receive and store irradiated nuclear fuels from off-site reactors, the RBOF can also handle and store SRS fuel assemblies as well as other reactor components. The facility mission has never changed. Most of the material currently stored at the facility was irradiated in off-site reactors.

Facility holdings include aluminum-, stainless steel-, and zirconium- clad HEU, and stainless steel- clad uranium of various enrichments that contains quantities of uranium 233. Approximately 43 percent (estimated) of the material is aluminum clad; the remainder, stainless steel or zirconium clad. The quantity of uranium 235 is 858.544 kilograms, of which 89.454 kilograms (approximately 10.4 percent) has been received since the SNF Vulnerability Assessment in 1993. Holdings also include 31.158 kilograms of uranium 233, all of which

...Building 244-... the WGAT co...

The RBOF barriers identi... the SAT... appropriate. In additi... information provided b... question 3 of the Question S... approximately 7 kilograms of ... contained in the Nereide fuel ... France in 1983. This irradiate... enrichment of approximately 20%... most recent shipments of irradiated ... received from the Missouri University Resear... Reactor contain 5.4 kilograms of uranium7... The WGAT concurs that the causes, effe... and consequences of barrier failure (respons... to questions 4, 5, and 6) presented by the SI... are complete and appropriate.

Identified ES&H Vulnerabilitie...

The SAT identified no ES&H vulnerabili... associated with the HEU currently stored wi... the RBOF. The WGAT concurs in t... conclusion.

2.11.3 Working Group Assessment/ Evaluation

Facility Walkdowns

The WGAT toured the RBOF. Durin... walkdowns, discussions were held with fa...

operations and engineering support personnel to get a clear understanding of current and planned operations and concerns. Reviews of log books, turnover sheets (May 20–June 6, 1996) and the required reading program were conducted and discussed with the Facility Manager. It was noted that the turnover sheet for the June 4 swing shift is missing, though the current turnover sheet is up-to-date and complete. Additionally, the required-reading program is deficient in terms of on-time completion; some items are months overdue. Remedial action is being effected by the Facility Manager. Observations were made relative to general facility conditions, potential ES&H concerns, and operating practices and procedures. It quickly became apparent that the RBOF operations management team is doing an excellent job ensuring that facility operators are comprehensively trained and qualified, that facility housekeeping effectiveness is continually improved, and that authorization basis–related requirements and limitations are consistently met. It was observed, however, that the RBOF, like several other facilities assessed, has no provisions for containing or redirecting firefighting water runoff and is accumulating quantities of potentially contaminated combustible material.

Tabletop Discussions

Authorization basis documents and related materials were reviewed to determine accident scenarios considered and analyses performed, and to identify resulting operational limitations and constraints. Discussions were held with various facility operating and engineering personnel and numerous documents were reviewed, the object being to determine the actual inventory of HEU at the facility and to obtain clarification regarding which shipments had been received since the 1993 SNF Vulnerability Assessment. These discussions resulted in an accurate accounting of materials holdings and clear identifications of which materials had been received since 1993. While touring the facility, the WGAT observed what appeared to be excessive combustible loading (records and procedures) in a small, skid-mounted building adjacent to Building 244–H. It was also observed that office space recently added to the building does not have automatic fire suppression sprinkler systems. Reviews of other documents, including the facility Fire Hazards Analysis, resulted in a WGAT conclusion that this condition poses no ES&H vulnerability or concern. The combustibles in question are not primary records, and they are being relocated, with completion expected before September 1996. Moreover, the area of the new office space is below the threshold (gauged in square feet) beyond which automatic sprinkling is required. An engineering decision was made during the design of these facilities that it would not be cost-effective to install an automatic fire suppression system not required by the current fire code or DOE Orders.

The SAT identified no new vulnerabilities for the RBOF beyond those identified during the SNF Vulnerability Assessment. As part of this assessment, the WGAT reviewed those vulnerabilities, their identified corrective actions, and progress being made toward completion. The WGAT agrees that there are no new vulnerabilities as a result of the 12 fuel shipments received since completion of the SNF Vulnerability Assessment, and has concluded that progress is being made toward completion of the corrective actions for the vulnerabilities identified in that assessment. The vulnerabilities in question are as follows:

- SRS–15: Conduct-of-operations
- SRS–16: Inadequate tornado protection at RBOF
- SRS–17: Seismic Vulnerability of RBOF

- SRS–20: Inadequate leak detection system on the underground meter filled RINM storage basin

- Generic: No up-to-date and approved SAR

2.12 Savannah River Technology Center

2.12.1 Facility Description

The Savannah River Technology Center (SRTC) comprises several facilities, including Building 773–A and Building 735–A, that have been built and modified continually since 1951. Construction is thus consistent with a number of different design criteria and building codes. Operations at the SRTC entail direct support to production reactor and chemical-processing facilities; developmental support to separations, waste-handling, and storage operations; and environmental restoration and environmental and personnel monitoring. These operations involve the use of many hazardous materials, radioactive and nonradioactive, generally in small quantities.

2.12.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for the SRTC.

Question Set Responses

For the purposes of the HEU Vulnerability Assessment, the SRTC was determined to have two partitioned areas: Building 773–A (the Main Technical Laboratory), which contains most of the HEU material in the laboratories; and Building 735–A, which contains only a small calibration source. The WGAT concurs in this determination.

Building 773–A, the primary research and development facility in the SRTC,, contains more than 350 grams of HEU. The facility is composed of six connected wings on two levels, and a basement that includes office, laboratory, operations, and maintenance activities. Laboratory areas are equipped with hoods and gloveboxes to confine materials that may be a hazard to workers, the public, and the environment.

The Building is currently operating in accordance with interim SAR, BIO, and OSR documents. There are no USQs relating to HEU. Of the approximately 350 grams of HEU in the facility, 257 grams are stored in Hot Cell 15 in four P-cans. The remaining materials are sources in safes and standards in hoods and gloveboxes throughout the facility. These sources and standards are inspected by the SRTC Material Control and Accountability Group every 6 months.

Building 735–A is also currently operating in accordance with interim SAR, BIO, and OSR documents. This facility contains low-level radionuclide laboratories, nonradiological chemical laboratories, testing equipment, and office areas. The only HEU in the facility is a 3.43-gram calibration source stored in a laboratory wall cabinet.

Identified ES&H Vulnerabilities

The SAT did not identify any vulnerabilities for HEU in the SRTC facilities. Given that all HEU is either collocated or commingled with plutonium, it does not present any vulnerabilities that were not identified in, and addressed as a result of, the Plutonium Vulnerability Assessment.

2.12.3 Working Group Assessment Team Evaluation

Facility Walkdowns

Members of the WGAT participated in a walkdown of Buildings 773–A and 735–A, the sand filter/stack area, and the liquid waste collection and transfer area. Activities involved in this walkdown included opening a P-can in Hot Cell 15 and visually inspecting the uranium alloy, visually identifying and inspecting the sources in the solid waste assay room, and visually inspecting standards and solutions in the laboratories.

Because of the presence of HEU sources in Building 773–A, that facility was subjected to a follow-up walkdown by the WGAT. Inspectors for the follow-up was added by the identification of a vulnerability with regard to control of HEU sources and standards of another facility. In its walkdowns, the WGAT was accompanied by the source control custodian. The team was provided with what the source control custodian indicated was the most recent inventory, dated February 17, 1995—more than 15 months out of date. It was also advised that the material in the inventory had been received sight unseen—at least by the source control custodian—and further that the custodian could not provide access to the material as he did not know the combination of the safe. When the safe was eventually opened, the source control custodian could not identify its contents nor assure the team that all was under control. The occurrence of unidentified materials in storage safes in two different locations indicates that the scope of vulnerability SRS/HBL/WGAT/001 can be extended to other facilities.

Tabletop Discussions

A tabletop discussion was held with the SRTC Senior Operations Manager, the DOE Environment, Safety and Health Manager and the NDA Custodian. Topics of discussion included HEU characteristics, systems and components, natural phenomena and fires, ventilation systems, electric power supply systems, routine operations, authorization basis documentation, the Chemical Hygiene Plan, and the scope of the previous Plutonium Vulnerability Assessment.

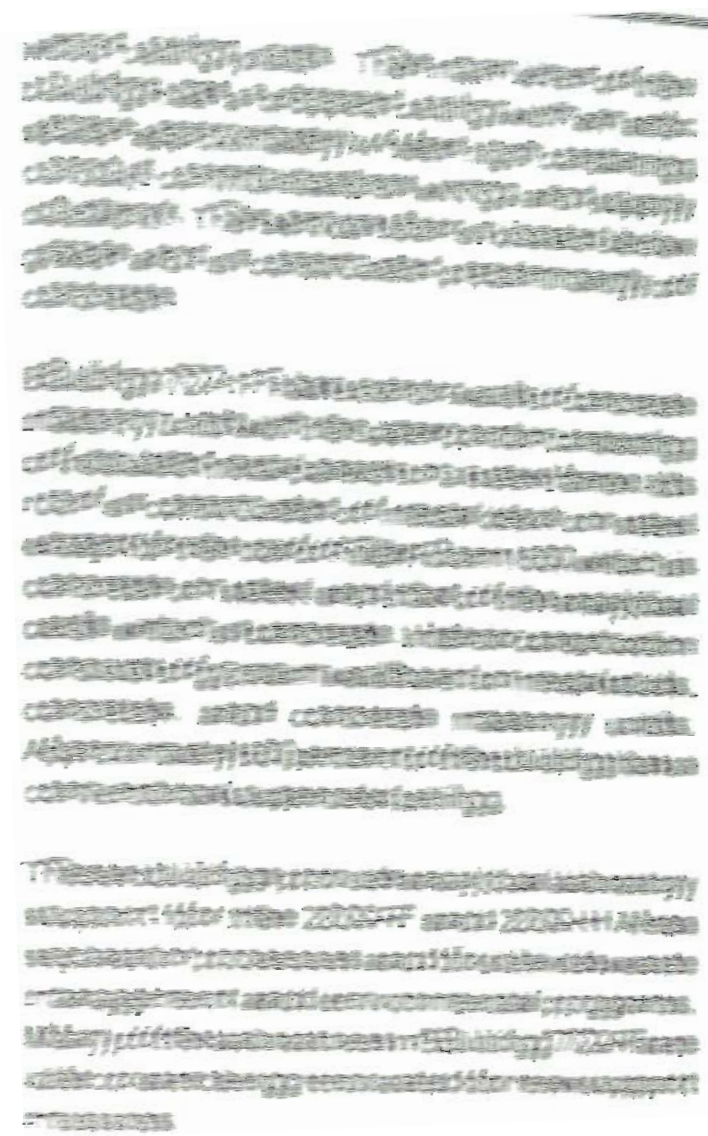
Members of the WGAT also held a follow-up discussion with the facility engineer, one of his principal engineers, a design authority engineer, the Senior Operations Manager for the SRTC and the NDA Custodian. These discussions contributed to the resolution of potential issues with respect to protective measures for cell block inlet airflow paths, electric power distribution and impacts of the loss of electric power, source control and custodianship, and the condition of the waste drain line and measures to protect against its stress-corrosion cracking.

2.13 Central Laboratories

2.13.1 Facility Description

The Central Laboratories consists of two buildings with HEU inventories: Buildings 772–F and 772–1F. Both are in the 200–F Area immediately west of the 221–F Canyon and approximately 10 kilometers from the nearest site boundary. Building 772–F was constructed in 1954 for support of the analysis of site nuclear material. In 1987, most of the analytical support was relocated to the new Building 772–1F.

Building 772–F is constructed of blast-resistant reinforced concrete with a concrete roof deck. Modular laboratories are separated by metal wall panels and arranged back-to-back in a double row down the center of the facility. Interior office and ancillary walls are constructed of metal and transite panels on metal studs, and the ceilings are transite panels supported by



The Central Laboratories buildings constitute the primary barriers for protection of the public and the environment from radioactive material releases. Confinement exhaust systems also minimize potential releases through the maintenance of a negative pressure in the laboratory spaces with respect to the outside environment and through HEPA filtering of any releases to the atmosphere. Material aggregation areas include locked laboratory cabinets, gloveboxes, radiobenches, and radiohoods. The HEU inventory consists of 249 grams (37 grams of oxide solid, 600 grams of metal, and 152 grams of uranyl nitrate solutions) in Building 771/2-H and 622 grams (72 grams in standards and 10 grams of in-progress samples) in Building 771/2-H. These materials

Tabletop Discussions

A tabletop discussion was held with the Facility Manager, a Materials Balance Area custodian, and a principal scientist. Topics of discussion included HEU characteristics, structures and components, natural phenomena and fires, electric power supply systems, routine operations, authorization basis documentation, and the scope of the Plutonium Vulnerability Assessment.

The main points of a USQ Determination (ESH–92001) regarding the deletion of fire suppression (Halon) in all gloveboxes in both buildings were discussed. Included was discussion of the determination that the authorization basis documentation took no credit for existence of the Halon systems, and that elimination of the Halon system had also eliminated the potential of personnel exposure due to inadvertent system actuation.

The WGAT also addressed with appropriate SRS personnel the lack of sprinkler systems in the interstitial space above the suspended ceiling of Building 772–1F. Cable trays are routed above the corridors and extend through most of the analytical, laboratory, and office portions of the facility. An uncontrolled fire in this space could spread below the suspended ceiling, and chemicals stored in laboratory areas would provide additional fuel for the fire. Unabated development of smoke above the suspended ceiling could adversely impact both personnel egress and operation of the HEPA filter banks of the central exhaust system. However, the migration of contaminated smoke throughout the facility could result in only minimal worker exposure. This was discussed with facility management. Since the amount of HEU at risk in the facility and the likelihood of a fire in this area are very low, the WGAT did not consider this to be a HEU vulnerability.

3.0 SUMMARY OF ADDITIONAL VULNERABILITIES IDENTIFIED BY WORKING GROUP ASSESSMENT TEAM

3.1 FB-Line

The WGAT did not identify any HEU vulnerabilities.

3.2 Building 235–F

The WGAT identified one additional ES&H vulnerability in Building 235–F; SRS/235–F/WGAT/001, *Leaky vault roof and corrosion of shipping containers in Building 235–F vault (barrier breakdown)*. During a tour of one of the storage vaults in Building 235–F, the WGAT observed plastic sheets covering several shipping containers in the vertical floor storage array near the north vault wall and several 5- and 10-gallon metal pails in the storage racks near the center of the vault. Facility staff reported that the plastic sheets are provided to protect storage containers from the leakage of rain water through the vault roof over those locations. HEU materials within the scope of this assessment are stored in these particular locations.

There are water marks on the plastic sheets from alternative wetting and evaporation of water and three of the 30-gallon shipping containers in the vertical floor storage array show signs of rusting and degradation. According to anaylsis by the target-barrier-hazard method, the leaky roof and rusty shipping containers are barriers in the process of failing. Therefore this condition was identified as a vulnerability.

If left uncorrected this situation could result in eventual rust-through of the shipping containers, and possibly the metal pails, thus exposing the inner packages to continued leakage.

wood ceiling joists. The main level of the building has a dropped ceiling with an attic space approximately 4 feet high containing conduit, communications wiring, and supply ductwork. The service floor is located below grade and is constructed predominantly of concrete.

Building 772–1F has exterior walls of concrete masonry units with the upper portion consisting of insulated metal panels on a steel frame. Its roof is constructed of metal deck on steel except for the roof of Filter Room 160, which is concrete on steel, and that of the analytical cells, which is concrete. Interior construction consists of gypsum wallboard on metal studs, concrete, and concrete masonry units. Approximately 60 percent of the building has a conventional suspended ceiling.

These buildings provide analytical laboratory support for the 200–F and 200–H Area separation processes, and for sitewide waste management and environmental programs. Many of the laboratories in Building 772–F are idle or are being renovated for new support missions.

The Central Laboratories buildings constitute the primary barriers for protection of the public and the environment from radioactive material releases. Confinement exhaust systems also minimize potential releases through the maintenance of a negative pressure in the laboratory spaces with respect to the outside environment and through HEPA filtering of any releases to the atmosphere. Material aggregation areas include locked laboratory cabinets, gloveboxes, radio benches, and radio hoods. The HEU inventory consists of 249 grams (37 grams of oxide solid, 60 grams of metal, and 152 grams of uranyl nitrate solutions) in Building 772–F and 82 grams (72 grams in standards and 10 grams of in-progress samples) in Building 772–1F. These materials, bounded by SAR/BIO limits, were addressed the Plutonium Vulnerability Assessment.

2.13.2 Site Assessment Team Report Evaluation

The WGAT evaluated the Question Set responses for the Central Laboratories.

Question Set Responses

For the purposes of this assessment, Building 772–F laboratory modules and corridors were considered a single partitioned area, as Building 772–1F was partitioned into the areas: the gloveboxes, the lab modules and corridors, and radio benches and radio hoods. The WGAT concurs in this partitioning scheme.

Identified ES&H Vulnerabilities

No vulnerabilities were identified by the Site. The WGAT identified one concern for Building 772–1F regarding the lack of sprinkler protection for an attic space common to Radiological Buffer Areas (RBAs) and non-RBAs. This is regarded as a situation in which alarm notification and fire response could be delayed. Any HEPA filter obstruction by smoke or spread of contamination incidental to smoke migration could pose a problem. However, the decision not to automatically sprinkler the interstitial space above the ceiling is supported by facility staff.

2.13.3 Working Group Assessment's Evaluation

Facility Walkdowns

Selected members of the WGAT participated in walkdowns of Buildings 772–F and 772–1F. This walkdown entailed entry into radiological areas and the visual identification of inventories.

Tabletop Discussions

A tabletop discussion was held with the Facility Manager, a Materials Balance Area custodian, and a principal scientist. Topics of discussion included HEU characteristics, structures and components, natural phenomena and fires, electric power supply systems, routine operations, authorization basis documentation, and the scope of the Plutonium Vulnerability Assessment.

The main points of a USQ Determination (ESH–92001) regarding the deletion of fire suppression (Halon) in all gloveboxes in both buildings were discussed. Included was discussion of the determination that the authorization basis documentation took no credit for existence of the Halon systems, and that elimination of the Halon system had also eliminated the potential of personnel exposure due to inadvertent system actuation.

The WGAT also addressed with appropriate SRS personnel the lack of sprinkler systems in the interstitial space above the suspended ceiling of Building 772–1F. Cable trays are routed above the corridors and extend through most of the analytical, laboratory, and office portions of the facility. An uncontrolled fire in this space could spread below the suspended ceiling, and chemicals stored in laboratory areas would provide additional fuel for the fire. Unabated development of smoke above the suspended ceiling could adversely impact both personnel egress and operation of the HEPA filter banks of the central exhaust system. However, the migration of contaminated smoke throughout the facility could result in only minimal worker exposure. This was discussed with facility management. Since the amount of HEU at risk in the facility and the likelihood of a fire in this area are very low, the WGAT did not consider this to be a HEU vulnerability.

3.0 SUMMARY OF ADDITIONAL VULNERABILITIES IDENTIFIED BY WORKING GROUP ASSESSMENT TEAM

3.1 FB-Line

The WGAT did not identify any HEU vulnerabilities.

3.2 Building 235–F

The WGAT identified one additional ES&H vulnerability in Building 235–F; SRS/235–F/WGAT/001, *Leaky vault roof and corrosion of shipping containers in Building 235–F vault (barrier breakdown)*. During a tour of one of the storage vaults in Building 235–F, the WGAT observed plastic sheets covering several shipping containers in the vertical floor storage array near the north vault wall and several 5- and 10-gallon metal pails in the storage racks near the center of the vault. Facility staff reported that the plastic sheets are provided to protect storage containers from the leakage of rain water through the vault roof over those locations. HEU materials within the scope of this assessment are stored in these particular locations.

There are water marks on the plastic sheets from alternative wetting and evaporation of water and three of the 30-gallon shipping containers in the vertical floor storage array show signs of rusting and degradation. According to anaylsis by the target-barrier-hazard method, the leaky roof and rusty shipping containers are barriers in the process of failing. Therefore this condition was identified as a vulnerability.

If left uncorrected this situation could result in eventual rust-through of the shipping containers, and possibly the metal pails, thus exposing the inner packages to continued leakage.

3.3 Building 247–F

The WGAT did not identify any HEU vulnerabilities For Building 247–F.

3.4 H-Canyon

The WGAT identified one vulnerability during the H-Canyon facilities assessment. Under certain circumstances the freezing of the water portion of the solutions in the tank is credible. At 0°C it can be postulated that the water component of the solution begins to freeze, thus increasing the total uranyl nitrate concentration, thus increasing the HEU concentration. Should this continue the concentration of HEU could reach a level where criticality is possible. As indicated in the tank-related SAR, quantities of HEU are sufficient to create a criticality concern. The barrier against such an incident is warning the solution with a steam-supplied heat exchanger on top of the EU–S Tank. Pumps inside the tank are required to force the solution through the heat exchanger. Pumps are also used for recirculation to ensure that the uranyl nitrate remains mixed, and for sampling of the tank. The sampling station is on top of the tank. None of the pumps or heating media are safety related, and none have backup power supplies in the event of loss of normal H-Area power. Should power be lost for an extended period of time during an extended period of cold weather (temperatures below freezing), HEU overconcentration could occur. This potential for criticality was formalized as Vulnerability SRS/HCO/WGAT/001, *Potential criticality in new HEU storage tank outside the H-Canyon facility due to freezing.*

3.5 HB-Line

While the SAT identified no vulnerabilities associated with HB-Line, the WGAT identified two. One of these is deemed an institutional vulnerability applicable to all SRS facilities.

Materials assessed in safe SRP 1494 in HB-Line are contained in opaque plastic screw-top jars, ice cream–type containers, metal slip-top cans, plastic bags, paint-type cans, and a 5-gallon metal container. Such packaging does not allow the facility to monitor the degradation of package contents. The WGAT concluded, as a result of the source inspection and inventory activity, that the inability to establish the actual condition of the sources and standards in HB-Line safe SRP 1494 constitutes a vulnerability. This vulnerability was formally documented as SRS/HBL/WGAT/001.

Review of the Radioactive Source Control and Accountability Program yielded several discrepancies. In at least one instance, material was unaccounted for. In another, a custodian could not gain access to the storage safe which contained the material he was responsible for. others within the facility, however, had uncontrolled access. Such a loss of control and accountability, coupled with incomplete inventory records, could lead to loss of radioactive material. Since discrepancies in the program were found at multiple facilities, the issue was judged to be a institutional vulnerability. The vulnerability was formally documented as SRS/HBL/WGAT/001.

3.6 Building 321–M

The WGAT identified one additional ESH vulnerability in Building 321-M SRS/321–M/WGAT/001, *Accumulation of combustible contaminated waste in Building 231–M.* During a tour of the building the WGAT observed a backlog of HEU-contaminated waste that constitutes a considerable combustible loading. Since the building does not have an operational automatic fire suppression system, a fire involving this material could lead to the exposure and contamination of workers and Fire Department personnel.

Waste-processing activities at the SRS are in various stages of shutdown, and thus there are larger-than-normal waste accumulations at various site facilities. Such accumulations could result in higher than normal combustible loadings, and thus to fire durations and heat release rates in excess of the design capability of existing automatic sprinkler systems. Higher-than-normal accumulations could also provide for additional exposure of facility personnel during fire evacuations and of Fire Department personnel during firefighting activities. This condition has been identified in Buildings 321–M and 244–H and in the L-Reactor Basin, and may be applicable to all buildings having HEU inventories.

3.7 105–K Assembly Area

The WGAT identified no ES&H vulnerabilities. It did note that this facility, like several others assessed, has no provisions for redirecting or containing firefighting water runoff.

3.8 K-Reactor Disassembly Basin

The WGAT did not identify any HEU vulnerabilities.

3.9 L-Reactor Disassembly Basin

The WGAT did not identify any HEU vulnerabilities.

3.10 P-Reactor Disassembly Basin

The WGAT did not identify any HEU vulnerabilities.

3.11 Receiving Basin for Off-Site Fuel

The WGAT identified no ES&H vulnerabilities here. However, it did note that the RBOF, like several other facilities assessed, has no provision to contain or redirect firefighting water runoff.

3.12 Savannah River Technology Center

The WGAT did not identify any HEU vulnerabilities. It did, however, identify a concern with regard to the custodianship and integrity verification of radioactive source packaging. This concern contributed to a an institutional vulnerability (SRS/HBL/WGAT/002) regarding source control.

3.13 Central Laboratories

The WGAT did not identify any HEU vulnerabilities associated with the Central Laboratories located in Buildings 772–F and 772–1F.

3.14 General Site

The WGAT identified two situations applicable to most HEU facilities:

Automatic sprinkler actuation and manual hose stream firefighting activities could result in the release of contaminated water from Radiological Control Areas (RCAs) to non-RCAs, to the environment in the immediate vicinity of the building, and to the storm drain system and associated area outfall. This situation has been identified in Buildings 321–M, 244–H, 221–HB, 221–H, 735–A, 221–FB, 235–F, 105–K, 100–P, 100–L, and the RBOF, and may apply to all buildings having HEU inventories. Projects S–4580 (Buildings 221–H and 221–HB) and S–4610 (Building 221–FB) currently include curbs and ramps for water containment purposes.

Waste-processing activities at the SRS are in various stages of shutdown, and thus there are larger-than-normal waste accumulations at various site facilities. Such accumulations could result in higher-than-normal combustible loadings, and thus to fire durations and heat release rates in excess of the design capability

APPENDIX A

WORKING GROUP ASSESSMENT TEAM MEMBERSHIP AND BIOGRAPHICAL SKETCHES

THIS PAGE LEFT INTENTIONALLY BLANK

Appendix A
Working Group Assessment Team Membership

Name	Organization	Functional Area
Jon MacLaren	U.S. Department of Energy, DP—24	Team Leader
Patrick Ward	SCIENTECH, Inc.	Deputy Leader
Barry Collyer	Mason & Hanger	Fire Protection
Leo Faust	M.H. Chew	Criticality/HP
Nels C. Jensen	Lockheed Idaho Technologies Company	SAR/HVAC
Alan Krichinsky	Oak Ridge National Laboratory	HEU
Daryl Lopez	Lockheed Idaho Technologies Company	SAR/HVAC
Matthew Miller	Lockheed Martin, Portsmouth	Industrial Hygiene
Michael Nitzel	Lockheed Idaho Technologies Company	Seismic/Other NPH
Ronald D. Shaffer	Parallax, Inc.	Operations & Maintenance
Richard Taylor	Lockheed Martin Energy Systems	Criticality/HP
Lance Traver	SCIENTECH, Inc.	Operations & Maintenance

E: Barry C. Collyer

CATION: BS, Mechanical Engineering Technology, Southern Technical Institute (Georgia Tech), 1979

ERTISE: Fire Protection

ERIENCE: Mr. Collyer has 17 years fire protection engineering experience consisting of 3 years industrial insurer (HPR), 10 years commercial nuclear and 4 years DOE facility experience. Mr. Collyer has extensive experience in fire hazards analysis, combustible loading analysis, fire barrier analysis, suppression systems, detection systems and application of DOE and NRC requirements. He has outstanding skills in research, analysis, problem solving and computer based hydraulic calculations. He is responsible for one patent disclosure. His experience includes Risk Management, Project Management, Project Engineering, System Engineering and Design Engineering assignments.

IE: Leo G. Faust

CATION: Graduate Studies, Physics and Nuclear Engineering, University of Washington, 1959-1975
BS, Physics, Humboldt State University, 1959

ERTISE: Senior Program management/Scientific Health Physics Researcher

ERIENCE: Leo G. Faust has over 38 years of experience in the management of research and development of health physics dosimetry and measurement programs, the development of radiological design criteria, the management of a radiation monitoring programs, and the establishment of methods and programs leading to improved radiological protection programs for the DOE and its predecessors. Established, managed and served as the Associate Department Manager Health Physics Department, PNL, served on and chaired several internal committees of PNL including the Work for Others and the National Security Affairs committees.

Current duties include technical support to Westinghouse Hanford Company in their Plutonium Stabilization Program and their Terminal Cleanout Programs of the Plutonium Finishing Plant. Also provides technical support to the RFFO ES&H program including the ongoing worker dose reconstruction activities.

NAME: Nels C. Jensen

EDUCATION: U.S. Navy Nuclear Power Program School, 1966

EXPERTISE: Safety Analysis

EXPERIENCE: Mr. Jensen has over 27 years professional experience in the nuclear industry, including nuclear reactor operation, operating personnel supervision, personnel training, procedure development, operating facility safety and health assessments, safety analysis activities, and operator performance evaluations. He was a member of DOE Chemical Safety Vulnerability Review team, reviewing operations for chemical safety vulnerabilities at the Los Alamos National Laboratory, and has been a member of seven different Technical Safety Appraisal Teams at various DOE nuclear sites. Mr. Jensen has prepared and administered nearly 100 Reactor Operator and Senior Reactor Operator written, oral/walk-through, and simulator examinations at NRC-regulated commercial reactor sites across the United States. He was a shift supervisor and training coordinator at the Loss of Fluid Test Facility, a DOE Category 1 reactor, at the Idaho National Engineering Laboratory. Mr. Jensen was a member of the INEL HEU Vulnerability Site Assessment team.

NAME: Alan M. Krichinsky

EDUCATION: MS, Chemical Engineering, University of Tennessee, 1981
BS, Chemical Engineering, University of Maryland, 1974

EXPERTISE: HEU, Safety Analysis

EXPERIENCE: Alan Krichinsky is the manager of the Radiochemical Development Facility at ORNL. This facility includes the national storage and distribution center for ^{233}U and several pilot-scale systems for processing nuclear fuels. He has over 22 years of experience in the design, construction, operation, and shutdown of various nuclear fuel processes. Principal materials involved in these processes include depleted and enriched uranium, 233-uranium, and plutonium. Alan has participated in chemical safety evaluations of nuclear fuel fabrication plants for the Nuclear Regulatory Commission and has been involved in the interpretation, communication, and graded implementation of Conduct of Operations principles across a broad spectrum of activities ranging from research and development to uranium enrichment to weapons production.

Over the years, Alan has been the author of several articles, national consensus standards and regulatory guides in the areas of nuclear fuel processing and safeguards, and was the Plant Safety Features section editor for Nuclear Safety.

NAME: Daryl A. Lopez

EDUCATION: MS, Mechanical Engineering, University of Pittsburgh, 1973
BS, Mechanical Engineering, Washington State University, 1969

EXPERTISE: HVAC

EXPERIENCE: Mr. Lopez has over 25 years of nuclear equipment and system engineering and management DOE Weapons Complex and commercial nuclear power facilities. He has designed commercial nuclear power plant safety systems, DOE reactor experiments, handling equipment, and high- and low-level nuclear waste handling equipment. In the last 10 years he has specialized in the area of Nuclear HVAC systems for hot cells, caves, canyons, gloveboxes, and hoods. He has been a module team leader and member (in the HVAC discipline), of the two EG&G Corporate Operational Readiness Reviews for restart of the DOE Rocky Flats Plant (RFP). He was a member of the RFP Plutonium duct hold-up team for accessing, sampling, and removing the Pu hold up from the HVAC ducts and clean-up train systems. He has working knowledge, in the HVAC area, of the ASHRAE standards, DOE Order 6430.1A, DOE Order 400.1, ERDA 76-21 Handbook, ACGIH manual, and ANSI/ASME N509 and N510. He has expertise in many relevant nuclear topics including design, analysis, testing, design basis documentation, and design verification and review.

NAME: Jon MacLaren

EDUCATION: MS, Engineering Management, Catholic University of America, 1996
BS, Mechanical Engineering, University of Texas at Arlington, 1982

EXPERTISE: Conduct of Operations and Maintenance

EXPERIENCE: Jon MacLaren has more than twelve years of naval nuclear engineering and operations experience in positions concerning Reactor Controls, Chemical and Radiological Controls and plant operations. Additionally, he has been involved in an extensive shipyard submarine overhaul and a 14-month shipyard submarine depot modernization. He is certified as a chief nuclear engineer by Naval Reactors.

Since being assigned to DP-24, his primary responsibilities have concerned the Department's transition to Standards and Requirements and the Necessary and Sufficient Process to create an integrated safety management program. He has also been actively involved in the Quality Evaluation Program for insuring stockpile validity. As the Co-Team Leader for Task 2 and 3 in conjunction with the DNFSB Recommendation 94-4, he has a working knowledge of criticality safety requirements and the desired safety envelope requirements. Additionally, as the assistant to the Director of Site Operations (DP-24), he is

actively involved in the oversight and program management of those laboratory facilities involved with Stockpile Management.

NAME: Matthew J. Miller

EDUCATION: MS, Environmental Management (In progress)
BS, Industrial Hygiene, Ohio University, 1992

EXPERTISE: Industrial Safety and Health

EXPERIENCE: Mr. Miller has safety and health experience in general industry, construction, nuclear enrichment and hazardous waste remediation. He has worked for the DOE in the capacity as a safety professional. Mr. Miller has a wide range of experience in safety and health ranging from industrial hygiene surveys, writing and implementing sampling protocols, serving as a site safety officer in accordance with 29 CFR 1910.120 (HAZWOPER), preparing Job Safety Analysis's, and writing safety and health plans. Mr. Miller served on the Portsmouth Gaseous Diffusion Plant Site Assessment Team for the HEU venerability assessment.

NAME: Michael E. Nitzel

EDUCATION: ME, Civil Engineering, University of Idaho, 1979
BS, Aerospace Engineering, Iowa State University, 1972

EXPERTISE: Seismic Analysis/Natural Phenomena Hazards

EXPERIENCE: Mr. Nitzel has over 24 years experience related to the nuclear industry. His experience in the areas of structural analysis, applied mechanics, and component design has included the analysis and evaluation of structures and components subjected to a variety of loading conditions including seismic and other natural phenomena loads. He has been involved in a variety of research, consultation, design, and analysis projects performed for customers that include the Department of Energy (DOE), the U. S. Nuclear Regulatory Commission (NRC), and military organizations. This work has included participation in a number of industry-wide programs for the NRC and special initiatives for the DOE. He has participated in reviews and/or inspections at 24 commercial nuclear power plants and been involved in reviews and/or assessments at a number of DOE weapons complex facilities. He was actively involved in the previous DOE Spent Fuel Vulnerability Assessment.

NAME: Ronald D. Shaffer

EDUCATION: BS, Mechanical Engineering, Ohio State University, 1970

EXPERTISE: Operations & Maintenance

EXPERIENCE: Mr. Shaffer is the vice president of Parallax, Inc. Mr. Shaffer has over twenty-five years of experience in nuclear and non-nuclear facility safety, management, operations, engineering, regulatory compliance, and Department of Energy site quality audits, facility safety appraisals, and integrated oversight reviews. The first eight years of Mr. Shaffer's experience was in the Naval Nuclear Power Program. Mr. Shaffer has been a Nuclear Shift Supervisor, which lead to his certification as Senior Reactor Operator, and maintenance manager during the startup phases of an 1100 and 1350 megawatt BWRs. Mr. Shaffer also was certified Level III, ANSI 45.2.6, for inspection and testing, electrical and mechanical startup engineering, and calibration of mechanical and electrical measuring and test equipment. Mr. Shaffer also was assigned to the reactor restart issues management team as project manager in support K, L, and P reactor restart for the Savannah River Site. He has also provided technical support to the Department of Energy for special appraisals and performance based assessments in the areas of safety analysis, engineering, operations and maintenance.

NAME: Richard G. Taylor

EDUCATION: Graduate Work, Computer Sciences
BS, Nuclear Engineering, Mississippi State University, 1968

EXPERTISE: Nuclear Criticality Safety

EXPERIENCE: Mr. Taylor has 28 years nuclear criticality safety experience as both an engineer and a manager. He has experience with nuclear criticality safety analysis and inspection of process and process support activities conducted for high enrichment uranium (HEU) metallurgical, chemical, and transportation activities associated with nuclear weapon component manufacturing. Management experience includes 4 years as Nuclear Criticality Safety Department Head at the Oak Ridge Y-12 Plant. He has performed hands-on fissile material work in the Republic of Kazakhstan as nuclear criticality safety subteam leader for the Project Sapphire team. He is a member of the Transparency Monitor pool of persons selected to be monitors at Russian facilities performing isotopic dilution of weapon grade uranium. He is currently a senior staff engineering specialist primarily responsible for reviewing the work of staff nuclear criticality safety engineers, development and implementation of a training and qualification program for nuclear criticality safety engineers, and providing a leading role in safety/security interface considerations.

NAME: Lance E. Traver

EDUCATION: MS, Environmental Engineering, University of Maryland, 1992
U.S. Navy Nuclear Power Program, 1983 - 1987
BS, Civil Engineering, Rice University, 1982

EXPERTISE: Conduct of Operations

EXPERIENCE: Mr. Traver has over 13 years experience in the nuclear and environmental industry. Mr. Traver served in the U.S. Navy for 5 years where he developed an understanding of reactor design, operations, and safety principles. For the past seven years, Mr. Traver has been providing technical support on a variety of projects related to the DOE Nuclear Weapons Complex. This has included evaluating the Reactor Restart Program at the Savannah River Site, conducting root cause analysis of safety issues at the Rocky Flats Plant, performing conduct-of-operation assessments and environmental compliance audits, observing start-up testing at various waste management facilities at the Savannah River Site, and participating in several operational readiness reviews. Participation in operational readiness reviews has been as a technical expert in the disciplines of conduct of operations, maintenance, environmental compliance, and waste management. Specific facilities evaluated as part of an operational readiness review include: Building 559 at the Rocky Flats Plant and the Replacement Tritium Facility, F-Canyon, FB-Line, and the Defense Waste Processing Facility at the Savannah River Site.

NAME: Patrick A. Ward

EDUCATION: MS, Nuclear Engineering, University of Maryland, 1972
BS, Chemical Engineering, University of Maryland, 1970

EXPERTISE: Safety Analysis

EXPERIENCE: Mr. Ward has over 25 years of nuclear safety and regulatory experience, including design, construction, operations, licensing, management and life extension of DOE Weapons Complex and commercial nuclear power facilities, and U.S. Navy Vessels. He has been involved with worker, environment and public safety evaluations, nuclear safety assessments and reviews, Nuclear Regulatory Commission safety reviews and inspections, headquarters and onsite safety program development and reviews, including recent Plutonium, Spent Nuclear Fuel, Low-Level Waste Working Group environment, safety and health vulnerability studies for DOE/EH. He has nuclear regulation, licensing and license renewal, Safety Analysis Report preparation and review and safety analysis and evaluation experience. He has expertise in many relevant nuclear safety topics including configuration management, design basis documentation, procedure preparation and review, emergency

management, self-assessment, continuous improvement, quality assurance and technical specifications, including development, review and improvement of technical safety requirements. He also has managed desk-top publishing operations.

APPENDIX B

WORKING GROUP ASSESSMENT TEAM VULNERABILITY ASSESSMENT FORMS

THIS PAGE LEFT INTENTIONALLY BLANK

Appendix B
Working Group Assessment Team Vulnerability Assessment Forms
Index

Vulnerability Number	Executive Summary	Report Section
SRS/235–F/ WGAT/001	Leaky vault roof and corrosion of shipping containers in Building 235–F vault (barrier breakdown)	3.2
SRS/321–M/ WGAT/001	Accumulation of combustible contaminated waste in Building 321–M	3.6
SRS/HCO/ WGAT/001	Potential criticality in the new HEU storage tank outside H-Canyon facility due to freezing	3.4
SRS/HBL/ WGAT/001	Condition of internal packaging material is unknown for radioactive source/standards stored in the safe, HB–Line	3.5
SRS/HBL/ WGAT/002	Loss of source accountability at SRS could lead to radiation exposure to the worker and potentially the public	3.5

ES&H Vulnerability Assessment Form

Vulnerability # SRS/235-F/WGAT/001

Block 1: *Title of the Vulnerability. (<20 words)*

Leaky vault roof and corrosion of shipping containers in building 235-F vault (barrier breakdown).

Block 2: *Executive Summary. (<50 words) Concise description of the sequence of events leading to the vulnerability.*

At several locations in Building 235-F storage vault, there is evidence of roof leakage. Beneath one of the leak locations, HEU is stored in 30-gallon shipping containers in a floor storage array. Although a sheet of plastic has been placed over some of the containers, several of the HEU containers have rusted lids and the sides have begun to corrode. Beneath another leak location, HEU is stored in 5- and 10-gallon metal pails. A sheet of plastic has been placed over the containers in this area, and there were no signs of container corrosion. Beneath another leak location, there are water stains on the floor. At the time of the vault walk down, there was no accumulated water or wetness observed at any of the identified locations, but evidence of previous cycles of wetting/evaporation was present. This indicates a breakdown in the facility barrier (roof) and corrosion/deterioration of the outer layer of HEU packaging. Facility staff stated that a roofing contractor had made several attempts to fix the leaking roof. Facility staff could not confirm that the latest attempt to stop the leakage had been successful.

Block 3: *Describe the condition or weakness, including the material, material form, quantity (if unclassified), packaging type and number of packages, and facility and other barriers that contribute to the vulnerability.*

Vulnerability Description/Information	
Material and material form	HEU/zinconium alloy material, a portion of which is oxidized (>20 years old), is contaminated with plutonium, is in oxide form.
Material at risk (approximate mass [kg] and composition of material which may participate in the release—not necessarily the inventory of material at a given location)	Approximately 2,000 grams/per package were used for calculational purposes.
Packaging type and number of packages	There are a total of 2 packages; in can/bag/can packaging configuration; placed in 5-gallon metal pails.
Facility and other barriers	Facility roof, vault, temporary barriers (plastic sheets), site boundary, material limits, monitoring, shipping containers, and storage pails.
Condition or weakness	Dispersible uranium and plutonium oxide on uranium/zirconium metal alloy, packaged in plastic, packages over 20 years old.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/235-F/WGAT/001

Block 9: *Database information.*

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR_i (g)
Uranium-235 (Contaminated with Plutonium-239)	Metal/ powder	Uranium oxide	2,000

Collocated Chemicals and Release Products

Chemical		Release Product	
Name	Mass (g)	Name	Mass (g)
None			

Release Path Parameters[1]

Chemical Form and Release Products	DR_i	ARF_i	RF_i	LPF_i
Uranium oxide	1.0	0.002	0.3	$1x10^{-6}$

Exposure Parameters[1]

Chemical Form and Release Products	V ($meter^3$)	t (minutes)	ΔT (minutes)	X/Q	
				Ex-facility	Public
Uranium oxide	50		1.0	0.04	$2.3x10^{-5}$

Block 10: *Comments and references for parameter selection.*

This scenario is based on the worst case in scope packages in the vault. In this case, the WGAT used packages from SRS Material Grouping #186; HEU/ZR alloy contaminated with plutonium. The physical form is metal with partial oxidation (dispersable powder) and the chemical form is primarily uranium oxide. However, there is also some plutonium oxide powder from the original plutonium contamination.

The WGAT postulated dropping one of these packages and releasing the contents thus affecting the worker.

The WGAT assumed the entire contents are oxidized and all of the material is involved in the release.

This breakdown of facility and container barriers accelerates and exacerbates the vulnerable packaging configuration weaknesses identified in SRS/235-F/SAT/001. In combination, material packaging weaknesses, degraded shipping containers and a roof leak make this storage situation more serious.

Signature, Team Member — Date: 7/31/96

Signature, Team Leader — Date: 8/6/96

1. Described in the Assessment Plan.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/321-M/WGAT/001

Block 1: *Title of the Vulnerability. (<20 words)*

Accumulation of combustible contaminated waste in Building 321-M.

Block 2: *Executive Summary. (<50 words) Concise description of the sequence of events leading to the vulnerability.*

Site waste disposal activities are in various stages of shutdown and as such combustible contaminated waste is accumulating in Building 321-M and various other facilities. Building 321-M does not have an operational automatic fire suppression system. This presents an unnecessary risk of fire which presents the potential for higher heat release rates and longer fire duration. This higher than normal fire hazard could result in additional exposure to facility and fire department personnel.

This condition was also identified in the RBOF; K-, L-, and P-Disassembly Basins and K-Assembly Basin.

Block 3: *Describe the condition or weakness, including the material, material form, quantity (if unclassified), packaging type and number of packages, and facility and other barriers that contribute to the vulnerability.*

Vulnerability Description/Information	
Material and material form	Holdup U-Al alloy pieces in HVAC duct work and equipment
Material at risk (approximate mass [kg] and composition of material which may participate in the release—not necessarily the inventory of material at a given location)	1156 grams
Packaging type and number of packages	Tightly adhered holdup in HVAC duct work and equipment
Facility and other barriers	Building structure, HVAC, bags, boxes
Condition or weakness	Waste accumulation as combustible loading

ES&H Vulnerability Assessment Form

Vulnerability # SRS/235-F/WGAT/001

Block 9: *Database information.*

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR_i (g)
Uranium-235 (Contaminated with Plutonium-239)	Metal/ powder	Uranium oxide	2,000

Collocated Chemicals and Release Products

Chemical		Release Product	
Name	Mass (g)	Name	Mass (g)
None			

Release Path Parameters[1]

Chemical Form and Release Products	DR_i	ARF_i	RF_i	LPF_i
Uranium oxide	1.0	0.002	0.3	$1x10^{-6}$

Exposure Parameters[1]

Chemical Form and Release Products	V ($meter^3$)	t (minutes)	ΔT (minutes)	X/Q	
				Ex-facility	Public
Uranium oxide	50		1.0	0.04	$2.3x10^{-5}$

Block 10: *Comments and references for parameter selection.*

This scenario is based on the worst case in scope packages in the vault. In this case, the WGAT used packages from SRS Material Grouping #186; HEU/ZR alloy contaminated with plutonium. The physical form is metal with partial oxidation (dispersable powder) and the chemical form is primarily uranium oxide. However, there is also some plutonium oxide powder from the original plutonium contamination.

The WGAT postulated dropping one of these packages and releasing the contents thus affecting the worker.

The WGAT assumed the entire contents are oxidized and all of the material is involved in the release.

This breakdown of facility and container barriers accelerates and exacerbates the vulnerable packaging configuration weaknesses identified in SRS/235-F/SAT/001. In combination, material packaging weaknesses, degraded shipping containers and a roof leak make this storage situation more serious.

Signature, Team Member — Date: 7/31/96

Signature, Team Leader — Date: 8/6/96

1. Described in the Assessment Plan.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/321-M/WGAT/001

Block 4: *Potential causes and effects of barrier failure that contribute to the vulnerability.*

Contaminated combustible waste accumulation could exceed the fire extinguishment capability and result in higher than expected exposure to facility personnel and Fire Department personnel.

Causes: other collocated hazards, combustible loading, contaminating fire

Effects: contamination, material release and fire

Block 5: *Compensatory measures that reduce the severity of the vulnerability.*

No compensatory measures were identified. SRS plans to resume waste handling activities on a facility by facility basis.

Block 6: *Possible consequences of the vulnerability.*

Potential for higher than expected exposure to facility and Fire Department personnel. Potential for spread of contamination to collocated worker, the environment and public.

Block 7: *Time period in which the consequences of the vulnerability might occur (e.g., 0 to 5 years; 5 years to facility end-of-life; may not occur during facility lifetime).*

0-5 years

Block 8: *Comments, views, or plans by the site operations office and site contractor relative to mitigating or minimizing any potential vulnerability. Describe the plan and schedule of corrective actions (if any).*

Accumulated Waste: All SRS nuclear facilities have a completed and approved Fire Hazard Analysis which specifies limits on combustible loading within the facility. While it is obviously beneficial to limit combustible loading due to waste accumulation or any other source, the Site knows of no instance where these allowable limits have been exceeded. A recently revised procedure for Building 321-M (effective 7/08/96) will assure proper packaging and handling of waste, and the combustible loading is to be reduced to as low as reasonably possible by 7/22/96.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/321-M/WGAT/001

Block 9: *Database information.*

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR_i (g)
Uranium-235	Holdup	uranium oxide	1156 g

Collocated Chemicals and Release Products

Chemical		Release Product	
Name	Mass (g)	Name	Mass (g)
None			

Release Path Parameters[1]

Chemical Form and Release Products	DR_i	ARF_i	RF_i	LPF_i
Uranium oxide	1.0	0.0001	0.3	1.0

Exposure Parameters[1]

Chemical Form and Release Products	V ($meter^3$)	t (minutes)	ΔT (minutes)	X/Q	
				Ex-facility	Public
Uranium oxide	50		1.0	0.04	1.2×10^{-3}

Block 10: *Comments and references for parameter selection.*

The WGAT postulated a fire in the accumulation of HEU contaminated combustible waste stored in the building. Since there is no operable fire suppression system in the building it is not unreasonable to assume that the fire quickly involves the entire building. This fire is postulated to cause the release of all the HEU holdup material in the HVAC duct work, which is on the roof external to the building. Even though this holdup material is tightly adhered to the duct walls, all of it is released and causes consequences to the workers and fire fighters as well as local areas surrounding the building. The small amount of HEU in the waste itself is not quantified but its effect is expected to be overwhelmed by the quantity of holdup in the duct work.

Signature, Team Member — Date: 7/30/96

Signature, Team Leader — Date: 8/6/96

1. Described in the Assessment Plan.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HCO/WGAT/001

Block 1: *Title of the Vulnerability. (<20 words)*

Potential criticality in new HEU storage tank outside the H-Canyon facility due to freezing.

Block 2: *Executive Summary. (<50 words) Concise description of the sequence of events leading to the vulnerability.*

The EU-S HEU storage tank located in the H-Canyon 221-A facilities does not have backup power to the recirculation pumps that pump the solution to the heat exchangers located on top of the tank. Should normal power be lost for an extended period during below freezing weather it is possible that the water in solution could freeze. This would cause the nitric acid concentration to increase and solubility of the HEU to decrease. As a result, criticality could happen in the tank. The current criticality fault tree provides no basis to support the 1.0 E-8 value assumed for this event.

Block 3: *Describe the condition or weakness, including the material, material form, quantity (if unclassified), packaging type and number of packages, and facility and other barriers that contribute to the vulnerability.*

Vulnerability Description/Information	
Material and material form	Nitric Acid Solution
Material at risk (approximate mass [kg] and composition of material which may participate in the release—not necessarily the inventory of material at a given location)	70,000 gals.
Packaging type and number of packages	Double walled, 150 Kgals, SS Tank
Facility and other barriers	Double walled, seismic, SS Tank
Condition or weakness	Potential for inadvertent criticality

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HCO/WGAT/001

Block 4: *Potential causes and effects of barrier failure that contribute to the vulnerability.*

The team conducted walkdowns and extensive reviews of documents associated with the new HEU storage tank (EU–S) located in the H-Canyon outside facilities A-Line. This tank contains >99% of the HEU located in the H-Canyon outside facilities partitioned area reviewed by the team. The issue is related to the possibility of freezing of the water portion of the solution in the tank. At 0 degrees C it can be postulated that the water component of the solution can begin to freeze, thus increasing the concentration of the uranyl nitrate in the tank and increasing the concentration of HEU. There are sufficient quantities of HEU in the tank, as identified in the tank associated safety analysis report, to cause a criticality concern. The barrier that exists to prevent this incident from taking place is a heat exchanger located on the top of the EU–S tank. This heat exchanger uses steam and requires motive force from pumps located inside the tank to pump the solution through the counterflow heat exchanger. Pumps are also used to: a) recirculate tank contents thus ensuring the urnayl nitrate remains mixed; and b) sampling of the tank contents via a tank top sample station. None of the pumps or heating media are safety related and have no backup power supplies are provided in the event of loss of normal H-Area electrical power. Should loss of electrical power occur as a result of an earthquake or some other event during cold weather (temperatures below freezing) the possibility of criticality is credible. The safety documentation substantiates this conclusion. This issue is further complicated by the inability to sample or recirculate the tank to insure insitu instruments for temperature and specific gravity are reading correctly to profile the actual conditions in the tank. Although it would take longer for higher tank inventories to freeze, no minimum level in the tank is established in the operational safety requirement. The Safety Analysis Report for H-Canyon outside facilities (DPSTSA-200-10, Supp-II, Rev.1) criticality fault tree contains an unsubstantiated value of 1.0 E-8 for probability of a criticality occurring in the EU–S Tank. This probability is attributed to engineering judgement with no backup assumptions or calculations for justification.

Block 5: *Compensatory measures that reduce the severity of the vulnerability.*

There are currently no compensatory measures in place to address this condition. There have been reviews of tank temperature response to cold conditions since it began to receive solutions and no adverse effects have been noted. Further, there are operational safety requirements in place to test the heating system components monthly and no problems have been identified. The likelihood of extended cold weather in the Aiken, SC area is low; however, the current safety basis documentation does not substantiate the unlikelihood of a EU–S Tank criticality.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HCO/WGAT/001

Block 6: *Possible consequences of the vulnerability.*

Nuclear criticality

Block 7: *Time period in which the consequences of the vulnerability might occur (e.g., 0 to 5 years; 5 years to facility end-of-life; may not occur during facility lifetime).*

0-5 years. This scenario requires extended loss of power concurrent with a long period of below freezing temperatures.

Block 8: *Comments, views, or plans by the site operations office and site contractor relative to mitigating or minimizing any potential vulnerability. Describe the plan and schedule of corrective actions (if any).*

SRS considers a criticality due to overconcentration by freezing of the UNH solution in the EU–S Tank to be an incredible event. Analyses are being revised to more clearly demonstrate the extremely low probability. The analyses will be complete by October 01, 1996, and any appropriate additions to limits in the Authorization Basis will be completed by August 01, 1997.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HCO/WGAT/001

Block 9: *Database information.*

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR_i (g)

Collocated Chemicals and Release Products

Chemical		Release Product	
Name	Mass (g)	Name	Mass (g)

Release Path Parameters[1]

Chemical Form and Release Products	DR_i	ARF_i	RF_i	LPF_i

Exposure Parameters[1]

Chemical Form and Release Products	V (meter^3)	t (minutes)	ΔT (minutes)	X/Q	
				Ex-facility	Public

Block 10: *Comments and references for parameter selection.*

Since this vulnerability involves criticality, there are no computations and the worker consequence is high by definition.

Safety Analysis-200 Area Savannah River Site, Separations Area Operations Building 211-H Outside Facilities, DPSTSA-200-10, SUPP-11, January, 1993

Operational Safety Requirements URANYL NITRATE STORAGE FACILITY, WSRC-RP-90-568, November, 1992

Ronald O Stepp — Signature, Team Member — 7/29/96 — Date

Signature, Team Leader — 8/6/96 — Date

1. Described in the Assessment Plan.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HBL/WGAT/001

Block 1: *Title of the Vulnerability. (<20 words)*

Condition of internal packaging material is unknown for radioactive source/standards ·· .red in the safe, HB-Line.

Block 2: *Executive Summary. (<50 words) Concise description of the sequence of events leading to the vulnerability.*

Observation of source material stored in HB-Line safe SRP-1490 showed that numerous metal containers were dented or otherwise deformed. Other packaging types (plastic, ice cream cans, etc.) prevented visual inspection of the physical condition of the source material and inner packaging. Over time, the physical condition of the containers/packaging may degrade, thus increasing the possibility of the release of radioactive material to the worker.

Block 3: *Describe the condition or weakness, including the material, material form, quantity (if unclassified), packaging type and number of packages, and facility and other barriers that contribute to the vulnerability.*

Vulnerability Description/Information	
Material and material form	Uranium oxides
Material at risk (approximate mass [kg] and composition of material which may participate in the release—not necessarily the inventory of material at a given location)	Approximately 1000 grams was used for calculational purposes
Packaging type and number of packages	Plastic, metal & cardboard cans
Facility and other barriers	Safe, Room, Building
Condition or weakness	Many sources/standards packages were observed to be dented, interior condition unknown

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HBL/WGAT/001

Block 4: *Potential causes and effects of barrier failure that contribute to the vulnerability.*

Interior packaging condition of many items is unknown since many have not been opened for a long time. This coupled with visible damage to the outside package could result in loss of confinement and inadvertent exposure to workers and facility when opening the storage safe. It is common knowledge that plastics deteriorate with exposure to radiation and many of the packages are suspected to contain plastics.

Block 5: *Compensatory measures that reduce the severity of the vulnerability.*

Compensatory measures include semi-annual source inventories which includes smears of outside containers for detection of unwanted radioactivity. When sources are not in use, they are locked in a safe in 221-HB-Line whose entry is well maintained and controlled. The HVAC of this facility is filtered and monitored continuously. A similar vulnerability SR-HB-3 WGAT Pu VA was formed for material stored in the HB-Line vault.

Block 6: *Possible consequences of the vulnerability.*

The possible consequences are release of radioactive material resulting in worker exposure and contamination of the facility.

Block 7: *Time period in which the consequences of the vulnerability might occur (e.g., 0 to 5 years; 5 years to facility end-of-life; may not occur during facility lifetime).*

Any of these events could occur at most any time, e.g. 0 to 5 years.

Block 8: *Comments, views, or plans by the site operations office and site contractor relative to mitigating or minimizing any potential vulnerability. Describe the plan and schedule of corrective actions (if any).*

Uncertain Material Packaging: NMSP personnel will develop and implement a plan to inspect, repackage as required, or dispose to waste those sources and standards in the source safe that have inadequate or indeterminate packaging. The vulnerability will be corrected by July, 1997.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HBL/WGAT/001

Block 9: *Database information.*

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR_i (g)
Uranium-235	Powder	Uranium oxides	1,000 g

Collocated Chemicals and Release Products

Chemical		Release Product	
Name	Mass (g)	Name	Mass (g)
None			

Release Path Parameters[1]

Chemical Form and Release Products	DR_i	ARF_i	RF_i	LPF_i
Oxides	1.00	0.002	0.3	0.001

Exposure Parameters[1]

Chemical Form and Release Products	V (meter^3)	t (minutes)	ΔT (minutes)	X/Q	
				Ex-facility	Public
Oxides	50		1.0	0.04	1.9×10^{-5}

Block 10: *Comments and references for parameter selection.*

The WGAT assumes that since the HB-Line safe had not been opened in over 5 years and the sources/samples/standards have not been monitored or swiped, and since the packaging is in unknown configuration, there is a likelihood that a package could fail and release material. The scenario assumes that uranium oxide is released when the item is handled and the worker is exposed.

The WGAT assumed that a uranium oxide item was involved because of the oxides' dispensability.

Even though plutonium, neptuim, americium sources were also in the safe, the WGAT pursued the uranium oxide scenario.

Ronald S. O'Shaff — 7/29/96

Signature, Team Member — Date

For [signature] — 8/6/96

Signature, Team Leader — Date

1. Described in the Assessment Plan.

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HBL/WGAT/002

Block 1: *Title of the Vulnerability. (<20 words)*

Loss of source accountability in the HB-Line and other site storage safes could lead to radiation exposure to the worker and potentially to the public.

Block 2: *Executive Summary. (<50 words) Concise description of the sequence of events leading to the vulnerability.*

The review of the radioactive source control and accountability program associated with the HB-Line storage safe and other HEU facilities yielded several discrepancies. In at least one instance material was unaccounted for and in another a custodian could not gain access to the storage safe which contained the material he was responsible for; however, other non-custodial personnel within the facility had uncontrolled access. Loss of control and accountability could lead to loss of radioactive material. Further, incomplete inventories can increase the likelihood of the loss of control of HEU sources and standards.

Block 3: *Describe the condition or weakness, including the material, material form, quantity (if unclassified), packaging type and number of packages, and facility and other barriers that contribute to the vulnerability.*

Vulnerability Description/Information	
Material and material form	Various
Material at risk (approximate mass [kg] and composition of material which may participate in the release—not necessarily the inventory of material at a given location)	Hundreds of sources and standards
Packaging type and number of packages	Plastic bags, metal & cardboard cans
Facility and other barriers	Safe, gloveboxes, rooms, bldgs, vaults
Condition or weakness	Loss of accountability

ES&H Vulnerability Assessment Form

Vulnerability # SRS/HBL/WGAT/002

Block 4: *Potential causes and effects of barrier failure that contribute to the vulnerability.*

The requirements of SQ 1.1, #502, Rev. 2, require the Source Control Custodian (SCC) to maintain control over his materials at all times. This same procedure formalizes a site wide program for source inventories and integrity checks which are to be implemented. Without uniform program implementation, accountability can not be ensured with loss of sources for up to six months possible. In one instance, the team found a SCC that did not have or know the combination to the safe in which material he was responsible for is stored while others did have the combination. No visible log/record book was observed nor was there evidence of a current inventory. The last known inventory was performed in November 1995. The program calls for semi annual inventories. The loss of sources and standards could lead to worker and public exposures.

Causes: inadvertent transfers, aging degradation, other collocated hazards, inadequate configuration knowledge, administrative control, and human error

Effects: contamination, material release, ad increased radioactivity level

Block 5: *Compensatory measures that reduce the severity of the vulnerability.*

There is a WSRC Facility Evaluation Board (FEB) Program which requires an oversight audit at least once every 3 years. The first audit was conducted on SRTC in 1996 and in its report (FEB Report No. 96 p. 2-4) dated May 28, 1996, Section 2.3.3.4.1, identified similar conditions.

Block 6: *Possible consequences of the vulnerability.*

The unknown movement of materials with the potential for loss, misplacement or unauthorized use of radioactive materials could lead to increased exposure to the workers and possibly the public.

Block 7: *Time period in which the consequences of the vulnerability might occur (e.g., 0 to 5 years; 5 years to facility end-of-life; may not occur during facility lifetime).*

0-5 years

Block 8: *Comments, views, or plans by the site operations office and site contractor relative to mitigating or minimizing any potential vulnerability. Describe the plan and schedule of corrective actions (if any).*

Source Accountability - Internal appraisals had previously identified deficiencies in the Site's Source Control and Accountability Program. Although the SAT did not identify this problem as an HEU related vulnerability, the Site agrees that systematic improvement is required and is developing a Corrective Action Plan in response to the internally identified problem. SRTC has taken the responsibility for this plan which will be available by 8/15/96. The corrective actions will be monitored and tracked to closure within the Site's Commitment Management System.

APPENDIX C

CLASSIFICATION OF VULNERABILITIES BY LIKELIHOOD AND CONSEQUENCE

THIS PAGE LEFT INTENTIONALLY BLANK

United States Government Department of Energy

memorandum

DATE: August 31, 1996

REPLY TO
ATTN OF: Jon MacLaren, Working Group Assessment Team Leader, Savannah River Site

SUBJECT: Addendum to SRS Working Group Assessment Team Report

TO: S. Acharya, EH-32

During the July 16 - 19, 1996 Prioritization Meeting at the Washingtonian Marriott, Gaithersburg, Maryland, HEU assessment team leaders and Support Group personnel reached consensus on the likelihood; and worker, public and environmental consequences for each of the ES&H vulnerabilities identified by the site teams. This includes the Savannah River Site (SRS) vulnerabilities. The SRS Site Assessment Team Co-Leaders, both the Operations Office (DOE-SR) and Site Contractor, Westinghouse Savannah River Company (WSRC) Co-Leaders, and the Working Group Assessment Team Deputy Leader, other team members and myself were present to provide qualitative technical input to the Support Group. Because of the incredible nature of their scenarios and their very low consequences (computed consequences for all targets are below the consequence threshold for vulnerabilities), two of the 12 original SRS ES&H vulnerabilities identified by the teams were dropped.

During the August 13 and 14, 1996, Second Working Group Meeting, the SRS Site Assessment Team Co-Leaders and myself agreed to delete a third vulnerability because of newly developed information that made the likelihood of the specific scenario incredible. Based on these evaluations, SRS reports a total of nine vulnerabilities.

The classification and categorization of SRS HEU vulnerabilities presented in Appendix C have been reviewed and agreed to by the Site Assessment Team Co-Leaders, and the Working Group Assessment Team Deputy Leader and myself.

Jon MacLaren
Working Group Assessment Team Leader
Savannah River Site

United States Government

Department of Energy

memorandum

DATE: September 24, 1996

REPLY TO ATTN OF: Jon MacLaren, Working Group Assessment Team Leader, Savannah River Site

SUBJECT: Addendum to Highly Enriched Uranium Working Group Assessment Team Report - Vulnerability Classifications

TO: Sarbes Acharya, Project Leader, HEU Vulnerability Assessment

The Project Support Group performed initial vulnerability classifications (likelihoods and consequences) based on information contained in the vulnerability assessment forms (VAFs) completed as a part of the site assessments. During the Vulnerability Prioritization Meeting held on July 16-19, 1996 at the Washingtonian Marriott, as well as the Second Working Group Meeting, held on August 13 and 14 at the Gaithersburg Hilton, the classification results were reviewed and finalized by the Working Group and Site Assessment Team Leaders and the Project Support Group. The final results of the vulnerability classifications supersede those contained in prior versions of the Working Group Assessment Team (WGAT) report.

This memo, together with the attached final vulnerability classifications for the Savannah River Site, is recognized as an addendum to this WGAT report.

Jon MacLaren, Working Group Assessment Team Leader
Savannah River Site

Enclosure: Table of final vulnerability classifications

HEU Assessment VAF Summary

Site	Facility	VAF Number	Description	Volume II Reference No./Part A Sect.	Like-li-hood	Conse-quences W	P	E	VAF Cate gory
Site:	SRS								
SRS	235-F	SAT-001	HEU with U-233 and collocated/commingled plutonium in plastic or unknown packaging.	6/2.2.3	+ L	M	*	*	MP
SRS	235-F	WGAT-001	Corrosion of HEU shipping containers resulting from leaky vault roof.	6/3.2	+ L	M	*	*	FC
SRS	247-F	SAT-001	Possible HEU releases from building as a result of Design Basis Natural Phenomena Events.	6/2.3.2	VL	L	*	L	FC
SRS	321-M	SAT-001	Possible release of HEU holdup from building ducts and equipments during high winds or earthquake.	6/2.6.2	H	L	*	L	FC
SRS	321-M	WGAT-001	Accumulations of combustible, contaminated materials and lack of operational fire suppression system in building, increasing fire risk and potential for exposure to workers and Fire department.	6/3.6	H	L	*	*	FC
SRS	H-C-O	WGAT-001	Potential nuclear criticality in the EU-S tank during extended period of freezing weather and coincident extended loss of electric power.	6/3.4	L	H	*	*	FC
SRS	H-CANYON	SAT-001	Unsuitability of Outside Facilities and H-Canyon tanks for extended uranyl nitrate solution storage.	6/2.4.2	L	L	*	L	MP
SRS	HBL	WGAT-001	Uncharacterized packaging of radioactive sources/standards.	6/3.5	H	L	*	*	MP
SRS	HBL	WGAT-002	Weaknesses in SRS source control and accountability program.	6/3.5	-	-	-	-	IV

* Consequence Below Threshold for Characterization.
** VAF not accepted as vulnerability by WGAT.
- IV VAFs not characterized.
+ VAF contains U-233 or Plutonium.

APPENDIX D

REFERENCES

THIS PAGE LEFT INTENTIONALLY BLANK

Appendix D
References

1. DOE Approval Draft, "Safety Analysis - 200-F Area Savannah River Site, Building 235-F, Final Safety Analysis Report", WSRC-RRP-89-575, Rev. 0, dated April 1995.

2. "Holdup Monitoring of the 235-F Process Exhaust System", NMP-SPF-92-328, dated November 9, 1992.

3. "Plutonium Accumulation in the FB-Line Exhaust Duct System", NMP-SBA-91-0006, dated March 7, 1991.

4. Pu-239 CSMO Annual Report, FY-80, dated December 18, 1980.

5. "Building Surveillance Round Sheet 235/292-F", SOP 235-F-PRM-10, dated November 9, 1995.

6. "Building Surveillance Round Sheet", SOP 247-BS-022.

7. "Supporting Information for 247-F Hazard Category Determination", G-CLC-F-00057, dated May 1, 1996.

8. "Increased Activity in Segregated Cooling Water System", EOP 221-H-0055, dated September 28, 1995.

9. "Operator's Shift Patrol and Narrative Log", NOP 211-H-1522, Rev. 27, dated May 8, 1996.

10. "Safety Analysis - 200 Area", Sup. 3 - RBOF, DPSTSA-200-10-3, dated September 1983.

11. "BIO - RBOF", WSRC-TR-94-0287, Rev. 1, dated August 31, 1995.

12. "TSRs - RBOF", WSRC-TS-95-11, Rev. 0, dated August 31, 1995.

13. "BIO - K-Reactor Assembly Area", WSRC-TR-93-500, Rev. 3, dated June 1995.

14. Tech Specs, "L-Reactor Facility", WSRC-TS-10002, Rev. 5, dated November 1, 1995.

15. Tech Specs, "P-Reactor Facility", WSRC-TS-10001, Rev. 3, dated November 1, 1995.

16. "Savannah River Site Production Reactor Technical Specifications, K Production Reactor", WSRC-TS-10003, Rev. 23, dated December 12, 1995.

17. "FHA for Building 321-M", F-FHA-M-00007, dated April 20, 1995.

18. "FHA Building 321-M", WSRC-TR-92-476, dated May 1993.

19. "Fire Fighter Hazardous Materials Training Manual", 2Q2-2.6, dated November 1992.

20. "FHA for Project S-5891 244 H Support Facility Expansion", F-FHA-H-00027, dated November 27, 1995.

21. "FHA for 773A Main Laboratory Facility", F-FHA-A-00010, dated November 9, 1994.

22. "FHA for 735A Facility", F-FHA-A-00020, dated February 12, 1996.

23. "FHA for 772-F Facility", F-FHA-F-00006, dated July 21, 1994.

24. "FHA for 772-1F", F-FHA-F-00012, November 7, 1994.

25. "FHA for 235-F Facility", F-FHA-F-00007, dated November 30, 1994.

26. "FHA for RBOF", F-FHA-H-00014, dated June 28, 1994.

27. "FHA for 221-H Facility", G-FHA-H-0005, Rev. 2, dated July 22, 1994.

28. "FHA for 221 HB-Line Facility", F-FHA-H-00007, dated December 26, 1993.

29. "FHA for L-Reactor", F-FHA-L-00001, dated March 1, 1996.

30. "FHA for 221 FB-Line", M-FHA-F-00022, Rev. 4, dated February 14, 1994.

31. "FHA for 247-F Facility", F-FHA-F-00003, (DRAFT) Rev. A, dated February 13, 1996.

32. "FHA for K-Reactor", F-FHA-K-00006, dated November 17, 1995.

33. USQD, "Deletion of Fire Suppression in Glove Boxes", ESH-92001, Rev. 1, dated August 12, 1992.

34. "Department of Energy Highly Enriched Uranium ES&H Vulnerability Assessment, Site Assessment Team Report, Savannah River", dated June 23, 1996.

35. Spent Fuel Working Group Report, Volume II, dated November 1993.

36. Spent Fuel Working Group Report, Volume III, dated November 1993.

37. Effect of Concrete on RBOF NCS Limits, DPSPU-82-272-1, dated January 5, 1982.

38. NCSE Impact of Concrete Reflection on RBOF Fuel Storage and Handling Operations N-NCS-H-00021, Rev. 0, dated May 24, 1996.

39. DRAFT, RBOF U-VA Question Set, dated June 6, 1996.

40. Nuclear Criticality Safety of General Storage of Various Shipping Containers, SRS Nuclear Criticality Safety Evaluation 93–08, dated March 9, 1993.

41. "Savannah River Site Production Reactor Safety Analysis Report, K Production Reactor", WSRC-SA-10003, Amendment 4, dated November 8, 1992.

42. Nuclear Criticality Safety Evaluation 95-06 Fissionable Material Transfers in 235F(U), EPD-NCS 95001-8, dated March 30, 1995.

43. "105 P, K, and L Disassembly Basin Cask Support Frame Final Report", ELS-CES-96-0020, dated April 24, 1996.

44. Occurrence Report SR-WSRC-RBOF-1994-0012, dated June 6, 1996.

45. Occurrence Report SR-WSRC-RBOF-1994-0021, dated June 6, 1996.

46. Occurrence Report SR-WSRC-RBOF-1994-0013, undated.

47. "100 Area Irradiated Fuel Consolidation and Horizontal Storage Criticality Concerns (U)", SRT-CMA-930074, Revision 0, dated January 1994.

48. Technical Specification Change Request (TSCR) 94-0004, Horizontal Tube Storage Limits Revision, dated May 1994.

49. Unreviewed Safety Question Determination 94-0061, dated June 7, 1996.

50. Unreviewed Safety Question Determination 94-0074, "Project S5839 FPR for Fuel Storage Rack", dated July 5, 1994.

51. Occurrence Report, SR-WSRC-S247-1994-0006, 1994.

52. Nuclear Safety Data Sheet (NSDS) 165, Revision 2, dated January 29, 1996.

53. Nuclear Safety Data Sheet (NSDS) 195, Revision 6, dated May 7, 1996.

54. Nuclear Safety Data Sheet (NSDS) 119, Revision 14, dated March 13, 1996.

55. Procedure 244-H-3012, Receipt and Shipment of Battelle Memorial Institute (BMI) Cask USA/5957/B( )F(U), dated March 4, 1996.

56. Assessment of Seismic Qualification of Concrete Piers, Walkways, and Roof for L Disassembly Area, Joshi, et al, letter to S. Pogula, dated May 14, 1996.

57. "Savannah River Site Plutonium Vulnerability Working Group Assessment Team Report", Vol. III, DOE/EH-0415, dated November 1994.

58. "Savannah River Site Plutonium Vulnerability Site Assessment Team Report", Vol. II

DOE/EH-0415, dated November 1994

59. "K-Reactor Cold Standby Basis for Interim Operation (BIO), WSRC-TR-94-207, Rev. 0, dated February 1995.

60. "The Highly Enriched Uranium Environmental, Safety and Health Vulnerability Assessment Plan", dated March 29, 1996.

61. Operating Safety Report SRT Technical Area, WSRC-RP-92-904.

62. Letter from Wilnorth to Doswell on "Reduction of Radiation Material in SRTC - Second AOP Milestone," SRT-AEC-96-004, dated March 28, 1996.

63. Waste Handling Guidelines Procedure, L1-6.01, Revision 3.

64. Movement and Inventory Control of Radioisotopes, L1-2.18, Revision 1.

65. Routine SRTC OSR Surveillance Status Charts.

66. "Evaluation of Nuclear Incident Monitor (NIM) Locations - Savannah River Laboratory," letter report from K. H. Rosenbuerger to P. B. Gerrard, ESH-HPT-910356, dated December 17, 1991.

67. CRC (Criticality Review Committee) Review of SRTL NIM DCFs (Design Change Forms), letter from R. L. Frost to Distribution, SRT-CRC-950003, dated October 12, 1995.

68. "235 U Holdup, Building 321", WSRC-TR-95-0492.

69. Excess Facility Daily Rounds Sheet, SOP-300-33.

70. Performing Rounds for Building 321-M, SOP-319-101.

71. M-Area JCO DP SSA-300-3A, Addendum 1.

72. "Safety Analysis-200 Area Outside, DP SSA-200-10", Sup. 11, Revision 1, dated January 1993.

73. "Safety Analysis-200, H Canyon Operations, DP STSA-200-10", Sup. 5, dated February 1986.

74. "211-H Operation Safety Review, WSRC-RP-90-568", dated September 1992.

75. "Safety Class and Safety Significant Systems for Separation Facilities." This document applies to F/H Can., F/H B lines, 235-F and 247-F, US Tank/OF EQ: List, NMS-ENG-95-001, Revision 3, dated 1995.

76. "Functional Classification Report for the 221-H Canyon/OF/HA-line", NMP-SHC-0788, dated May 25, 1996.

77. Calculations No. N81137, Qualification Calculations for Enriched Uranium Storage Tank, dated December 15, 1988.

78. "Structural Qualification Program for Savannah River Site Facilities, Rev. 3, "WSRC-RP-92-1083, dated April 14, 1995.

79. "H-Area/ITP Structures Final Report," WSRC-TR-95-0073, Rev. 1, dated May 15, 1995.

80. DRAFT, Excerpt from WSRC February Report on SRTC Evaluation, pp 26 and 27/61, Source Control.

81. "235F SAIZ", WSRC-RP-89-595 Vol-1, Revision 0, dated April 1995.

82. "Interim Management of Nuclear Materials", DOE/EIS-0220, dated October 20, 1995.

83. Operational Safety Requirements, Separations Area Operations, Building 211-H Outside Facilities, Uranyl Nitrate Storage Facility, WSRC-RP-90-568, September, 1992.

84. Assessment Team Report, WSRC-TR-95-0429, R-1, dated January 15, 1996.

85. "291-H Stack Monitor Operations", 323A, Rev. 3, dated March 19, 1996.

86. Facility Evaluation Board Report, FEB Report 96-2-4, dated May 28. 1996.

87. "Radioactive Source Accountability and Control", 5Q 1.1, No. 502, Rev. 2, August 1, 1995.

88. "Sand Filter Profile Survey", 5Q 1.2, No. 452, Rev. 2, dated March 6, 1996.

89. "221-H Stack Monitoring System - Alpha, Fission Products and Radioidine", 5Q 1.5, No. 323, Rev. 2, dated February 22, 1994.

90. "221-H Canyon Special Procedure SP 8W-149, Setting Up 8.7 to 7.6E", Rev. 0, approved May 11, 1996.

91. "Jetting Swimming Pool Sump", SOP 221-H-8201, Rev. 10, dated May 21, 1993.

92. "Jetting Hot Shop Sump", SOP 221-H-8217, Rev. 8, dated May 15, 1992.

93. "Installation or Removal of Jumper 68(W) PO", SOP 221-H-975, Rev. 3, dated July 16, 1991.

94. "Failure to verify canyon scroll per procedure", Occurrence Report Notification, SR-WSRC-HCAN-1996-0016, dated June 6, 1996.

95. "Justification for Continued Operation of NMSP Facilities During Re-evaluation of Canyon Structural Analysis", JCO-SEPGEN-96-001, Rev. 0, dated May 1996.

96. "Canyon Piping Preparation and Use", ADM 221-H-6054, Rev. 2, dated June 5, 1996.

97. "Operational Safety Requirements Building 211-H outside Facilities, Uranyl Nitrate Storage Facility", WSRC-RP-90-568, dated November 1992.

98. "Safety Analysis 200 Area, Separations Area Operations Building 211-H Outside Facilities", DPSTSA-200-10 SUPP-11, Rev. 1, dated January 1993

99. "Safety Analysis-200 Area, Savannah River Plant, H-Canyon Operations", DPSTSA-200-10 SUPP-5, dated February 1986

100. H-Canyon Facility 2S Drill Scenarios:
Contaminated Dry Spill, NSBGRR19.W0100, dated February 6, 1996
Fire Response, NSBGDR09.W0100, dated February 6, 1996
Injured Person, NSBGDR22.W0100, dated March 14, 1996
Contaminated Acid Spill, NSBGDR18.W0100, dated September 29, 1995
150 Lb.. Steam Failure, NSBGDR14.W0100, dated February 6, 1996
High Activity in Segregated Cooling Water, NSBGDR11.W0100, dated June 15, 1995
Normal Cooling Water Failure, NSBGDR13.W0100, dated March 22. 1995
PCM-1B Contamination Alarm Response, NSBGDR26.W0100, dated June 4, 1996

101. "H-Canyon, Hot Canyon Log Book-Control Room General Log Book", WSRC-NB-96-485-02, started June 3, 1996.

102. 10.2 Tank Associated Readings, Log 221-H-RS20, pg. 1 of 3, Rev. 1, dated May 25, 1994.

103. H-Canyon Facility Manager's Observation Log Book

104. "H-Canyon Low Activity Waste/Solvent Recovery/Vessel Vent/Control Room General-Warm Side Log Book", WSRC-NB-96-484-02, started May 19, 1996.

105. "Second Uranium Cycle Control Room Round Sheet", Log 221-H-RS130, Rev. 1, dated May 25, 1994.

106. Shift Manager/Control Room Supervisors Log Book, WSRC-NB-96-0487-05, started May 21, 1996.

108. Site maps, Doc. No. OSR3-158, Rev. 5, dated January 1996.

109. "Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities, dated November 21, 1994.

110. SAIC 92/1180, dated August 26, 1992.

111. "Routine Sampling/Source Checking the 291-H Stack Fission Product and Radioiodine Monitors Using DOREX Canisters", 323B, Rev. 4, May 7, 1996.

112. "Nuclear Criticality Safety Evaluation 95–6– Fissionable Material Transfers in 235–F (U)", EPD-NCS-90018, dated March 30, 1995.

113. "Receipt, Relocation, Movement or Transfer of Accountable Nuclear Materials", SOP 235–F–8060A.

114. "The Savannah River Site Corrective Action Plans", WSRC-TR-94-0515, dated November 21, 1994.

115. "Calibration of the 291-H Alpha Monitor", 324, Rev. 2, February 22, 1994.

116. P.A. Ward memo to Ranny Saylor/Steve Beck-Montgomery, SAT Report Review Comments/Feedback, dated June 8, 1996.

117. P.A. Ward memo to Tim Worth, SAT Report Review Comments/Feedback, dated June 8,1996.

118. "Integrated Program Plan – Implementation Plan", DNFSB 94-1, dated February 28, 1995.

INFORMAL NOTE

Date: June 8, 1996

To: Ranny Saylor, 235-F Operations Support
Steve Beck-Montgomery, 235-F Engineering Support

From: P. A. Wardt, WGAT Subgroup #3

Subject: SAT REPORT REVIEW COMMENTS/FEEDBACK

Based on our discussions this past week, regarding the response to Question Set Section 8 for 235-F Building and VAF SAT/235-F/SAT/0001, we request the following:

- Revise the response to Question #3 to differentiate between items that are (1) mostly Pu with some HEU, (2) mostly HEU with some Pu, and (3) HEU only materials. For packages that contain mixtures of plutonium and HEU, report these materials were previously addressed under the plutonium vulnerability assessment and will be addressed by the plutonium corrective action.

- Since the WGAT agrees with VAF SAT/235-F/SAT/0001 for the HEU materials, please revise the VAF to address known adverse material packaging combinations and material packaging uncertainties for HEU. The VF does need to repeat the vulnerabilities identified for plutonium only and mixtures of plutonium and HEU.

  Please note that Y-12 has developed a technical paper discussing the acceptability of packaging HEU materials in plastic, at least for period less than 10 years. We can provide a copy if needed. HEU in contact with plastic may be as hazardous as plutonium in contact with plastic.

cc: JJ Middleton, WGAT Team Leader
LL Traver, WGAT Subgroup #3
DD Lopez, WGAT Subgroup #3
DD McWhorter, SRS SAT

INFORMAL NOTE

Date: June 8, 1996

To: Tim Worth, 247-F Engineering Support

From: P. A. Ward, WGAT Subgroup #3

Subject: SAT Report Review Comments/Feedback

Based on our discussions this past week, regarding VAF SAT/247-F/SAT/001, we request the following:

- Since the WGAT tends to agree with VAF SAT/247-F/SAT/001 content, please revise the VAF to create two separate vulnerabilities; (1) building collapse as a result of a design basis earthquake or design basis tornado, and harm to workers in the building and release of materials to the environment from process and HVAC holdup; and (2) criticality due to the relocation of holdup materials. Mechanisms for relocation could include DBAs resulting in the rearrangement of process vessels containing residual HEU materials or a reverse flow wash-out of HVAC holdup that collects in a process cabinet to create a criticality situation.

In regard to the second part, we would like to have the WGAT HEU and criticality experts take a look at the Process Area to validate these ideas. We will call ahead to give you appropriate prep time and will pursue FastScans for these individuals prior to coming over.

cc: J. MacLaren, WGAT Team Leader
L. Traver, WGAT Subgroup #3
D. Lopez, WGAT Subgroup #3
D. McWhorter, SRS SAT

APPENDIX E

STAKEHOLDER INVOLVEMENT

THIS PAGE LEFT INTENTIONALLY BLANK

Appendix E
Stakeholder Involvement

COMMENTS AND QUESTIONS FROM PUBLIC HIGHLY ENRICHED URANIUM ENVIRONMENT, SAFETY AND HEALTH VULNERABILITY ASSESSMENT IN-BRIEFING JUNE 4, 1996

Disposition of HEU

Q. What are the plans for disposition of this material? Will these materials change form?

A. This vulnerability assessment is not a disposition plan but is a study of material vulnerability until there is a final disposition. The material form could change as part of a corrective action. This assessment is only a snapshot in time where the Department of Energy (DOE) will identify vulnerabilities with corrective action plan(s). The information gathered will be sent to the Secretary of Energy who will ultimately make the decision on any disposition. For example, during the plutonium vulnerability assessment one corrective action identified was to change some of the cans of plutonium into another package form. Any corrective action will be described and implemented to ensure safe storage.

C. When reviewing alternative forms for storage, please consider highly enriched uranium (HEU) as a valuable resource. I do not want to see it buried somewhere.

Vulnerabilities identified by SAT

Q. Why not talk about vulnerabilities Site Assessment Team (SAT) has found?

A. The vulnerabilities that Westinghouse Savannah River Company (WSRC) has identified in a draft document has not had concurrence by either WSRC or DOE management. We want to determine if these are true vulnerabilities and if these are all of the vulnerabilities. We have taken a very conservative approach, but we only want to correct valid problems for the most effective use of our limited resources ($). However, any necessary corrective actions are being addressed now to protect human health and the environment. As always, any safety problem must be addressed.

Worker health and safety

Q. Having reviewed several DOE documents from other sites (ex. Preliminary Safety Analysis at Hanford), I am concerned about the workers who are near facilities. Most documents seem to focus on public health and safety and not worker health and safety. In the event of any criticality, the worker health and safety must be a primary concern. How are you treating effects on criticality on workers?

A. The new focus of DOE is on safety of worker and public health, and safety and the environment with the Defense Nuclear Facility Safety Board (DNFSB), new DOE orders, and other initiatives. There is a rigorous question set for this assessment that focuses on:
   1. worker health and safety
   2. public health and safety
   3. environment

   DOE believes by protecting workers, we are also protecting public health and safety and the environment.

Public involvement

C. Having been involved with public activities with SRS and the Citizens Advisory Board (CAB) for the past several years, and having read many of the documents you have produced for the public, I find that you provide too much detail for the public to understand. There is so much detail provided that significant issues can be overlooked. For example, releases from the plant are not put in context and they tend to be conservative. The public perception is that there are two types of radiation (SRS and natural). Numbers that refer to three significant decimals provide too much detail for the public. Please put results of the study in terms so that lay person can understand it.

C. I realize it is difficult to report on "non-problems". When people don't understand something they become suspicious. Then they believe you must be covering something up. However, if you don't find a problem, please don't list the problems you did not find. This is confusing for the public. I recognize that diligence is good and I am not advocating you obscure work you have done. The Secretary of Energy and the President need to have this information. I guess it is a fine line in what to communicate in your report.

C. Our local public should be able to understand and believe any findings of the teams.

Process

Q. How are you going to have all those people on the DOE-HQ team talk to all the facility managers for the 16 facilities you are going to evaluate, as well as give them all a tour in one afternoon? How will you provide all the talent you have brought to SRS to walk through all these facilities in just two weeks?

A. The management team will be divided so that they can talk to all these people and have the tour of the facilities. Today the team members will get an introduction from facility managers who will provide information on the problems they have recognized. The team will be all over the site for the next 1½ weeks. The team will be broken into four groups; each group will tour each facility once, twice or more, as necessary.

Q. Why are you doing this assessment now? There is an EIS on the disposition of these materials, you have already done a plutonium vulnerability assessment. So why now?

A. We wanted to do everything at the same time, but we believed plutonium had more problems than HEU. As far as the EIS is concerned, EIS is evaluating the disposition options, not vulnerability. This vulnerability assessment will look at environmental, safety, and health issues and will provide correction actions which will be necessary before the disposition of these materials.

Q. Three speakers today have said that this assessment is not a safeguards and security assessment. Why is this an issue?

A. We have looked at terrorism before in performing our safeguards and security vulnerability assessments, and we want everyone to recognize that this assessment is not for safeguards and security. In addition, most safeguards and security audits are called "vulnerability assessments", and we want to make sure that everyone understands the scope of our work.

Q. Please look at what will happen to the vulnerabilities in times of declining funds. In other works, look at what increased vulnerabilities will result from limited funding to correct vulnerabilities.

A. It is the responsibility of DOE and WSRC management to ensure the safety and health of the workers and the public and the environmental are protected in times of declining funds.
C. Yes, but these vulnerabilities may give you some ammunition to get more funding. I have been involved in the budget prioritization process and believe these are good concepts used by DOE. However, because SRS has less risk than other sites, we seem to get fewer dollars.

Q. I am pleased that you are looking in the "nooks and crannies" to find HEU. Did you look at materials in process or in facilities when you were doing the plutonium vulnerability study?
A. There is a difference between "in process" and "in facilities". "In process" usually refers to those materials left to be processed. "In facilities" usually means the materials found in facilities that will be moved to the ER program. (Speaker was referring to the decontamination and decommissioning (D&D) of these facilities.)

Value of HEU

C. There is a total 22-24 MT of enriched uranium at SRS. This is worth about $3-10 billion if the uranium was converted to commercial fuel to produce electricity.

Announcement

The out briefing will be June 14 at 12:30 here in the Rainbow Rooms.

COMMENTS AND QUESTIONS FROM PUBLIC
HIGHLY ENRICHED URANIUM ENVIRONMENT, SAFETY AND HEALTH VULNERABILITY ASSESSMENT OUT-BRIEFING
JUNE 14, 1996

Stakeholder Input

C. There didn't appear to be a sincere effort to obtain significant stakeholder input, particularly from the general public.

A. Notices were put in the local newspapers and known interested parties were contacted.

Safeguards

C. Although this assessment was not supposed to deal with safeguards issues, the public should be better informed about the issues regarding the safeguarding of fissile materials, both nationally and internationally.

Followup

C. The corrective actions responding to the vulnerabilities should be tracked and the public should be kept aware of the status.

A. Corrective actions will be tracked. Although there is currently no plan to issue information to the public regarding the closure of actions, this information is available at any time if the public or anyone else should ask.

WGAT

C. The WGAT members all appear to be highly qualified. Before they sign the final report, they should make sure that if they were the supervisor of the activities under review they would be comfortable that all vulnerabilities have been identified.

APPENDIX F

PREVIOUS SRS VULNERABILITY ASSESSMENTS

THIS PAGE LEFT INTENTIONALLY BLANK

The SNF Vulnerability Assessment was conducted by an SRS Site Assessment Team (SAT) and a WGAT. The WGAT was on-site from October 4 through October 11, 1993. Included in the assessment were K-, L-, and P-Disassembly Basins; F- and H-Canyon Storage Basins; the RBOF; Building 773–A; and Building 321–M. Much of the spent fuel assessed contained HEU. Because of the need for the report to be unclassified, the inventory was reported as estimated kilograms of heavy metal; no breakdown as kilograms of HEU was provided. Twenty-one ES&H vulnerabilities (Table F-1) were identified in that assessment, and a *Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities,* dated November 21, 1994 was developed specifically to address the disposition of the SNF.

SRS during the summer 1994. The WGAT was on-site from July 6 through July 20. Facilities assessed included FB-Line, Building 235–F, F-Canyon, H-Canyon, HB-Line, Old HB-Line, the RBOF, the Savannah River Technology Center (SRTC), the Central Labs, and Building 321–M. Much of the plutonium assessed was collocated or commingled with HEU, so in many cases the vulnerabilities and corresponding corrective action plans address HEU as well as plutonium. Inventory data were in the form of kilograms or number of packages of plutonium; quantities of HEU were not reported. The assessment yielded a total of 55 ES&H vulnerabilities (Table F–2), and many of the plutonium corrective actions contained in the *Savannah River Site Corrective Action Plans*, WSRC-TR-94-0515, dated November 21, 1994, also address the disposition of collocated or commingled HEU.

Table F-2. Vulnerabilities as Determined in Plutonium Vulnerability Assessment

Vulnerability Number	Vulnerability Title
**SR–B235–1	Plutonium holdup in process equipment and ductwork awaiting D&D in Building 235–F
**SR–B235–2	Plutonium materials with significant adverse conditions stored in shipping containers in Building 235–F
**SR–B235–3	Plutonium materials with significant adverse conditions stored in pails in Building 235–F
**SR–B235–4	Plutonium materials with potential adverse conditions stored in shipping containers in Building 235–F
**SR–B235–5	Plutonium materials with potential adverse conditions stored in 5-gallon pails in Building 235–F
**SR-B235–6	Helium buildup and potential for breach of containment with Pu-238–bearing materials
SR–CL–1	Spill in Sample Tunnel, Building 772–F
SR–FB–01	Incomplete characterization and location of Pu process holdup in FB-Line
SR–FB–02	Stored materials in FBL & 235–F subject to an increase in source strength and heat buildup from daughter in-growth
SR–FB–03	FB-Line stored plutonium-bearing sample solutions and standards
SR–FB–04	Plutonium metal stored in direct contact with plastics, FB-Line
*SR–FB–05	Plutonium compounds (e.g., oxides) stored in direct contact with plastics, FB-Line
SR–FB–06	Stored plutonium metal with a high surface-to-mass ratio (FB-Line and 235–F)
*SR–FB–07	Pu metals w/major adverse conditions in FB-Line (age, high thermal heat, PVC plastic packaging, etc.)
SR–FB–08	Plutonium metals w/moderate adverse conditions in FB-Line (e.g., PE plastic and organic can seals)
SR–FB–09	FB-Line stored recovery feed materials containing calcium, fluoride, and plutonium (i.e., SSC, sweepings)

Table F-2. Vulnerabilities as Determined in Plutonium Vulnerability Assessment

Vulnerability Number	Vulnerability Title
SRS–I–2	Seismic issues and design inadequacies of SRS facilities
SRS–I–3	Prolonging the interim storage mode and mission path forward

*Indicates vulnerabilities for FB–Line that are applicable to HEU.
**Indicate vulnerabilities for Building 235–F that are applicable to HEU.

PART B

SITE ASSESSMENT TEAM REPORT

NMP-PLS-960113
RETENTION: Until dismantlement or disposal of facility...., review at 10 year intervals
RIDS Tracking #398
REVISION: 2

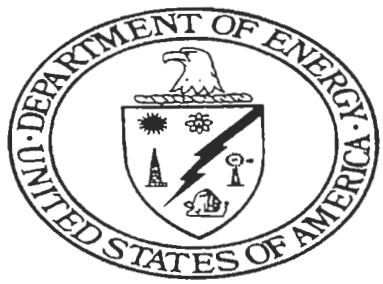
DEPARTMENT OF ENERGY

HEU ES&H VULNERABILITY ASSESSMENT

SAVANNAH RIVER SITE

SITE ASSESSMENT TEAM REPORT (U)

AUGUST 20, 1996



UNCLASSIFIED
DOES NOT CONTAIN
UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION
ADC & Reviewing Official: Gordon Ellis, Staff Spec.
(Name and Title)
Date: 8/22/01

HEU ES&H Vulnerability Assessment

Savannah River Site

Site Assessment Team Participants

8/22/96
Roger Rollins, DOE Safety Group, Team Co-Leader

8/22/96
R. L. Geddes, WSRC, NMSP, Team Co-Leader

WSRC DIVISIONAL COORDINATORS:

8/21/96
A. Barone, NMSP

8/22/96
F. Key, SRTC

8/21/96
C. E. Varner, EF&RFSP

LIST OF REVISIONS

REVISION 1

Added the Blocks 9 and 10 data to the Vulnerability Assessment Forms which was provided by the Working Group Assessment Team.

Incorporated comments which various interested groups made on Revision 1. Incorporation of these comments did not change the content of the report, but only involved additional information or grammatical changes to enhance the report to the reader.

Corrected typographical errors in the original issue.

REVISION 2

Based on recent information released by an SRS engineering support group, both the WGAT and SAT decided to delete the vulnerability from a criticality resulting from rearrangement of holdup materials in Building 247-F by a design basis accident. Analysis in nearly completed study has determined that such an event is incredible. Although the study has not been issued, conversations with the responsible organization personnel have provided the SAT and WGAT with sufficient confidence that the analysis is complete and sound.

The content of this report was modified to incorporate the deletion of this vulnerability. The reader should review the entire report to fully realize the impact of the modifications.

EXECUTIVE SUMMARY

OBJECTIVES AND SCOPE

This report fulfills the directive issued by the Secretary of Energy on February 22,1996 to complete a comprehensive assessment of potential vulnerabilities associated with the management of highly enriched uranium (HEU) throughout the DOE complex. In a subsequent letter of instruction, the DOE-SR Field Office[1] formally directed WSRC to conduct an assessment of the HEU materials at SRS.

The assessment provides ongoing support for the Department of Energy (DOE) HEU ES&H Vulnerability Assessment Project utilizing the methodology provided by the DOE-Headquarters Office of Environment, Safety, and Health (DOE-EH) in the *Highly Enriched Uranium Environmental, Safety and Health Vulnerability Assessment Plan*[2].

The term "ES&H vulnerabilities" is defined for the purpose of this assessment to mean conditions or weaknesses that could lead to unnecessary or increased exposure of workers or the public to radiation or to HEU-associated chemical hazards, or to the release of radioactive materials to the environment. The assessment will identify and prioritize ES&H vulnerabilities, and will serve as an information base for identifying corrective actions for the safe management of HEU.

The evaluation focused mainly on *in-scope* quantities of HEU materials as defined in the Assessment Plan. The team evaluated *all* inventories of highly enriched uranium including those commingled or co-located with other materials in the facilities.

HEU is defined as any quantity of uranium containing material which contains greater than 20% of the isotope ^{235}U by weight of the total uranium content, or any amount of the isotope ^{233}U. Per the Assessment Plan, all quantities of HEU are included in the assessment including sources and standards.

METHODOLOGY

The SRS Site Assessment Team (SAT) was established comprising key facility personnel, technical experts, coordinators, and logistical support personnel. The SAT completed this assessment report which will be reviewed by the Working Group Assessment Team (WGAT). The WGAT will issue a separate, independent report on their assessment of the SRS HEU materials and facilities.

A training session on the methodology and conduct of the assessment was held by the DOE in San Antonio, TX. on April 8-11, 1996. Members of the SRS WGAT and the SRS SAT co-team leaders attended the training session. Training materials from the session were distributed to the division team leaders for subsequent distribution to the facility assessment teams. The ES&H Support Team developed an electronic database to facilitate the development of the assessment reports. The database also provided a measure of consistency in the data input provided by the various facility assessment teams.

All material inventories were placed into categories as defined in the ES&H Assessment Plan. Storage and facility conditions were evaluated to determine the primary adverse conditions that could indicate a potential for increased exposure to workers and the public, or releases to the environment.

An important parameter in the HEU VA methodology was that those materials defined as *out-of scope* by the Assessment

---

1 See Letter CC-96-0025, Mario P. Fiori to Mr. Ambrose Schwallie, titled *Highly Enriched Uranium (HEU) Vulnerability Assessment*, dated March 25, 1996.

2 The Office of Environment, Safety, and Health Highly Enriched Uranium Environmental, Safety and Health Vulnerability Assessment Plan will be called the Assessment Plan throughout the balance of this report.

enriched uranium. SRS is currently authorized per the *SRS Site Integrated Stabilization Management Plan, Rev. 3* to stabilize the uranyl nitrate solutions stored in the H-Canyon Facility by the end of FY-2000.

- SRS previously recognized that the packaging materials used to contain the HEU materials in Building 235-F may present a vulnerability in the IMNM EIS. The DNFSB recognized the same vulnerability in its *Letter of Recommendations No. 94-1*. Plans are in place to either repackage or process the HEU stored in the 235-F vaults. SRS is currently authorized per the *Site Integrated Stabilization Management Plan, Rev. 3* to stabilize the HEU material in 235-F by the end of FY-2002.
- SRS previously recognized that a design basis accident could release HEU materials from Building 321-M. Plans have been formulated which will either decontaminate or remove the ventilation ducts in Building 321-M,
- SRS previously recognized that a vulnerability from a material release due to a design basis accident may exist in Building 247-F. Therefore, SRS developed a decontamination and demolishing (D&D) plan in 1994 for eventual removal of existing uranium facilities and associated contaminated support equipment. Meanwhile, the facility is pursuing formal deactivation in 1996. Facility personnel continue a surveillance and maintenance program to ensure that the facility barriers are not comprised. This activity will continue until D&D is accomplished.

There is no significance to the order in which the above vulnerabilities are presented. The SAT did not prioritize the SRS HEU vulnerabilities, nor was it requested in the Assessment Plan. The WGAT will prioritize the HEU vulnerabilities later in the assessment process.

Plan were exempted from the HEU vulnerability assessment. Since a significant portion of the SRS HEU materials were evaluated in previous assessments, this methodology significantly reduced the number of materials which were subject to assessment.

To provide a cross-link between the HEU VA and the covering VA, the SRS HEU facility assessment teams completed the first three questions in the Question Set Database. A reference to the previous assessment which covered any vulnerabilities associated with a material was included as part of the response.

Per additional guidance from the DOE HEU Vulnerability Assessment Project Manager, any spent nuclear fuel containing HEU that was received since the Spent Nuclear Fuel Vulnerability Assessment was to be assessed using the methodology that was established for the Spent Fuel VA. This guidance also stated only new vulnerabilities that have been determined since the Spent Nuclear Fuel Vulnerability Assessment would be included. The assessment teams for the concerned SRS facilities determined that there were no new vulnerabilities associated with spent nuclear fuel. Therefore, no Vulnerability Assessment Forms or Corrective Action Plans for these materials were completed.

The Assessment Plan clearly states that the determination of a vulnerability relies heavily on the judgment of the individual and the team(s). The Assessment Plan methodology is based on a zero tolerance of unnecessary or increased risk to the worker, public and environment.

Primary facilities that hold HEU at SRS are H-Canyon, K-Reactor Assembly Area, K, L and P-Reactor Disassembly Basins, and the Receiving Basin for Offsite Fuels (RBOF).

SITEWIDE CONCLUSIONS

The SRS site team identified four specific potential vulnerabilities that meet, or may meet, the criteria for a vulnerability. The four vulnerabilities are:

- Worker and public exposure and an environmental release resulting from a design basis accident as extended storage of HEU uranyl nitrate solutions in the H-Canyon Facility continues,
- Worker exposure and environmental release from a HEU release if a storage container were to fail due to overpressurization caused by hydrogen buildup generated by uranium metal in contact with plastic packaging materials which may have been utilized in the HEU storage containers in Building 235-F,
- Worker exposure along with an environmental release when the HEU holdup materials in the Building 321-M ventilation ducts are released by a design basis accident ,
- Worker exposure and an environmental release when the HEU holdup materials in Building 247-F are released when the building structural integrity is breached by a design basis accident,

None of these vulnerabilities is thought to represent an imminent threat.

CORRECTIVE ACTIONS

As part of the Site Assessment Report, SRS has identified a corrective action for each of the above vulnerabilities:

- SRS previously recognized that the long term storage of uranyl nitrate solutions in H-Canyon could present a vulnerability in the *Interim Management of Nuclear Materials* (IMNM) *Environmental Impact Statement* (EIS). The Defense Nuclear Facility Safety Board (DNFSB) recognized the same vulnerability in its *Letter of Recommendations No. 94-1* to the Secretary of Energy. Plans are in place to blend down the HEU to low

enriched uranium. SRS is currently authorized per the *SRS Site Integrated Stabilization Management Plan, Rev. 3* to stabilize the uranyl nitrate solutions stored in the H-Canyon Facility by the end of FY-2000.

- SRS previously recognized that the packaging materials used to contain the HEU materials in Building 235-F may present a vulnerability in the IMNM EIS. The DNFSB recognized the same vulnerability in its *Letter of Recommendations No. 94-1*. Plans are in place to either repackage or process the HEU stored in the 235-F vaults. SRS is currently authorized per the *Site Integrated Stabilization Management Plan, Rev. 3* to stabilize the HEU material in 235-F by the end of FY-2002.
- SRS previously recognized that a design basis accident could release HEU materials from Building 321-M. Plans have been formulated which will either decontaminate or remove the ventilation ducts in Building 321-M,
- SRS previously recognized that a vulnerability from a material release due to a design basis accident may exist in Building 247-F. Therefore, SRS developed a decontamination and demolishing (D&D) plan in 1994 for eventual removal of existing uranium facilities and associated contaminated support equipment. Meanwhile, the facility is pursuing formal deactivation in 1996. Facility personnel continue a surveillance and maintenance program to ensure that the facility barriers are not comprised. This activity will continue until D&D is accomplished.

There is no significance to the order in which the above vulnerabilities are presented. The SAT did not prioritize the SRS HEU vulnerabilities, nor was it requested in the Assessment Plan. The WGAT will prioritize the HEU vulnerabilities later in the assessment process.

1.0 FACILITY DESCRIPTIONS

Brief summary descriptions of the SRS facilities which contain any quantity of HEU are contained in this section. The HEU facilities represent most of the major SRS production facilities. The facilities are grouped by WSRC operating division with no consideration to number of vulnerabilities or risks posed by the facility.

The facilities are described in much greater detail in the Question Set Responses. The reader should refer to the Question Sets in Appendix B if additional facility information is needed to better understand the designed safety features of any SRS HEU facility.

1.1 FB-LINE

1.1.1 FB-Line Facility Description

The FB-Line Facility is a hardened structure located in the third through sixth levels of the south end of Building 221-F. FB-Line was placed into service around 1960 to produce plutonium metal or oxide. Several improvements to the facilities were completed in the 1980's including upgraded special recovery controls and equipment, new precipitator facilities, and a computerized Distributed Control System (DCS) for selected facility operations.

The facility ventilation system is designed to maintain the cabinets at a negative pressure to the rooms which are maintained at negative pressure with respect to the airlocks and corridors. The cabinet exhaust is HEPA filtered before it flows into the remaining facility and F-Canyon exhaust. The cabinet room exhaust fans for the facility ventilation system are safety interlocked to the supply fans to prevent pressurization and potential air flow reversals. The ventilation exhaust for the FB-Line Facility is combined with the F-Canyon ventilation exhaust prior to the sand filters. The combined exhaust is monitored before release through the 291-F Exhaust Stack. Modifications have been made to the FB-Line ventilation system to reduce risk to the facility worker, public and environment.

1.1.2 FB-Line Material Holdings

The FB-Line vaults currently store various special nuclear materials (SNM), some of which are to be processed through FB-Line. The plutonium product, scrap from offsite, and a small backlog of recycle residues are stored for interim periods of time in one of two vaults.

All the HEU materials stored in FB-Line are commingled or co-located with plutonium, and were evaluated in the Pu Vulnerability Assessment. Therefore, no "in-scope" HEU materials are located in FB-Line. All the vulnerabilities with the HEU containing materials were addressed in the Pu Vulnerability Assessment.

1.1.3 FB-Line Partitioned Area

For the purposes of the vulnerability study, the FB-Line was determined to have only one partitioned area consisting of the 4th level vault. This vault contains the only HEU material in the FB-Line Facility.

1.1.4 Significant Events and Activities

Two recently completed assessment studies focused on: (1) radiolysis of plutonium-bearing solutions in FB-Line, and (2) a non-operational process hazards review (PHR) of FB-Line. The radiolysis study examined the facility for effects of radiolysis in plutonium-bearing solutions, including the generation of hydrogen gas. The non-operational PHR examined the facility for potential problems that might result from not operating the facility as intended.

FB-Line has also undergone several reviews and audits, including a Readiness Self-Assessment, an Operational Readiness Review, and a evaluation by the Defense Nuclear Facilities Safety Board.

1.2 BUILDING 235-F

1.2.1 Building 235-F Description

Built in the early 1950's, Building 235-F is a two-story, windowless, steel-reinforced concrete structure. It was originally designed and built as a blast-resistant structure which has since been evaluated to current design basis tornado and earthquake criteria.

A key safety feature of the building is a ventilation system which includes double HEPA filtration for two of the partitioned areas as well as sand filter protection for all three partitioned areas. Ventilation is provided by two redundant exhaust fans that are safety-interlocked with the supply fans. An emergency diesel generator provides electrical power in the event of a normal electrical supply outage. Building 235-F has an independent sand filter and continuously monitored stack exhaust system, which was installed in the 1980's. Process rooms are also monitored by permanently installed and/or portable equipment to detect contamination releases within the facility.

Current operational surveillances include visual inspections and contamination control monitoring. All three vault storage areas are continuously monitored for airborne contamination along with monthly smears of storage container sealing areas to evaluate for contamination from leakage. Currently these containers are selected on a random basis, but it has been proposed that all *higher risk* containers be inspected monthly while checks of the other containers are continued on a random basis. Visual inspection of containers for deformation and deterioration is conducted as part of the semi-annual security seal checks. Within Building 235-F, opening of storage containers for internal inspection is not permitted by the current authorization basis documentation.

1.2.2 Building 235-F Material Holdings

The HEU materials stored in the Building 235-F vaults are oxides, process residues, special reactor spent fuels, and sources. Some very low activity sources are stored in non-vault locations in the building.

1.2.3 Building 235-F Partitioned Areas

The facility assessment team separated the building into three partitioned areas which are:

- Vaults - This partitioned area consists of three storage vaults where a variety of nuclear materials are stored in a multi-layered storage configuration.
- PEF Material Balance Area - This partitioned area is a Category IV.B Storage Area that includes standards and sources.
- Process Areas and Ventilation System - This partitioned area consists of five *cold standby* process areas that are awaiting decontamination and decommissioning (D&D) and the building ventilation system. The holdup materials in this partitioned area were addressed in the Pu VA.

1.2.4 Significant Events and Activities

A planned activity is in progress to better characterize the condition of shipping/storage containers, packaging materials within containers, and isotopic contents of nuclear materials stored in the facility. Data from shipping documentation, scrap declarations, and facility reports have been collected, complied and entered into a classified computerized database. Additional information gathered from visual inspections is being added. Also, nondestructive analysis (NDA) methods are being considered to characterize materials including such techniques as radiography.

Radioactive materials are known to accumulate in the process vessel vent filters and sand filters, and have been discovered in the canyon air tunnel. The H-Canyon ventilation system is designed to remove radioactive particulates from the exhaust air stream prior to discharge to the environment. The exhaust air is monitored prior to release with instrumentation that is remotely observed by personnel in the H-Canyon Facility Control Room and the 211-H Control Room. The exhaust air monitoring instrumentation is checked through a sample collection program.

The holdup materials are not completely characterized, leaving open the potential for release events. The holdup materials are addressed in the Pu VA with any vulnerabilities presented by HEU materials bounded by other actinide materials.

1.5 HB-LINE

1.5.1 HB-Line Facility Description

HB-Line is located on the south end of the 221-H Building in the third through sixth levels. HB-Line is a maximum resistance structure designed to withstand design basis accidents. Facility modifications completed in the 1980's were designed and constructed in accordance with the ERDA Manual, Appendix 6301, *General Design Criteria-Plutonium Facilities*, applicable DuPont Engineering Standards, Nuclear Air Cleaning Handbook, and National Electric Code.

1.5.2 HB-Line Materials Holdings

The only HEU materials in the HB-Line Facility are sources stored in a safe.

1.5.3 HB-Line Partitioned Areas

The facility assessment team designated the Scrap Recovery Facility as the one partitioned area within the HB-Line Facility

1.5.4 Significant Events and Activities

The facility assessment team determined that there were no vulnerabilities associated with HEU source and standard materials stored in the facility.

1.6 BUILDING 321-M

1.6.1 Building 321-M Description

Completed in 1957, Building 321-M was a fuel and target manufacturing facility which provided assemblies for the SRS nuclear production reactors and offsite research reactors. The building has been placed into a non-operating status. The building is located 0.7 kilometers from the site boundary.

The building is a steel frame structure with a roof consisting of precast concrete panels covered by insulation board, a vinyl membrane and protective tiles. The steel frame is covered with asbestos cement board cladding. The floor is a concrete pad.

The Building 321-M Contamination Area (consisting of the charge preparation, casting, and machining rooms) is ventilated via a once through HVAC system. The HVAC supply fans and nine exhaust fans are designed to maintain the Contamination Area at a slightly negative pressure with respect to the remainder of Building 321-M. Each exhaust fan ventilates a specific piece of equipment or room. The exhaust ducts are constructed of galvanized sheet steel. Each exhaust stream is either single or double-staged HEPA filtered. The exhaust fans, a portion of the ductwork, and most of the HEPA filter housings are located on the building roof. Each exhaust stream is sampled to monitor radionuclide emissions.

1.6.2 Building 321-M Material Holdings

The 321-M contains HEU as:

- holdup materials in the process equipment and ventilation system, and

These items are evaluated in this assessment.

1.11.3 RBOF Facility Partitioned Areas

The RBOF storage basins and fuel handling basins are considered part of a single partitioned area for this study.

1.11.4 Significant Events and Activities

RBOF is expected to continue its current mission for the next twenty years.

1.12 BUILDING 773-A

1.12.1 Building 773-A Description

Building 773-A is the primary R&D facility in the Savannah River Technology Center (SRTC). The facilities were built and modified over the period from 1951 to the present, and consequently have been built to a number of different structural design criteria and building codes. The building is approximately 640 meters from the site boundary.

Building 773-A is composed of six connected wings on two levels. These wings house work areas that include office, laboratory, operations, and maintenance activities.

Some of the 773-A exhaust air stream is routed through HEPA filters before it combined with the remaining exhaust streams prior to a sand filter. The exhaust stream is monitored before it is released to the environment via three stacks located near the building.

1.12.2 Building 773-A Material Holdings

The HEU materials in Building 773-A are contained in a reactor fuel assembly, laboratory solutions, sources and samples. All these materials were addressed in the Pu VA, therefore there are no *in-scope* materials in Building 773-A.

1.12.3 Building 773-A Partitioned Areas

Building 773-A was partitioned into six areas for the HEU VA. The areas were designated by the ventilation system which exhausts the rooms comprising the partitioned area. Identical methodology was utilized in the Pu VA.

1.12.4 Significant Events and Activities

Noteworthy programs designed to limit exposure to workers and the public are the ALARA program and the SIRIM system. Both programs have been in use for some time with excellent results.

A large variety of analytical and developmental initiatives are in progress which support SRS and other DOE sites. SRTC is highly involved with the DOE effort to transfer technology to the private sector.

1.13 BUILDING 735-A

1.13.1 Building 735-A Description

Building 735-A is located in A-Area approximately 640 meters from the site boundary. Building 735-A houses the site environmental surveillance and personnel monitoring programs. In addition, support of emergency response capabilities and collaborative environmental research with other scientists are performed here.

In certain laboratories, the hood exhaust air is HEPA filtered prior to release. The building has a fire detection and alarm system which is monitored in the Building 773-A Control Room. The building has limited standby power provided by the 776-A diesel generator.

1.13.2 Building 735-A Material Holdings

The Building 735-A contains only sources for analytical equipment. The sources were evaluated by the Pu VA. There are no *in-scope* materials located in the building.

Exhaust ventilation from facility radiohoods and radiobenches is provided by the main exhaust system which is routed through a two-stage HEPA filtration system to remove radioactive particulate, then monitored prior to release to the environment. The exhaust air streams from the gloveboxes and shielded cells go through single stage HEPA filtration systems, then are routed to the main exhaust system for an additional two stages of HEPA filtration prior to release.

1.15.2 Building 772-1F Material Holdings

The building contains HEU stored in locked lab modules or cabinets, and in the gloveboxes, radiobenches, and radiohoods. All the materials which are commingled with plutonium or other actinides were addressed in the Pu VA, therefore the building contains no *in-scope* materials.

1.15.3 Building 772-1F Partitioned Areas

The building was divided into three partitioned areas by the assessment team. The partitioned areas are: (1) the gloveboxes. (2) the lab modules and corridor, and (3) the radiohoods and radiobenches.

1.15.4 Significant Events and Activities

The building is expected to continue its analytical mission. There have been no significant events related to HEU Materials in Building 772-1F.

2.0 SUMMARY OF VULNERABILITIES BY FACILITY

2.1 Introduction

2.1.1 Scope and Objectives of Assessment

The Highly Enriched Uranium Environmental, Safety, and Health (ES&H) Vulnerability Assessment is being conducted by the DOE Office of Environment, Safety, and Health (DOE-EH) to evaluate the ES&H vulnerabilities arising from the Department's storage and handling of its holdings of highly enriched uranium (HEU). The assessment, which is being performed for all DOE sites with such holdings, will be documented in a final report to be submitted to the Secretary of Energy by August 30, 1996. This report on Savannah River Site (SRS) facilities and materials provides the results of a self-assessment for the purpose of identifying issues as potential vulnerabilities. The report provides data and analyses for the DOE-EH Working Group Assessment Team, which will make the final determination as to ES&H vulnerabilities at SRS.

The term "ES&H vulnerabilities" is defined for the purpose of this assessment to mean conditions that could lead to unnecessary or increased radiation exposure of workers and the public, and release of radioactive materials to the environment. The self-assessment identifies candidate or potential vulnerabilities and issues for consideration by the Working Group Assessment Team, and will serve as an information base for identifying corrective actions for the safe management of HEU materials. It will also establish a foundation for decision making regarding the safe management and disposition of DOE HEU.

The materials covered by the Vulnerability Assessment are defined as any uranium materials with greater than 20% by weight of the total uranium content of the ^{235}U isotope and any quantity of the ^{233}U isotope. The scope of the assessment covers any radioactive or hazardous materials in the same facility that are commingled (i.e., intermixed or in-grown) or co-located with the uranium materials. Examples of materials excluded from the scope of this assessment are assembled weapons components, waste, and materials previously addressed by the recently completed Spent Nuclear Fuel ES&H Vulnerability Study and the Plutonium Vulnerability Assessment. For SRS, the number of materials requiring assessment was significantly reduced by the categorical exemption from HEU VA if the materials was evaluated in a previous assessment.

2.1.2 Methodology Overview

The DOE-EH approach to conducting the Vulnerability Assessment is documented in the *DOE Highly Enriched Uranium Vulnerability Assessment Plan*. The Assessment Plan describes the objectives, scope, management responsibilities, implementation approach, deliverables, milestones, schedules and the methodology to assess ES&H vulnerabilities. Vulnerabilities are identified, analyzed, and documented in response to a format provided in the Assessment Plan. Additional guidance on the assessment of spent fuel was provided in a DOE memorandum titled *Simplifying Guidance for ES&H Vulnerability Assessment of HEU Containing Spent Fuel Not Previously Evaluated*, dated May 9, 1996

The vulnerability assessment process examines materials at risk, the packaging and barriers used to protect the materials, adverse conditions or events that could lead to containment or barrier failure, compensatory measures that can prevent or mitigate the effects of releases or exposures, and finally the impact or consequences on the worker, the public, and the environment. The methodology is a qualitative approach that relies on the experience and expertise of members of the Site Assessment Team (SAT) in making judgments regarding the likelihood and severity of containment or barrier failures, relevant historical experience, and the frequency of adverse events or conditions.

Table 2.1.4-2 SRS HEU Facilities Overview - EF&RFSP Facilities

Facility	Age (years)	Type of Facility	Status and Mission
321-M	>40	Standard metal frame structure with HEPA filtered exhaust	Not operating
K-Assembly Area	>40	Steel reinforced concrete structure	Storage of irradiated fuels, miscellaneous components and process residues
K-Reactor Disassembly Basin	>40	Steel reinforced concrete structure	Spent fuel storage
L-Reactor Disassembly Basin	>40	Steel reinforced concrete structure	Spent fuel storage
P-Reactor Disassembly Basin	>40	Steel reinforced concrete structure	Spent fuel storage
RBOF	<30	Standard metal frame structure with HEPA filtered exhaust	Spent fuel receipt and storage

Table 2.1.4-3 SRS HEU Facilities Overview - SRTC Facilities

Facility	Age (years)	Type of Facility	Status and Mission
773-A	>40	Hardened structure with HEPA and sand-filtered exhaust	Operating - Technical research laboratory
735-A	>40	Standard metal frame structure with negative-pressure ventilation	Operating - Radiological and Environmental Science Laboratory
772-F	>40	Hardened structure with HEPA-filtered exhaust	Limited Operation - Actinide isotopics and non-radiological environmental support
772-1F	<10	Standard structure with HEPA-filtered exhaust	Operating - Process control analytical laboratory

Table 2.1.5-1 HEU Material Forms Stored in SRS HEU Facilities

Facility	Metal	Metal Alloy	Oxides	Residues	Solutions	Fuel Assemblies	Holdup	Samples, Sources & Standards
FB-Line		X	X					
Building 235-F	X	X	X	X		X	X	X
Building 247-F							X	X
H-Canyon Facility					X	X	X	
HB-Line Facility								X
Building 321-M							X	X
K-Assembly Area				X		X		
K-Disassembly						X		
L-Disassembly						X		
P-Disassembly						X		
RBOF						X		
Building 773-A					X	X		X
Building 735-A								X
Building 772-F					X			X
Building 772-1F					X			X

2.2 FB-Line

FB-Line has HEU containing items stored in a vault. The items are uranium/plutonium compounds that were addressed in the Pu VA; and therefore are excluded from the scope of this assessment by the Assessment Plan. No additional vulnerabilities were determined which exceed the vulnerabilities described in the Pu VA. The assessment team did not proceed past Question 3 after this determination was made.

FB-Line has a material stabilization and interim storage mission. The stored materials will be processed per the *SRS Site Integrated Stabilization Management Plan, Rev. 3*, or relocated to a proposed new vault.

2.3 Building 235-F

Building 235-F is utilized to store various HEU containing materials and compounds. Generally, if an item contains HEU mixed with another actinide, it was covered by the Pu VA. There are HEU materials stored in 235-F which are within the scope of the HEU VA.

Certain materials stored in the Partitioned Area 1 (235-F vaults) may be packaged such that HEU is in direct contact with plastic bags or containers. The activity of the HEU may cause plastic materials to degrade creating by hydrogen gas which would cause a pressure buildup in the container. The pressure buildup may deteriorate the container integrity. While this configuration is not known to exist, the lack of sufficient packaging information makes this a suspect condition.

Vulnerability: The uncertainty of the packaging materials utilized in the shipping containers.

While there may be HEU in the other two partitioned areas, it is commingled with other actinides which were evaluated in the Pu VA. The current storage mission is expected to continue for an undetermined time. SRS is considering the construction of a new vault to which the Building 235-F inventory would be eventually relocated.

2.4 Building 247-F

Within Building 247-F there are two categories of HEU materials. The first category consists of sources and standards which do not pose any vulnerability to the public or environment. The other is holdup material which may be released by a design basis accident.

Vulnerability: Release of holdup material through a breach of the building structural integrity by a design basis accident.

There are no planned missions for Building 247-F. The building has an approved surveillance and maintenance plan which ensures that the building safety features are maintained in accordance with provided guidance. The building has been placed on the surplus facility list.

2.5 H-Canyon Facility

The H-Canyon Facility is storing HEU in various forms, both solid and solution. Both forms are scheduled to be converted to a solid oxide form which is better suited for long term storage. The facility incorporates a number of structural and administrative features which allow HEU to be safely managed for extended periods.

The long term storage of HEU solutions does present a vulnerability. The H-Canyon storage vessels are located both inside and outside the 221-H Building.

Vulnerability: Long term storage of uranyl nitrate solutions in the H-Canyon Facility.

SRS is currently authorized per the *SRS Site Integrated Stabilization Management Plan, Rev. 3*[3] to stabilize the uranyl nitrate solutions stored in the H-Canyon Facility by the end of FY-2000.

2.6 HB-Line Facility

The HB-Line Facility HEU inventory consists of sources stored in a safe. The facility assessment team determined that there were no vulnerabilities associated with the HEU materials stored in the facility.

2.7 Building 321-M

The building contains HEU in sources and standards retained after the building was deinventoried, and in holdup material. Only the holdup material in the ventilation system is considered to present a vulnerability.

Vulnerability: Release of holdup material in the process ventilation system ducts from loss of building structural integrity in a design basis accident.

Plans have been formulated to decontaminate or remove the exposed ventilation ducts. The corrective activities will be addressed during the F-1997 Annual Operating Plan process and, consistent with the site priorities and resource availability, consideration will be given to scheduling correction.

2.8 K-Reactor Assembly Area

The K-Reactor Assembly Area contains significant quantities of HEU, especially in the form of reactor fuel assemblies and assembly components. The assembly components consist of partially manufactured assemblies, raw materials, and compacted assemblies. Process

[3] See WSRC Document No. NMP-PLS-950068, titled *Integrated Stabilization Management Plan, Rev. 3*, dated October 10, 1995.

SITE: Savannah River Site	FACILITY (Building or Location) SRTC
	FUNCTION:

Question 1: SITE

DOE Headquarters Facility Landlord: EM-60
DOE Headquarters Program Sponsor: EM-60
Facility Age: 42
Design Life: 0

Location of Facility on Site and Distance to Site Boundary

Building 773-A is located 640 meters from the Site boundary. Building 773-A is located in the 3/700 Area of the Savannah River Site.

Design Mission, Interim Mission, Current Use

Building 773-A is subdivided into six sections on two levels, the main floor and the service floor. Executive offices occupy the second floor of Section A. Nineteen (in 1987) divisions share 265 offices in Building 773-A. Seven of these divisions occupy 91 laboratories where research and development activities are conducted and the accompanying analytical laboratories in 1987 is described in the following text. The description of this work has been used to define the operating envelope for the nature of the tasks that are expected to be performed in these laboratories in the future. Generic development work including the chemistry of actinide compounds can be expected to be performed in any of these laboratories as needs dictate and shifting of experimental tasks between laboratories. The description of 1987 activities is expected to bound the risk for future undefined activities.

The 773-A Main Technical Laboratory provides a myriad of analytical and developmental initiatives which support the Savannah River Site as well as the other DOE Complexes. It is also involved in Technology Transfer with the public sector and universities. Some of the programmatic initiatives include technology development and analytical support for Defense Waste Processing, Hydride Programs, Transuranics, Waste Management, Environmental Preservation and Restoration.

Operational Status

Operating

Historical Information

From the inception of the Site Item Reportability and Issue Management (SIRIM) program in January 1991 to April 1995, there have been 494 abnormal occurrences at the SRTC Technical Area. Of these, only one has been determined to be significant. Occurrence Report SR-WSRC-LTA-1993-0072 documents a personnel injury that occurred during preventive maintenance activities on an Automatic Transfer Switch. The employee was taken to the hospital and admitted for observation and testing. This occurrence was determined to be potentially significant since it could have resulted in a fatality. Abnormal occurrences from the founding of the SRTC Technical Area until approximately 1983 are summarized in Appendix I of the SRTC SAR, WSRC-SA-2-Vol. 1, September 1993. The period between 1983 and 1991 was analyzed by reviewing the SRTC Incident Database for any significant occurrences. None of the incidents in the database met the current criteria for a significant occurrence.

List Authorization Basis

WSRC-SA-2, Vols. 1-4, Savannah River Laboratory Technical Area Safety Analysis (U), September 1993

WSRC-PR-904, SRTC Technical Area, Operational Safety Requirements, 1993

Basis for Interim Operations (BIO), 1993

Building 773-A, Hazards Assessment, WSRC-TR-93-548

Fiori, M. P. to Schwallie, A. L., "Department of Energy-Savannah River Operations Office (DOE-SR) Approval Draft, Safety Analysis Report, Savannah River Technology Center (SRTC)-Technical Area (Your letter to P. M. Hekman,

September 30, 1992)." U. S. Department of Energy, Savannah River Operations Office, Aiken, SC, July 7, 1993.

Describe Important or Unique Design Features

Building 773-A safety features include: air sampling and stack monitoring, nuclear incident alarms, a fire protection and detection system (which reports to the 773-A Control Room and the Fire Department), and standby diesel generators. The facility has a number of separate exhaust systems providing ventilation and confinement for process areas. All 773-A process ventilation exhausts through high efficiency particulate air (HEPA) filters, and most of the exhaust is filtered through a sand filter. The Shielded Cells and Intermediate Level Cells facilities provide the shielding and confinement necessary for examination, analysis, and testing of highly radioactive materials.

Describe Weaknesses in the Design Basis

The existing safety analysis documentation does not adequately address the full range of seismic events and their impact on the facility. Only a design basis earthquake of 0.2g has been analyzed.

Structural Design

Concrete/slab

Partitioned Areas of HEU within facility

(A) Type 1 Exhaust Path
(B) Type 4 Exhaust Path
(C) Type 5 Exhaust Path
(D) Type 6 Exhaust Path
(E) Unmitigated Exhaust Path
(E) Unmitigated Exhaust Path

Description of Partitioned Areas

The Safety Analysis Report (SAR) analyzes the risks to on-site and off-site populations due to process related accidents and due to natural phenomenological hazards. Mitigation of the process related accidents is credited based on the filtration available in the various gloveboxes, hoods, rooms, etc. The SAR defines 6 different exhaust path types depending upon the number of HEPA filters, whether or not the HEPAs are verifiable, whether the sand filter is in the exhaust path, and whether or not exhaust is diverted to the sand filter. Based on the analyzed accident scenarios, only 4 of the 6 exhaust paths are utilized to mitigate process related accident releases; therefore, these are chosen as aggregate areas. The natural phenomenological analysis assumes that all releases as a result of earthquake, tornadoes, etc. are released at ground level with no filtration. Therefore, this is chosen as the last aggregate area. The laboratories, cells, rooms, etc. involved in the process related accidents are categorized into the aggregate are appropriate to the exhaust path type available to mitigate the release, and all remaining laboratories, cells, rooms, etc. are categorized into the unmitigated exhaust path aggregate area.

(A) Type 1 Exhaust Path

Releases from these areas are filtered by two verifiable (testable) HEPA filters, and the sand filter. The HEPA filters are assumed to have a degraded penetration factor of 0.1. Multiple stages of HEPA filtration that can only be tested as a series pair are credited as a single stage of filtration. Room, laboratories, cells, etc. are categorized in this aggregation area if the majority of releases (> 99%) from associated process-related accidents follow this exhaust path. Specifically, those areas aggregated under area 1 with credible process related accidents based on current operation include: Cell 1, Cell 2, Cell 4, Cell 5, Cell 6, Cell 9, Cell 10, Cell 11, Cell 12, Cell 15, Cell 16, and the shielded cell general area.

(B) Type 4 Exhaust Path

Releases from these areas are filtered by one verifiable (testable) HEPA filter, and the sand filter. The HEPA filter is assumed to have a degraded penetration factor of 0.1. Multiple stages of HEPA filtration that can only be tested as a series pair are credited as a single stage of filtration. Room, laboratories, cells, etc. are categorized in this

aggregation area if the majority of releases (> 99%) from associated process-related accidents follow this exhaust path. Specifically, those areas aggregated under area 2 with credible process related accidents based on current operation include: Rooms B-115, B-155, C-075, C-077, C-079, C-155, C-159, and C-163.

(C) Type 5 Exhaust Path
Releases from these areas are filtered by one non-verifiable HEPA filter (filter that cannot be visually inspected) and the sand filter. The HEPA filter is assumed to have a degraded penetration factor of 1.0. Multiple stages of HEPA filtration that can only be tested as a series pair are credited as a single stage of filtration. Room, laboratories, cells, etc. are categorized in this aggregation area if the majority of releases (> 99%) from associated process-related accidents follow this exhaust path. Specifically, those areas aggregated under area 3 with credible process related accidents based on current operation include: Room F-054, and Section F cask handling.

(D) Type 6 Exhaust Path
Releases from this exhaust path are filtered by one verifiable HEPA filter (filter that can be visually inspected). These releases (once filtered by the HEPA filter) do not contain sufficient radioactivity to actuate automatic diversion to the sand filter. The HEPA filter is assumed to have a degraded penetration factor of 0.1. Multiple stages of HEPA filtration that can only be tested as series pair are credited as a single stage of filtration. Room, laboratories, cells, etc. are categorized in this aggregation area if the majority of releases (> 99%) from associated process-related accidents follow this exhaust path. Specifically, those areas aggregated under area 4 with credible process related accidents based on current operation include: Rooms B-114, B-115, B-126, B-127, B-130, B-131, B-138, B-150, B-159, B-162, B-163, C-075, C-077, C-079, C-143, C-147, C-159, C-163, and waste containers in general 773 in RCAs.

(E) Unmitigated Exhaust Path
Releases from these areas are not filtered. Confinement barriers are the structural integrity of the shielded cells, intermediate level cells, sealed sources, and casks. This type of exhaust path is the result of damage due to *natural* phenomenological hazards such as earthquake, or earthquake followed by fire. The materials that are released during these accident scenarios are released at ground level. This aggregate area includes all rooms, laboratories, cells, etc. not covered by aggregate areas 1-4.

Amount & Location of Hazardous Material Collocated or Commingled with HEU
cals in the Technical Area were screened as referenced in S-EHA-A-00001, Interim Emergency Preparedness Hazards Assessment for the SRTC TA. Lab modules typically maintain 500 ml to 2.5 L containers of laboratory reagents. These same lab modules may contain quantities of HEU. Primary containers may be glass or plastic bottles and they are stored in their original packaging from the vendor. They are set inside acid resistant tubs or metal trays. Chemical packages or containers are set inside single wall chemical cabinets. Bulk storage of laboratory reagents occurs in small quantity containers in Chemical Stores, located on the main floor of 773-A, placed in tubs on acid resistant trays on iron-framed racks or on the concrete floor. Chemical Stores does not maintain any nuclear material inventory of HEU. Chemical Stores contains those chemicals identified as meeting the hazard screening criteria and worst-case scenario quantities for accident analysis within Building 773-A and are shown below:

Ammonium Hydroxide - 191.0 lbs
70% Nitric Acid - 10,596.8 lbs
90% Nitric Acid - 804.1 lbs
Hydrochloric Acid. - 5,390.1 lbsChemi

Process Material Transfers
All radioactive samples are received in the 773-A E Section truck dock. An Interdepartmental Transfer Request

accompanies the transfer. These samples are transported (via DOT approved five gallon shipping container with lid attached) to their intended destination per approved routes (L1 2.03). An Interdepartmental Transfer Request form accompanies the transfer. Verification of the quantity, of the type of material, or its destination, and of the total quantity allowed in the location is performed. The fissile material is received into a criticality working zone and each zone has a fissile material limit which cannot be exceeded. The transfer of material from one zone to another zone requires supervisor approval and verification that the transfer from the current location to another location will not exceed the mass limit.

On-Site Transportation

Radioactive samples including Enriched Uranium are transported from various Savannah River Site areas to building 773-A E Section truck dock via an approved "Restricted Radiological Use Only" vehicle per manual 5Q1.1-501. These samples are likewise returned to their point of origination. These samples are packaged and transferred according to WSRC 19Q, "Site Transportation Safety Manual".

Staff Levels & Experience

Minimum staffing levels are specified in the SRTC Operational Safety Requirements (WSRC-RP-92-904) in the Administrative Controls section. These levels consist of an Operations First Line Supervisor, three operators, and a Radiological Control inspector. The average experience of the operators is approximately 12 years. Supporting the operations group are engineering (averaging 7 years site experience), procedures (averaging 15 years site experience), and material accountability (averaging 20 years site experience). The Research staff consists of various science disciplines with the greatest portion of the professional staff at the PhD level. Additionally, technicians who support the research effort average 14 years site experience.

Applicable References

5Q1 1.1-501 Radiological Control and Health Physics Department Radiation and Contamination Control Procedures

WSRC 190: Site Transportation Safety Manual

WSRC-SA-2-Vol. 1, September 1993. Safety Analysis--Savannah River Laboratory Technical Area (U), Chapters 1-8

SR-WSRC-LTA-1993-0072, Occurrence Report

L1, 2.18, Movement and Inventory Control of Radioisotopes (U)

L1, 2.03, Receipt and Shipment of Radioactive Samples at the 773-A E-Wing Truck Dock (U)

S-EHA-A-00001, Rev. 0, Interim Emergency Preparedness Hazards Assessment for the Savannah River Technology Center Technical Area

WSRC-RP-92-904, SRTC Technical Area Operational Safety Requirements, September 1993

SITE: Savannah River Site

FACILITY (Building or Location): SRTC

PARTITIONED AREA: (A) Type 1 Exhaust Path

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]

- [ ] Gloveboxes
- [ ] Transfer System
- [Y] Duct
- [Y] Filter
- [ ] Vault
- [Y] Room
- [Y] Hot Cell/Canyon
- [ ] Hood
- [ ] Piping
- [ ] Shielding
- [ ] Distance
- [ ] Respiratory Protection
- [ ] Protective Clothing
- [Y] Remote Handling
- [Y] Confinement System
- [ ] Burial Ground
- [ ] Tanks
- [ ] Alarm System
- [ ] Temporary Barriers
- [ ] Other-specify

Waste Burial Box

- [N] None

Public/Environmental Barrier [2]

- [Y] Facility/Building Boundary
- [Y] HVAC/Confinement
- [ ] Liquid Containment/Dike
- [ ] Bay, Cells, Magazines
- [ ] Canyons
- [ ] Pads
- [Y] Site Boundary
- [ ] Trenches
- [ ] Storage Vault
- [ ] Alarm System
- [ ] Fire Suppression
- [ ] Other - Specify

Criticality [1,2]

- [ ] Double Contingency Applied
- [Y] Double Contingency Not Applied (specify)

(e.g., Mass
Absorbers
Geometry
Interaction
Concentration
Moderation
Enrichment
Reflection
Volume)

Administrative Barrier [3]

- [Y] Procedure: Operation, Maint.
- [Y] Material Limts
- [ ] Monitoring
- [Y] Configuration Control
- [Y] Quality Assurance
- [Y] Conduct of Operations
- [Y] Authorization Basis
- [Y] Training
- [Y] Organization
- [Y] Lessons-Learned
- [ ] Testing
- [ ] Trending
- [Y] Records
- [ ] Standards
- [Y] External Regulation
- [Y] Surveillance
- [ ] Personnel Reliablity Assurance Program
- [Y] Worker/Access Occupancy Limits
- [Y] Emgergency Response
- [ ] Other-specify

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): SRTC
	PARTITIONED AREA: (A) Type 1 Exhaust Path

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Duct - HVAC ductwork transports radionuclides from the process and/or rom to filters, and to an exhaust stack, thereby providing a barrier to the worker.
Filter - Releases are transported by the HVAC from the process and/or room through two HEPA filters and the sand filter, thereby providing a barrier to the worker.
Room - Releases to the laboratory room are discharged from the room exhaust, thereby protecting workers outside the room.
Hot Cell - Section E cells have 3-ft thick shielding walls with 3-ft thick leaded viewing glass, and the intermediate level cells have 15-in thick shielding walls with 15-in thick leaded viewing glass. Process exhaust is filtered by the HVAC system. Shielding, HVAC, and the remote operations associated with cells provide a physical barrier to the worker.
Confinement - Confinement is provided in the rooms, gloveboxes, cells, etc., by negative pressure maintained by the HVAC system.
Remote Handling - Remote handling in gloveboxes and cells provide a barrier to worker exposure.
Waste Burial Box - If the radionuclide material is located in a waste burial box, the box provides a physical barrier preventing direct worker contact with the material.

Public/Environment Barrier Narrative:

Facility - the facility structure prevents the dispersal of materials, thereby providing a physical barrier to the environment and public. The facility HVAC and exhaust stacks disperse releases, thereby reducing exposures/contaminatino to co-located workers as well as the environment and public.
HVAC - HVAC filters the releases by two HEPA filters and a sand filter, thereby providing a barrier to the environment and the public.
Site - Distance from the release point to the site boundary (0.6) allows for material dispersion thereby reducing exposure/contamination to the environment and the public.

Criticality Barrier Narrative:

Protection in SRTC is provided by a system of multiple (at least two) controls on a single parameter. No single failure shall result in the potential for a criticality accident. Multiple controls at SRTC that assure single parameter mass limits are not exceeded include:

-Establishing mass control limits for each Mass Control Zone,
-Maintaining a running laboratory inventory of fissionable material within a Laboratory Module; an SRTC MC&A fissile inventory and an inventory by the Sectional Nuclear Material Inventory Coordinator are maintained as cross checks,
-Controlling movement of fissile material.

These controls are reviewed and implemented by multiple personnel (Section Nuclear Material Custodians and Coordinators, SRTC CRC/ARC, Criticality Control Representative, SRTC MC&A personnel, and Laboratory Module Custodians).

Administrative Barrier Narrative:

Procedure: Operation and Maintenance - Operation and Maintenace procedures are in place to support facility requirements associated with handling and storing HEU. Laboratory Services Operations and Maintenance procedures are located within 773-A and can be accessed by all personnel. R&D personnel use procedures for sampling receipt, handling and disposal.
Material Limits - materials limits are in place to support the off-site dose consequence. This information is located in Procedure L1. 2.18, Movement and Control of Radioisotopes.
Configuration Control - Procedures are written such that components are labeled consistent with the facility configuration. System design descriptions have been completed for all Safety Class and Safety Significant systems.
Quality Assurance - A Quality Assurance Program has been established to provide methods, practices and requirements to ensure quality is encompassed throughout the daily operations.
Conduct of Operations - Operations are managed and conducted in accordance with the 2S Manual, WSRC Conduct of Operations.
Authorization Basis - SRTC Authorization Basis documents include WSRC-SA-2-Vols. 1-4, Safety Analysis-Savannah River Laboratory Technical Area (U); OSR WSRC-RP-92-904, Operational Safety Requirements, September 1993; Fiori, M. P. to Schwallie, A. L. "Department of Energy-Savannah River Operations Office (DOE-SR) Approval Draft, Safety Analysis Report, Savannah River Technology Center (SRTC) - Technical Area (Your letter to P. M. Hekman, September 30, 1992)." U. S. Department of Energy, Savannah River Operations Office, Aiken, SC, July 7, 1993; SRT-TML-93-0241, Inter-office Memorandum, R. C. Edwards to C. G. Hardin, Inventory Limits for Nuclear Materials in 773-A; SRT-USQ-92-0001, Rev. 1, USQ Screen and Evaluation of the SED Trap Characterization Activity; WSRC-RP-92-904, SRTC Technical Area Operational Safety Requirements, 3/4.1 Criticality Prevention, 3.1.2, Separation Equipment Development (SED) Trap and Pump Removal and Storage; WSRC-TR-93-584, Hazards Assessment Document, 773-A.
Training - Training program descriptions exist that outline the training programs for operations, maintenance, and engineering. These training program descriptions are maintained by the training department in 766-H.
Organization - Various research departments provide support to the site and offsite initiatives. An operations group operates and maintains the facility and safety systems. Operations support groups assist operations with procedure, engineering and material accountability.
Lessons Learned - The WSRC Lessons Learned program provides widespread distribution of lessons learned through investigations of abnormal

SITE: Savannah River Site	FACILITY (Building or Location): SRTC
	PARTITIONED AREA: (A) Type 1 Exhaust Path

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

occurrences, both on site and external industries.
Records- Operation records (i.e. completed procedures, work packages, procedure history files, OSR surveillances) are maintained as specified in the LSS Records Management procedure AD-00-003.
External Regulation - WSRC's policy is that SRS (including SRTC) operations shall not adversely affect the environment or nearby population. This policy is implemented by conducting operations in compliance with requirements of DOE, the EPA, and SCDHEC, and by exceeding the requirements where feasible so as to have insignificant or negligible offsite effects. The SRTC ALARA and Environmental Section maintains close contact with the site Environmental Protection Department for both guidance and regulatory updates.
Surveillance - Surveilliances of Operational Safety Equipment are conducted monthly, quarterly, and annually by Laboratory Operations.
Worker Access/Occupancy Limits - Laboratory modules and shielded cells in which EU is handled and stored are locked and access is limited to employees who have a need to work or remove materials from the locations. Access lists are maintained by the location custodian.
Emergency Response - The SRTC Emergency Preparedness Program is designed to establish planning, procedures, and training programs to effectively prepare, manage, and respond to emergencies and incidents affecting the health and safety of SRTC Technical Area Employees, the public, and environment in support of WSRC Procedure Manual 6Q (Ref.40). Manual 6Q Annex I and facility implementing procedures are in place based on the current SAR.

SITE: Savannah River Site

FACILITY (Building or Location): SRTC

PARTITIONED AREA: (C) Type 5 Exhaust Path

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[Y] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[Y] Organization
[ ] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[Y] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[Y] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[ ] Alarm System			[Y] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emgergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

arriers between HEU and worker.
arriers between HEU and public/environment.
ıcludes management controls. Temporary administrative requirements are included in Question 6
compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): SRTC
	PARTITIONED AREA: (C) Type 5 Exhaust Path

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Duct - HVAC ductwork transports radionuclides from the process and/or room to filters, and to an exhaust stack, thereby providing a barrier to the worker.
Filter - Dependent upon location and quantity (radioactivity) of radionuclide release, releases are transported by the HVAC from the process and/or room through at least one HEPA filter, and up to two HEPA filters and the sand filter, thereby providing a barrier to the worker.
Room - Releases to the laboratory room are discharged from the room exhaust, thereby protecting workers outside the room.
Confinement - Confinement is provided in the rooms, gloveboxes, cells, etc. by negative pressure maintained by the HVAC system.

Public/Environment Barrier Narrative:

Facility Boundary - The facility structure prevents the dispersal of materials, thereby providing a physical barrier to the environment and public. The facility HVAC and exhaust stacks disperse releases, thereby reducing exposures/contamination to co-located workers as well as the environment and public.
HVAC - HVAC filters the releases by at least one HEPA filter, and up to two HEPA filters and a sand filter, thereby providing a barrier to the environment and the public.
Site Boundary - Distance from the release point to the site boundary (0.6 mile) allows for material dispersion thereby reducing exposure/contamination to the environment and the public.

Criticality Barrier Narrative:

Protection in SRTC is provided by a system of multiple (at least two) controls on a single parameter. No single failure shall result in the potential for a criticality accident. Multiple controls at SRTC that assure single parameter mass limits are not exceeded include:

-Establishing mass control limits for each Mass Control Zone.
-Maintaining a running laboratory inventory of fissionable material within a Laboratory Module; an SRTC MC&A fissile inventory and an inventory by the Sectional Nuclear Material Inventory Coordinator are maintained as cross checks.
-Controlling movement of fissile material.

These controls are reviewed and implemented by multiple personnel (Section Nuclear Material Custodians and Coordinators, SRTC CRC/ARC, Criticality Control Representative, SRTC MC&A personnel, and Laboratory Module Custodians)

Administrative Barrier Narrative:

Procedure: Operation and Maintenance - Operation and Maintenace procedures are in place to support facility requirements associated with handling and storing HEU. Laboratory Services Operations and Maintenance procedures are located within 773-A and can be accessed by all personnel. R&D personnel use procedures for sampling receipt, handling and disposal.
Material Limits - materials limits are in place to support the off-site dose consequence. This information is located in Procedure L1. 2.18, Movement and Control of Radioisotopes.
Configuration Control - Procedures are written such that components are labeled consistent with the facility configuration. System design descriptions have been completed for all Safety Class and Safety Significant systems.
Quality Assurance - A Quality Assurance Program has been established to provide methods, practices and requirements to ensure quality is encompassed throughout the daily operations.
Conduct of Operations - Operations are managed and conducted in accordance with the 2S Manual, WSRC Conduct of Operations.
Authorization Basis - SRTC Authorization Basis documents include WSRC-SA-2-Vols. 1-4, Safety Analysis-Savannah River Laboratory Technical Area (U); OSR WSRC-RP-92-904, Operational Safety Requirements, September 1993; Fiori, M. P. to Schwallie, A. L. "Department of Energy-Savannah River Operations Office (DOE-SR) Approval Draft, Safety Analysis Report, Savannah River Technology Center (SRTC) - Technical Area (Your letter to P. M. Hekman, September 30, 1992)." U. S. Department of Energy, Savannah River Operations Office, Aiken, SC, July 7, 1993; SRT-TML-93-0241, Inter-office Memorandum, R. C. Edwards to C. G. Hardin, Inventory Limits for Nuclear Materials in 773-A; SRT-USQ-92-0001, Rev. 1, USQ Screen and Evaluation of the SED Trap Characterization Activity; WSRC-RP-92-904, SRTC Technical Area Operational Safety Requirements, 3/4.1 Criticality Prevention, 3.1.2, Separation Equipment Development (SED) Trap and Pump Removal and Storage; WSRC-TR-93-584, Hazards Assessment Document, 773-A.
Training - Training program descriptions exist that outline the training programs for operations, maintenance, and engineering. These training program descriptions are maintained by the training department in 766-H.
Organization - Various research departments provide support to the site and offsite initiatives. An operations group operates and maintains the facility and safety systems. Operations support groups assist operations with procedure, engineering and material accountability.
Lessons Learned - The WSRC Lessons Learned program provides widespread distribution of lessons learned through investigations of abnormal occurrences, both on site and external industries.
Records- Operation records (i.e. completed procedures, work packages, procedure history files, OSR surveillances) are maintained as specified in the LSS Records Management procedure AD-00-003.
External Regulation - WSRC's policy is that SRS (including SRTC) operations shall not adversely affect the environment or nearby population. This

SITE: Savannah River Site	FACILITY (Building or Location): SRTC
	PARTITIONED AREA: (C) Type 5 Exhaust Path

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

policy is implemented by conducting operations in compliance with requirements of DOE, the EPA, and SCDHEC, and by exceeding the requirements where feasible so as to have insignificant or negligible offsite effects. The SRTC ALARA and Environmental Section maintains close contact with the site Environmental Protection Department for both guidance and requlatory updates.

Surveillance - Surveilliances of Operational Safety Equipment are conducted monthly, quarterly, and annually by Laboratory Operations.

Worker Access/Occupancy Limits - Laboratory modules and shielded cells in which EU is handled and stored are locked and access is limited to employees who have a need to work or remove materials from the locations. Access lists are maintained by the location custodian.

Emergency Response - The SRTC Emergency Preparedness Program is designed to establish planning, procedures, and training programs to effectively prepare, manage, and respond to emergencies and incidents affecting the health and safety of SRTC Technical Area Employees, the public, and environment in support of WSRC Procedure Manual 6Q (Ref.40). Manual 6Q Annex I and facility implementing procedures are in place based on the current SAR.

SITE: Savannah River Site

FACILITY (Building or Location): SRTC

PARTITIONED AREA: (D) Type 6 Exhaust Path

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[Y] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limits
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[Y] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[Y] Organization
[ ] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[Y] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[Y] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[Y] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[ ] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

Path

SITE: Savannah River Site

FACILITY (Building or Location): SRTC

PARTITIONED AREA: (E) Unmitigated Exhaust Path

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[ ] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limts
[ ] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[Y] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[Y] Organization
[ ] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[Y] Records
[ ] Remote Handling			[Y] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[ ] Alarm System			[Y] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[ ] Emgergency Response
[ ] Other-specify Sealed Sources & Casks			[ ] Other-specify
[N] None			

Barriers between HEU and worker.
Barriers between HEU and public/environment.
Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location)
	PARTITIONED AREA: (E) Unmi

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Access/Occupancy Limits - Laboratory modules and shielded cells in which EU is handled and stored are employees who have a need to work or remove materials from the locations. Access lists are maintained by the l Emergency Response - The SRTC Emergency Preparedness Program is designed to establish planning, procedu effectively prepare, manage, and respond to emergencies and incidents affecting the health and safety of SRTC Te and environment in support of WSRC Procedure Manual 6Q (Ref.40). Manual 6Q Annex I and facility implementin current SAR.

SITE: Savannah River Site	FACILITY (Building or Location) SRTC
	PARTITIONED AREA: (E) Unmitigated Exhaust

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
						0	

Cumulative Inventory Differences

0.0

Packaging Description

Material at Risk Description

SITE: Savannan River Site	FACILITY (Building or Location) SRTC
	PARTITIONED AREA: (A) Type 1 Exhaust Path

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Slightly irradiated	C0, , C0.,	Process Area	1-10 y	4	0.00

Cumulative Inventory Differences

0.0

Partitioned Area

1

Packaging Description

Material is packaged in P-cans and stored in dry storage in the Shielded Cells.

Material at Risk Description

Four irradiated fuel element pieces packaged in p-cans and stored in dry storage within the shielded cells.

SITE: Savannah River Site

FACILITY (Building or Location) SRTC

PARTITIONED AREA: (B) Type 4 Exhaust Path

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	U-233<10 ppm	Other	. . . P0. . P0.	Process Area	1 -10	1	0.00

Cumulative Inventory Differences

0.0

Partitioned Area

1

ackaging Description

olyethylene bottle in hood.

laterial at Risk Description

mall quanitity of HEU in polyethylene bottle, less than 10 ppm U233. Material is in ellet form. .001 KGs of material.

ust Path

0.0

SITE: Savannah River Site	FACILITY (Building or Location) SRTC
	PARTITIONED AREA: (D) Type 6 Exhaust Path

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Solutions	Enriched	Nitric acid	, P1,	Process Area	1-10	1	0.00

Cumulative Inventory Differences

0.0

Partitioned Area

1

Packaging Description

Polyethylene bottles in hood. Quantity of material is 0.007 KGs.

Material at Risk Description

Material does not pose a risk--there is less than 7 grams of material in solution stored in a hood.

SITE: Savannah River Site	FACILITY (Building or Location) SRTC
	PARTITIONED AREA: (D) Type 6 Exhaust Path

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other	, P2, , P2, , V5,	Process Area	1-10	9	0.00

Cumulative Inventory Differences

0.0

Partitioned Area

1

Packaging Description

Polyethylene bottles and glass vials in hood. Total of material is .0096 KGs.

Material at Risk Description

HEU is in glass vials and polyethylene bottles. Material is small quantities, used for standards in laboratory work. Material is stored inside Mosler safe within lab module.

SITE: Savannah River Site	FACILITY (Building or Location)
	PARTITIONED AREA: (E) Unmitigated Exhaust

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
						0	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Material at Risk Description

SITE: Savannan River Site	FACILITY (Building or Location) RTC 735-A
	FUNCTION:

Question 1: SITE

DOE Headquarters Facility Landlord: EM60
DOE Headquarters Program Sponsor: EM60
Facility Age: 42

Design Life: 0

Location of Facility on Site and Distance to Site Boundary

Building 735-A is located 640 meters from the Site boundary. Building 735-A is located in the 3/700 Area of the Savannah River Site.

Design Mission, Interim Mission, Current Use

Building 735-A, known to some as the Radiological and Environmental Science Laboratory, is home to the site's environmental surveillance and personnel monitoring programs. In addition, support of emergency response capabilities and collaborative environmental research with other scientists are rendered here.

Building 735-A is basically used by three groups: the HP Department's Environmental Monitoring Group (EMG), Dosimetry and Personnel Monitoring Group, and the Environmental Technology Section's Environmental Radiometrics Group. The EMG operates a Sample Receiving Area and several labs. Samples (air, water, vegetation, food, fish, and wildlife) are collected from the site and an area of over 1,200 sq. miles around the site and brought back for analysis. The Dosimetry and Personnel Monitoring Group operates several labs. The group collects and analyzes over 80,000 bioassay samples each year for traces of transuranic isotopes, fission products, tritium, and nonradioactive contaminants (as part of the industrial hygiene program). The Environmental Radiometrics Group operates several labs in which R & D of radiometric techniques, instrumentation, and facilities are conducted in support of environmental monitoring. This group also monitors tritium releases from operating facilities and uses data collected at an off-site location to assist in the determination of the dose to off-site population and for atmospheric transport model validation. The group operates an Ultra-Low Level Counting Facility and an Underground Counting Facility.

There is a Classified Document Storage Vault on the service floor operated by the ETS Group.

Operational Status

Operating

Historical Information

735-A is located within the SRTC Technical Area. From the inception of the Site Item Reportability and Issue Management (SIRIM) program in January 1991 to April 1995, there have been 494 abnormal occurrences at the SRTC Technical Area. Of these, only one has been determined to be significant. Occurrence Report SR-WSRC-LTA-1993-0072 documents a personnel injury that occurred during preventive maintenance activities on an Automatic Transfer Switch. The employee was taken to the hospital and admitted for observation and testing. This occurrence was determined to be potentially significant since it could have resulted in a fatality. Abnormal occurrences from the founding of the SRTC Technical Area until approximately 1983 are summarized in Appendix I of the SRTC SAR, WSRC-SA-2-Vol. 1, September 1993. The period between 1983 and 1991 was analyzed by reviewing the SRTC Incident Database for any significant occurrences. None of the incidents in the database met the current criteria for a significant occurrence.

List Authorization Basis

WSRC-SA-2, Vols. 1-4, Savannah River Laboratory Technical Area Safety Analysis (U), September 1993

WSRC-PR-904, SRTC Technical Area, Operational Safety Requirements, 1993

Basis for Interim Operations (BIO), 1993

Building 773-A, Hazards Assessment, WSRC-TR-93-550

Fiori, M. P. to Schwallie, A. L., "Department of Energy-Savannah River Operations Office (DOE-SR) Approval Draft, Safety Analysis Report, Savannah River Technology Center (SRTC)-Technical Area (Your letter to P. M. Hekman, September 30, 1992)." U. S. Department of Energy, Savannah River Operations Office, Aiken, SC, July 7, 1993.

Describe Important or Unique Design Features

735-A laboratories A146, A147, A148, A149, A150, and A151 have their hood exhaust HEPA filtered. The facility has fire protection and detection system which reports to the 773-A Control Room and the Fire Department. The facility also has limited standby power served by the 776-A diesel generator.

Describe Weaknesses in the Design Basis

The existing safety analysis documentation does not adequately address the full range of seismic events and their impact on the facility. Only a design basis eaerhquake of 0.2g has been analyzed.

Structural Design

Concrete/slab

Partitioned Areas of HEU within facility

Building 735-A

Description of Partitioned Areas

Aggregate Area 1 is Building 735-A and contains small amounts of radioactive material used in environmental analysis.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

Chemicals in the Technical Area were screened as referenced in S-EHA-A-00001, Interim Emergency Preparedness Hazards Assessment for the SRTC TA. Lab modules typically maintain 500 ml to 2.5 L containers of laboratory reagents. These same lab modules may contain quantities of HEU. Primary containers may be glass or plastic bottles and they are stored in their original packaging from the vendor. They are set inside acid resistant tubs or metal trays. Chemical packages or containers are set inside single wall chemical cabinets. Those chemicals identified as meeting the hazard screening criteria and worst-case scenario quantities for accident analysis within Building 735-A and are shown below:

Ammonium Hydroxide - 22.0 lbs
70% Nitric Acid - 1,084.0 lbs
Carbon Disulfide - 35.2 lbs

Process Material Transfers

An Interdepartmental Transfer Request accompanies material transfers. These samples are transported (via DOT approved five gallon shipping container with lid attached) to their intended destination. Verification of the quantity, of the type of material, or its destination, and of the total quantity allowed in the location is performed. The fissile material is received into a criticality working zone and each zone has a fissile material limit which cannot be

SITE: Savannah River Site	FACILITY (Building or Location): SRTC 735-A
	PARTITIONED AREA: Building 735-A

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

where feasible so as to have insignificant or negligible offsite effects. The SRTC ALARA and Environmental Section maintains close contact with the site Environmental Protection Department for both guidance and requlatory updates.
Surveillance - Surveilliances of Operational Safety Equipment are conducted monthly, quarterly, and annually by Laboratory Operations.
Worker Access/Occupancy Limits - Laboratory modules and shielded cells in which EU is handled and stored are locked and access is limited to employees who have a need to work or remove materials from the locations. Access lists are maintained by the location custodian.
Emergency Response - The SRTC Emergency Preparedness Program is designed to establish planning, procedures, and training programs to effectively prepare, manage, and respond to emergencies and incidents affecting the health and safety of SRTC Technical Area Employees, the public, and environment in support of WSRC Procedure Manual 6Q (Ref.40). Manual 6Q Annex I and facility implementing procedures are in place based on the current SAR.

SITE: S

Describ

Worke
Duct - H
Filter - L
Room -
barrier.
Confine

Public
Facility
facility
public.
Room
enviror
Site bc
the en

Critic
Protec
critical

-Esti
-Mai
Moc
Mat
-Cor

These
Critica

Adm
Proce
storinç
persor
Materi
Contrc
Config
have b
Quality
encorr
Condu
Autho
(U); O
River
P. M.
Inter-
Evalu
Preve
Docu
Train
desc
Orga
safet
Less
occu
Rec
LSS
Exte
poli

FACILITY (Building or Location) SRTC 735-A

PARTITIONED AREA: Building 735-A

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Max (Kg)
Sources and Samples	Enriched	Other		Process Area	1-10	1	

Cumulative Inventory Differences

0.0

Partitioned Area

1

Packaging Description

Plastic bottle in cabinet. 0.003 KGs of material.

Material at Risk Description

Material contained in a plastic bottle in a cabinet. It does not present a risk to the environment. Material is used for calibration of laboratory instruments.

SITE: Savannah River Site	FACILITY (Building or Location) CLAB 772-F
	FUNCTION:

Question 1: SITE

DOE Headquarters Facility Landlord: D. F. Knuth/P. Cowan
DOE Headquarters Program Sponsor: DP-60/EM-30 **Design Life:** 52
Facility Age: 42

Location of Facility on Site and Distance to Site Boundary

Building 772-F is located immediately west of the 221-F canyon and directly south of Building 772-1F in F-Area, and is approximately 6 miles from the nearest site boundary.

Design Mission, Interim Mission, Current Use

Building 772-F was designed to provide analytical laboratories required to support process control and product specification analyses for 200-F and 200-H separations production programs. Processes supported included all phases of production, from both hot and warm canyon operations to final product production in the B-line facilities. In later years, analytical support was extended to the Reactor areas' basins and Waste Management's tank farms. In late 1988, the facility confinement exhaust stack released low levels of radioactive contamination to the surrounding grounds. This led to reduction of facility air flows and near elimination of analytical activity. A line item project to add a post-filtration facility to the Building 772-F exhaust system has already been completed and started up a new HEPA filtration/fan house (Building 772-4F) that has resolved the original stack release problem. The facility is currently in a restricted operational mode pending completion of resumption activities expected for mid 1996.

Building 772-F will assume responsibility for missions which will include the DNFSB 94-1 NMSP stabilization program, site wide environmental remediation and waste characterization, and backup support for new Waste Management facilities such as the Consolidated Incinerator Facility and the Defense Waste Processing Facility.

Operational Status

Other- specify Restricted

Historical Information

The only process system capable of holding up radioactive material is the high level transfer tanks. All of the drain lines that feed the tanks are gravity drained and contain no traps of any kind. A recent USQ (the only positive USQ to date for CLAB) documented the discovery of approximately 300 grams of plutonium (no significant enriched uranium) in the transfer tanks that had accumulated over an operational period of 40 years. The quantity did not exceed facility limits for fissile storage in single locations (less than 400 grams). The material has been dissolved and processed through NMSP's 211-F facilities. Procedures have been written that implement a conservative method of maintaining accountability for fissile materials discarded to the tanks (see USQ-SSD-93-076 for details).

There have been no occurrence reports or DNFSB concerns regarding HEU in Building 772-F.

List Authorization Basis

Authorization Basis DPSTSA-200-10, SUP-12, "Safety Analysis - 200 Area, Savannah River Site, Production Control Facilities, Building 772-F (With Addendum of October 9, 1992) (U)", 10/92; DPW-87-105, "Operational Safety Requirements for Laboratories 772-F and 772-1F (U)", 4/87; USQ-SSD-93-076, "Discovery of Solids in the Building 772-F Transfer Tank System, Corrective Actions, and Resumption of Transfer Tank System Operation (U)", 11/29/93, approved by DOE-SR 4/1/94; and G-BIO-F-00001, "Central Laboratory Facility - Buildings 772-F, 772-1F, and 772-4F Basis for Interim Operation (U)", April 1996.

Describe Important or Unique Design Features

Building 772-F is a Class I blast resistant structure constructed in 1954 which is expected to survive up to a 0.2 g earthquake without loss of shell integrity. The outer walls and roof are at least 12 inches of reinforced concrete with

credible facility losses exceed DOE-allowed values. An F-Area fire protection upgrade project has recently corrected the low system pressure/delivery problem and the FHA deficiency will be deleted during the next revision.

Building 772-F's high level drain piping system is currently a 304 SST system that has had numerous corrosion failures. These failures have allowed radioactive liquids to leak into service areas. A line item project is currently working to replace the drain lines with a corrosion and radiation resistant plastic (Halar) which will include pipe jackets and modern leak detection/alarm capability.

As part of the ongoing upgrade of safety documentation per DOE Orders 5480.22/.23, a natural phenomena hazards analysis for Building 772-F structural qualifications was completed (WSRC-TR-95-0080, Rev. 0, "Natural Phenomena Hazards Qualification of Buildings 772-F, 772-1F, and 772-4F Structures, Systems and Components (SSCs) (U)", 4/95). Two structural deficiencies were identified, one for Building 772-F and another for Building 772-4F. Four of the six air supply units mounted on the roof of Building 772-F required additional support bracing and the exhaust ductwork saddle bolts in Building 772-4F required tightening to specified tolerances for these structures to meet the performance categories for seismic. Both of these deficiencies have been corrected.

Structural Design
Blast resistant

Partitioned Areas of HEU within facility

Lab Modules & Corridors

Description of Partitioned Areas
Lab modules typically measure 12' by 24' and include separate HVAC supply air and also draw air from adjacent corridors. The air is exhausted through the main exhaust system which includes two stages of DOP-testable HEPA filtration before release through the stack to the environment. Lab modules that contain HEU inventory are locked. Adjacent corridors include locked metal cabinets for additional storage of HEU inventory.

Amount & Location of Hazardous Material Collocated or Commingled with HEU
All of the enriched uranium material is stored in either locked metal cabinets in the lab corridors, or in locked laboratory modules. The inventory of mostly standards-type material includes: 37 grams of oxide solid; 60 grams of metal; and 152 grams of uranyl nitrate solutions.

Process Material Transfers
Primarily liquid process control samples or standards are received in the laboratory and analyzed for required parameters. Once results are obtained, the samples are discarded to the high activity drain system via gravity flow drains. Material transfers from one lab module to another is via manually carried individual sample containers as there are no process material transfer systems other than the high activity drain system. Solid waste generated from analytical activities is disposed as either low activity waste or TRU waste.

Any recoverable SNM (left over samples) is packaged and manually transferred to the appropriate originating processing facility.

On-Site Transportation
At present, all analytical samples and standards materials are received in Building 772-1F. Materials are received either from the 221-F canyon/FB-Line facilities via hand-carried or manually cart-transported means, or by truck from other site areas. Trucks unload at a elevator-style truck dock, and sample containers are manually carted into

the laboratory facility. Sample movement within the laboratory facility is via hand-carry and manual carts. Returnable sample containers (such as shielded containers for high radiation samples) are decontaminated and returned to the originating facility via same routing means.

Radioactive solid waste is packaged in B-25 steel boxes (low activity) measuring 6' by 6' by 4' high, which are shipped via truck to the E-Area vaults. TRU waste drums are shipped by truck to the E-Area TRU waste pads.

Staff Levels & Experience

Current staffing for CLAB includes approximately 200 exempt and non-exempt personnel. Most of the non-exempt personnel consists of lab analysts in Building 772-1F and facility support. The exempt force totals about 100 includes managers and professionals in analytical services, facility operations and support, engineering support, maintenance, and radiological control operations.

Experience levels typically vary from several years to more than 15 years in the CLAB facilities.

Applicable References

References have been provided in the previous sections as needed.

Additional vulnerability information is contained in WSRC-TR-94-0299 Summary Report, "Department of Energy Plutonium ES&H Vulnerability Assessment, Savannah River Site Assessment Team Report (U)", 8/31/94 and the main report DOE/EH-0415, Plutonium Work Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage", Volume II, Appendix B, Part 4: Savannah River Site, Site Assessment Team Report, U. S. Department of Energy, September 1994. The information for CLAB buildings 772-F, 772-1F, and 772-4F included all actinides in the laboratory inventory, mainly plutonium, enriched uranium, and small quantities of americium, thorium, neptunium, etc.

Appendix XXX of this HEU vulnerability report includes the following:

SRS map showing F-Area

F-Area map showing Buildings 772-F, 772-1F, and 772-4F relationship to Building 221-F and others

F-Area map showing Buildings 772-F, 772-1F, and 772-4F

Floor plans for Buildings 772-F, 772-1F, and 772-4F

Facility boundary diagrams for Building 772-F and 772-1F with aggregate areas for HEU study clouded

Color photograph of Buildings 772-F, 772-1F, and 772-4F

ITE: Savannah River Site

FACILITY (Building or Location): CLAB 772-F

PARTITIONED AREA: Lab Modules & Corridors

uestion 2: What barriers are used to protect the workers, the public and environment from HEU?

r each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. e below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[Y] Room	[ ] Pads		[ ] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[Y] Alarm System		[ ] Lessons-Learned
[ ] Distance	[Y] Fire Suppression		[Y] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emgergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: S

Describ

Worker

Duct - H
Filter - L
Room -
barrier.
Confine

Public

Facility
facility
public.
Room -
environ
Site bo
the env

Critic

Protect
criticali

-Esta
-Mair
Mod
Mate
-Con

These
Critical

Admi

Proced
storing
person
Materia
Control
Config
have b
Quality
encom
Conduc
Authori
(U); OS
River C
P. M. H
Inter-o
Evalua
Prever
Docur
Trainir
descri
Orgar
safety
Lessc
occur
Recc
LSS
Exte
polic

Pag

SITE: Savannah River Site	FACILITY (Building or Location) CLAB 772-1F
	FUNCTION:

Question 1: SITE

DOE Headquarters Facility Landlord: D. F. KNUTH/P. COWAN
DOE Headquarters Program Sponsor: DP-60/EM-30
Facility Age: 9

Design Life:

Location of Facility on Site and Distance to Site Boundary

Building 772-1F is located in F-Area northeast of the 221-F Canyon facility and directly north of Building 772-F. It is approximately 6 miles from the nearest site boundary.

Design Mission, Interim Mission, Current Use

Building 772-1F was designed to provide 24 hour per day seven days per week analytical support for process control analyses of 200-F and 200-H separations production programs that were previously done in Building 772-F. Process support includes both hot and warm canyon operations, B-line liquid operations, and also the Reactor areas' basins and Waste Management's tank farms. The facility has been fully operational since hot startup in October of 1987. Although its current mission is primarily to support NMSP, it is modifying/adding analytical capability to support more waste and environmental remediation activities as site missions change.

Operational Status

Operating

Historical Information

There have been no occurrence reports, USQs, or DNFSB concerns related to HEU in Building 772-1F. The only positive USQ to date concerned accumulation of plutonium in the high activity transfer tank system and did not involve HEU material. This USQ (USQ-SSD-93-076) is now part of the facility authorization basis.

List Authorization Basis

Authorization Basis DPSTSA-200-10, SUP-14, "Safety Analysis - 200 Area, Savannah River Plant, New Production Control Facilities Building 772-1F (U)", 4/87; DPW-87-105, "Operational Safety Requirements for Laboratories 772-F and 772-1F (U)", 4/87; USQ-SSD-93-076, "Discovery of Solids in the Building 772-F Transfer Tank System, Corrective Actions, and Resumption of Transfer Tank System Operation (U)", 11/29/93, approved by DOE-SR 4/1/94; and G-BIO-F-00001, "Central Laboratory Facility - Buildings 772-F, 772-1F, and 772-4F, Basis for Interim Operation (U)", April 1996.

Describe Important or Unique Design Features

Building 772-1F is a standard commercial construction building and per the Hazards Assessment Document is a Hazard Category 3 facility. As such, the SAR took no credit for any building features surviving earthquakes, high winds, or tornados. The laboratories and offices are provided with automatic water sprinklers, all alarming to the F-Area Fire Department which is only a few hundred yards distant. Unoccupied service areas have smoke detectors that alarm to the Fire Department. Emergency lighting is provided by battery-powered units. Primary confinement of radioactive materials is provided by a main exhaust system which includes two DOP-testable stages of HEPA filtration. The main exhaust fans are provided with standby diesel generator power to maintain a minimum (not operational) exhaust flow upon loss of power. They are not provided with emergency power since personnel can be readily evacuated in event of complete power loss with the possibility of only residual radioactivity being released within the facility. All secondary exhaust systems (HP air monitors, high and low level drain exhaust, vacuum exhaust, cell exhaust, glovebox exhaust) also have their own HEPA filters and exhaust to the main exhaust system. The facility supply/exhaust ventilation system is interlocked such that failure of the supply fans or loss of flow to the exhaust fans will sound alarms and shutdown all supply and all but one of the main exhaust fans. This process upset condition maintains facility confinement but requires precautionary evacuation of laboratory modules. Glovebox exhaust goes to testable HEPA filters and blowers in Building 772-1F, and then to another two stages of filtration in the main exhaust system. Each glovebox includes both a supply and exhaust HEPA filter (not DOP-testable) to

located inside a glovebox in a lab module. Approximately 6 to 10 grams of in-progress HEU samples are contained in radiohoods and radiobenches.

Process Material Transfers

Both sample and standards materials are manually transported within the facility, either by push cart or hand-carried. There are no process material transfer systems for these materials.

Samples/standards consumed in analysis (mixed with reagents, extractants, etc.) are batch disposed to a gravity drained (no traps) high activity drain system which drains to the Building 772-F high activity transfer tanks C and D. This collected material is batch-transferred to NMSP's 211-F facility via dedicated, underground piping where it is neutralized, evaporated and transferred to the F-Area tank farm.

On-Site Transportation

Building 772-1F receives samples and standards materials directly from the 221-F/FB-Line facility via a covered passageway between 221-F and Buildings 772-F/772-1F. Transport of material is either hand-carried or by push cart. Materials from other areas of SRS (221-H, HB-Line, etc.) are received at a truck dock that is included in the above covered passageway. Once unloaded, the materials are either hand-carried or carted to sample receiving locations in the laboratories.

Low activity and TRU solid waste is packaged and transported to the E-Area waste handling facilities via truck.

Staff Levels & Experience

Current staffing for CLAB includes approximately 200 exempt and non-exempt personnel. Most of the non-exempt personnel consists of lab analysts in Building 772-1F and facility support. The exempt force totals about 100 includes managers and professionals in analytical services, facility operations and support, engineering support, maintenance, and radiological control operations.

Experience levels typically vary from several years to more than 15 years in the CLAB facilities.

Applicable References

References have been provided in previous sections as needed.

Additional vulnerability information is contained in WSRC-TR-94-0299 Summary Report, "Department of Energy Plutonium ES&H Vulnerability Assessment, Savannah River Site Assessment Team Report (U)", 8/31/94 and the main report DOE/EH-0415, Plutonium Work Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage", Volume II, Appendix B, Part 4: Savannah River Site, Site Assessment Team Report, U. S. Department of Energy, September 1994. The information for CLAB buildings 772-F, 772-1F, and 772-4F included all actinides in the laboratory inventory, mainly plutonium, enriched uranium, and small quantities of americium, thorium, neptunium, etc.

Appendix XXX of this HEU vulnerability report includes the following:

SRS map showing F-Area

F-Area map showing Buildings 772-F, 772-1F, and 772-4F relationship to Building 221-F and others

F-Area map showing Buildings 772-F, 772-1F, and 772-4F

Floor plans for Buildings 772-F, 772-1F, and 772-4F

Facility boundary diagrams for Building 772-F and 772-1F with aggregate areas for HEU study clouded

Color photograph of Buildings 772-F, 772-1F, and 772-4F

SITE: S

Describ

Worke

Duct - H
Filter - L
Room -
barrier.
Confine

Public

Facility
facility h
public.
Room -
environ
Site bo
the env

Critic

Protect
criticali

-Esta
-Mair
Mod
Mate
-Cont

These
Criticali

Admi

Proced
storing
person
Materia
Control
Configu
have be
Quality
encomp
Conduc
Authori
(U); OS
River C
P. M. H
Inter-of
Evalua
Preven
Docum
Trainin
descri
Organ
safety
Lesso
occur
Recor
LSS F
Exten
policy

Pag

FACILITY (Building or Location): CAB 772-1F

PARTITIONED AREA: GLOVEBOXES

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [2]	Administrative [3]
[Y] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedures/Operations Manuals
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limits
[Y] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[Y] Room	[ ] Pads		[ ] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[Y] Hood	[ ] Trenches		[Y] Training
[Y] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[Y] Alarm System		[ ] Lessons Learned
[ ] Distance	[Y] Fire Suppression		[Y] Training
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Training
[ ] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Performance Assurance Program
[Y] Alarm System			[ ] Worker/Area Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Preparedness
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

ITE: Savannah River Site	FACILITY (Building or Location): CLAB 772-1F
	PARTITIONED AREA: GLOVEBOXES

Question 2: BARRIER TYPES

escribe each barrier identified above and its intended protective functions.

Vorker Barrier Narrative:

Gloveboxes are used for handling high alpha activity materials and provide physical isolation for the worker. The gloveboxes are located in lab modules nd are exhausted (as are the rooms themselves) via ductwork or piping to confinement ventilation systems that include HEPA filtration for all ischarges to the environment. Lab modules that contain gloveboxes include high volume constant air alpha monitors that have both local alarms and emote alarms in the building shift office and radiological control office.

ll material transfers into or out of the gloveboxes are done through airlock-connected radiohoods or radiobenches which are also exhausted to a HEPA ltered confinement system.

'ublic/Environment Barrier Narrative:

he building structure provides a physical barrier to release of hazardous material to the public.

he HVAC/confinement exhaust system maintains the building at a negative pressure with respect to the environment, and includes HEPA filtration for articulate contamination removal prior to discharge.

he gloveboxes are designed so that the interior work area will contain all liquid leaks from samples and analytical activities.

Vith the nearest site boundary at a distance of approximately 6 miles, gloveboxes do not contain sufficient inventory for release to significantly affect the ublic at the boundary.

ll gloveboxes are inside lab modules that have full automatic water sprinkler coverage. The sprinkler system is alarmed to the site fire department and ie facility. The gloveboxes include interior heat detectors that also alarm to the room, the facility, and to the site fire department.

he facility exhaust stack includes active monitors for alpha, beta, and gamma activity that alarm to the continuously manned shift office and to the adiological control office.

:riticality Barrier Narrative:

:LAB controls fissile material nuclear criticality via administrative single-parameter always safe mass control. The authorization basis recognizes a 50 gram fissile material mass as always safe for the control of plutonium and uranium enriched in U-233 and U-235. Room limits can not exceed 400 rams of any fissile isotope and are typically at even lower masses. Double contingency is applied via the administrative controls by using more than ne inventory control method.

:LAB does not use or require neutron absorbers as none are credited controls.

he only geometry control is to prevent back-to-back loading of fissile material in adjacent lab modules. This requirement will likely be eliminated by an ngoing criticality analysis that is showing that even under worst geometry the control is unnecessary as long as the 400 gram room limit is observed.

nteraction controls are not needed or used as material is controlled on a room basis and not within a room.

:oncentration is not controlled since mass control is used and concentration can vary without affecting mass limits. An example would be a fissile olution that evaporates and concentrates. The fissile mass would be constant.

Moderation is not controlled as mass control assumes full light water moderation and heavy water is not present in sufficient quantities for moderation.

:nrichment is not controlled as mass control assumes the worst case fissile isotope mass.

Reflection control is not needed as the always safe mass control includes reflection.

/olume control is not needed due to mass control which is volume-independent.

\dministrative Barrier Narrative:

Glovebox operating procedures includes filter and glove changeout, plus required exhaust system operating parameters (negative pressure in glovebox) hat are monitored each use.

Radioactive material limits for rooms maintain inventories below both fissile limits and SAR-analyzed limits.

Gloveboxes are functionally classified as safety significant and require documented configuration control for any modifications.

SITE: Savannah River Site

FACILITY (Building or Location): CLAB 772-1F

PARTITIONED AREA: GLOVEBOXES

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

The authorization basis includes many glovebox specific accident scenarios.

Personnel training includes checking glovebox negative pressures, and monitoring gloves for contamination. Upon alarm of an alpha activity [illegible] air monitor or due to a glove failure, etc., personnel are trained to exit the lab modules immediately.

Glovebox exhaust system fans are performance monitored, and the main HEPA filters are efficiency tested at regular intervals as specified by [illegible]

SITE: Savannah River Site

FACILITY (Building or Location): CLAB 772-1F

PARTITIONED AREA: LAB MODULES & CORRIDORS

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[Y] Room	[ ] Pads		[ ] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[Y] Alarm System		[ ] Lessons-Learned
[ ] Distance	[Y] Fire Suppression		[Y] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE:

Descri

Work

Duct -
Filter -
Room
barrier
Confin

Publi

Facilit
facility
public
Room
envirc
Site b
the er

Criti

Prote
critica

-Est
-Ma
Mo
Mat
-Co

These
Critica

Adm

Proce
storing
persor
Materi
Contro
Config
have b
Quality
encom
Condu
Author
(U); O
River (
P. M. H
Inter-o
Evalua
Prever
Docun
Trainir
descri
Organ
safety
Lessc
occur
Reco
LSS I
Exter
policy

[redacted]

Testing and surveillance includes system operability checks [redacted] etc.), calibration, and testing (such as DOP-testing of HEPA filters for efficiency).

Emergency response procedures/plans and the supporting program [redacted] responses are to various releases of radioactive material to the facility and [redacted] the affected room or facility.

Page

Page

SITE: Savannah River Site

FACILITY (Building or Location): CLAB 772-1F

PARTITIONED AREA: RADIOHOODS&RADIOBENCHES

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[ ] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[ ] Conduct of Operations
[ ] Hot Cell/Canyon	[ ] Site Boundary		[ ] Authorization Basis
[Y] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[Y] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[Y] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emgergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: ...E: Savannah River Site

FACILITY (Building or Location): CLAB 772-1F

PARTITIONED AREA: RADIOHOODS&RADIOBENCHES

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Exhaust ductwork pulls air through the radiohoods and radiobenches and thus contains possible airborne contamination. The radiohood/radiobenches themselves provide containment of radioactive material by including liquid-tight work surfaces to prevent material leakage to the room. Operators who work in radiohoods/radiobenches wear protective gloves, labcoats, coveralls, safety glasses, and shoe covers for contamination control. The facility exhaust ventilation system provides the confinement exhaust for the radiohoods/radiobenches. Alarms on the confinement exhaust fans provide indication of possible low airflow conditions in the radiohoods/radiobences.

Public/Environment Barrier Narrative:

The building shell provides a physical barrier between radioactive material and the environment. The HVAC/confinement system maintains the facility at a negative pressure to the environment and includes HEPA filtration of exhaust air. An automatic sprinkler system protects all lab modules and the corridors.

Criticality Barrier Narrative:

Criticality controls are the same as for the glovebox aggregate area.

Administrative Barrier Narrative:

Limitation of radioactive material in radiohoods/radiobenches is the principal adminstrative barrier that protects the worker. Both self-monitoring and Con operations monitoring for contamination controls spread of radioactive material outside the containment units. HVAMs monitor for airborne radioactive contamination. Radiohood/radiobench face velocities are tested periodically to certify that they meet capture velocity requirements. Emergency response for radioactive sample spills/accidents and ventilation system failures includes immediate room/facility evacuations as needed to protect the workers.

SITE: Savannah River Site	FACILITY (Building or Location) CLAB 772-1F
	PARTITIONED AREA: GLOVEBOXES

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other uranyl nitrate solution	, G1,,, , G1,,,	Other-specify inside glovebox	5 + years	5	0.05

Cumulative Inventory Differences

0.0

Facility

Bimonthly

Packaging Description

Material at Risk Description

This material is enriched uranium working standards used to prepare more dilute process quality control standards. They are typically contained in screw-capped glass bottles inside a glovebox. The activity level of these standards is significantly less than the plutonium materials handled in the facility (and this room). If the 0.05 kg of enriched uranium were assumed to be 100% U-235, the resulting curie inventory would only be about 0.1 millicuries. The same facility has a building limit of 42 curies of alpha emitting isotopes. Any accidents with HEU would be easily bounded by SAR analyzed plutonium accidents.

All of the Building 772-1F HEU material was included in the plutonium vulnerability assessment. Although the facility holdings listing on B.9.b.2 page 8 did not specifically include the codes for HEU material, the CLAB approved input document for the study did include the proper codes and showed that the HEU was assessed. The plutonium study identified one vulnerability, number CL-1 as shown on the report Appendix C.9, Central Labs, pages 1 and 2. The vulnerability involved a high alpha activity Pu-238 sample spill in an outdoor receiving area. The existing SAR analysed this event and the consequences were below the guidelines. The large volume sample (40 mLs) is no longer received (current samples less than 1 mL) and the samples are triple-contained. No corrective actions were needed.

SITE: Savannah River Site

FACILITY (Building or Locatic

PARTITIONED AREA: LAB MODULES

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages
Sources and Samples	Enriched	Other Metals and uranyl nitrate soln.	, G2, , B1, , X2, ,	Process Area Locked lab or locked cabinet	5 years +	136

Cumulative Inventory Differences

0.0

Packaging Description

Material at Risk Description

Material consists mostly of enriched uranium metal samples and oxide standards (NBS). About 2 grams of the material is U-233 isotopic spike standards, and is contained in 132 glass ampules. Packages are contamination free and are stored in either locked metal cabinets or in locked lab modules. Packages are only opened inside containment units as needed for standards/sample preparation. The locations are in areas exhausted by the facility main exhaust system which includes HEPA filtration and stack monitoring.

If the 0.03 kg of HEU was assumed to be 100% U-235 and the 2 g of U-233 were assumed to be isotopically pure, the total curie amount would be about 19 millicuries. The facility limit is 42 curies of alpha emitting isotopes, thus, any HEU accidents would be easily bounded by SAR analyzed plutonium accidents.

SITE: Savannah River Site

FACILITY (Building or Location) CAB 772-H

PARTITIONED AREA: RADIOHOODS&RADIOBE

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other Uranyl nitrate solutions	, G1.,	Other-specify Inside radiohoods/radio benches	1 month	10	0.01

Cumulative Inventory Differences

0.0

Facility

Monthly

Packaging Description

Material at Risk Description

Enriched uranium samples from H-Area processes are analyzed inside radiohoods and radiobenches. Samples are contained in screw-capped glass bottles, typically 60 and 250 mL in volume. An estimated typical facility inventory for these samples varies from 6 to 10 grams. If 10 grams of HEU were assumed to be 100 % U-235, the curie value would be only about 22 microcuries compared to routinely handled/analyzed plutonium samples containing curie quantities. The HEU hazard is insignificant when compared to the plutonium hazards, and the plutonium hazards have been found to be acceptable by SAR analysis and during the plutonium vulnerability study.

FACILITY ... ilding or Location) ...

FUNCTION: Pu Process and ...

Question 1: SITE

DOE Headquarters Facility Landlord: EM-60

DOE Headquarters Program Sponsor: EM-60

Facility Age: 45

Design ...

Location of Facility on Site and Distance to Site Boundary

The FB-Line facility is located within the F Separations Area. This area is located near the center of the 78 ... kilometer SRS site. The F-Area Limited Area boundary is approximately 8.85 kilometers from the site boundary. The site boundary is defined as the perimeter of the DOE-owned and controlled land at SRS, with the exception of areas where the public has uncontrolled access of SRS, ex., Route 125 through site property.

Design Mission, Interim Mission, Current Use

Design Mission, interim mission, current use, and operational status.

The F-Area, B-Line Facility (FB-Line) was designed to convert Plutonium (Pu-239) from a dilute nitrate stream ... high purity, castable metal form. The metal (referred to as a button because of its physical appearance) is ... packaged and shipped to the Rocky Flats Plant (RFP) to support programs funded by the Department of Energy (DOE).

The F-Area, FB-Line facilities primarily occupy the fifth and sixth levels of the 221-F Canyon building. Most of the facilities are contained within concrete reinforced walls and roofs with only non-vital support facilities (e.g., lunchrooms, shops, locker rooms, etc.) located in "soft" steel frame structures.

Major metal production unit operations consist of Cation Operations for the concentration of the Pu-239 nitrate stream from 221-F Canyon, Precipitator Operations to produce a solid Pu-239 cake, and Mechanical Line Operations to convert the Pu-239 cake into a metal button. Other unit operations include Recovery Operations used to recycle Pu-239 bearing materials (liquids and solids) from facility operations, Metal and Oxide Recovery Operations (no longer in service), and Vault storage areas.

Two new facilities, New Special Recovery (NSR) and the Plutonium Storage Facility (PSF), are fabrication complete, clean with no radioactive contamination and are in cold standby.

FB-Line Historical Mission:

In the early 1950's the Savannah River Project was constructed by DuPont under contract to the former Atomic Energy Commission (AEC). The original FB-Line was located in the third and fourth levels occupying most of Sections 1-4 of the 221-F Canyon structure. The unit operations operated to concentrate a 2-3 gram/liter plutonium nitrate stream provided from 221-F Canyon operations to eventually produce a plutonium metal "button". The button name came about from the rounded, button-like shape that was formed in the bottom of the magnesium oxide (MgO2) crucible during metal reduction operations. The original FB-Line facility (which began operation in 1954) could not maintain a satisfactory throughput with regard to 221-F Canyon continuous operations. Therefore, a project was authorized to construct new facilities to increase throughput of plutonium metal. This "new" FB-Line was constructed on top of the original FB-Line facility and occupied the fifth and sixth levels. The new FB-Line began operation in late 1957.

Several improvements to the facilities were completed in the 1980's to include upgraded special recovery control and equipment, new precipitator facilities, and a computerized Distributive Control System (DCS) for selected facility operations. A special improvement completed in the 1990's involved tying the 3rd and 4th level ventilation exhaust system into the exhaust through the 221-F Canyon sand filter.

Interim Mission

Mainline Processes - Operational

FB-Line receives a dilute (2-3 grams/liter) plutonium nitrate stream (rich in Pu-239) from 221-F Canyon. The solution is run through Cation Operations where the plutonium collects on the cation column resin material. The plutonium is eluted from the column, and after several batches are prepared, the plutonium bearing solution is precipitated to a plutonium tri-fluoride (PuF3) cake using a fluoride solution (hydrofluoric acid). In the event a small amount of plutonium is not precipitated, it is collected and recycled through the Recovery Operations. The PuF3 filtered cake is then air dried to remove moisture. At this point the material enters the area of the building referred to as the Mechanical Line. The dried cake is then prepared in measured batches and run through a "roasting" furnace where, at elevated temperatures and under an O2 purge, the PuF3 is converted to plutonium tetrafluoride (PuF4) and plutonium oxide (PuO2). The powders are mixed with a measured amount of calcium metal, placed in a MgO2 crucible, which in turn is placed into a stainless steel pressure vessel. The vessel is inserted into the reduction furnace where at elevated temperatures an exothermic reaction takes place with the resultant reaction products becoming a molten mass. The plutonium metal is sufficiently more dense than the other products so that is settles to the bottom of the crucible and solidifies into a button shape upon cooling. The crucible is allowed to cool and the button is then dumped and separated from the slag and crucible (S&C) pieces. The slag and crucible pieces contain recoverable quantities of plutonium and, therefore, are saved and eventually recycled. This recycle material is processed in Recovery Operations. Other materials recycled from the Mechanical Line Operations through the Recovery Operations include cabinet sweepings, button rinse ("pickling") solutions, and metal turnings from product sampling.

Recovery Operations - Standby

The Recovery Operations consist of a dissolver system (dissolver, filters, and hold tanks) and the Anion Columns. The dissolver can accept slag & crucible, sweepings, and metal turnings from the Mechanical Line Operations, as well as solutions and other solids recycled from the process control laboratory. The desired material is charged to the dissolver vessel and then dissolved using concentrated nitric acid. The resultant solution is filtered and then fed to the Anion Columns for recovery of the plutonium. Other recycled material (including liquid losses from Cation/Precipitator Operations, Mechanical Line "pickling" solutions, and facility sump solutions) are collected, adjusted, and fed to the Anion Columns for recovery of plutonium. Once the anion resin is "loaded" with product, the appropriate column is eluted and the product elution solution collected in a hold tank. The tank is sampled and then the solution transferred to the 221-F Canyon to be used as blend material.

Special Recovery Operations - D&D

The Special Recovery Operations consisted of a Metal Recovery line and an Oxide Recovery line. Off-specification buttons from the mechanical line and buttons, metal, and oxide received from off-site were processed in these facilities (dissolving with sulfamic acid or hydrazine or nitric acid/hydrofluoric acid. The resultant plutonium solutions were filtered and collected in hold tanks. Following sampling, the solutions were transferred to specific 221-F Canyon tanks for use as blend material. As stated earlier, Special Recovery is no longer operated.

Vault Storage - Operational

The product (button) from the mechanical line, scrap from off-site, or in-house solid recycle are stored for interim periods of time in one of two FB-Line vaults. Materials are typically packaged to provide tertiary containment (e.g., a sealed container inside of a sealed bag with both placed within a rigid outer container). Approximately 1600 spaces can be utilized for various material storage containers. These vaults remain in operation today.

New Special Recovery (NSR) - Cold Standby

The projects to build both New Special Recovery (NSR) and the Plutonium Storage Facility (PSF) were initiated in the early 1980's. Construction of NSR (located on the fifth and sixth levels, Sections 5-8, on top of the Canyon

facility in F-Area) began in earnest in 1983. Mechanical installation of the facility was completed in 1987. NSR was originally justified for construction to dissolve only Hanford oxides (9% to 12% Pu-240). By the time construction began in 1984 this specific mission was not the primary emphasis. The mission from 1983 through 1989 was to get the facility mechanically complete and started to dissolve high and low fired oxides and some less desirable materials (e.g., slag & crucible). This material would be sent to the 221-F Canyon for blending (prior to first cycle operations) then in turn would provide a high purity plutonium nitrate stream to FB-Line for conversion into specification metal (button). NSR did not have a "bulk" metal dissolving capability, as such, at this time.

In 1988, DOE directed the site to modify both NSR dissolving lines to allow for the processing of dissembled plutonium weapon components. Two (2) larger dissolvers were ordered and one was installed by late 1989. At this time, in late 1989, processing stopped at the Rocky Flats Plant (RFP) and the project (checkout, documentation, etc.) was stopped on the newly installed NSR dissolver. The second dissolver (which had not yet been manufactured by the vendor) was canceled and the equipment never delivered to SRS. NSR start-up activities were formally terminated in 1992. Engineering work packages were assembled and implemented to place the facility in an indefinite cold standby. The ventilation for the radiologically controlled areas of the NSR facility is tied into the 221-F Canyon process exhaust system. However, the facility remained "clean" as plutonium was never introduced into any of the facility processing lines.

Plutonium Storage Facility (PSF) - Cold Standby

The projects to build both New Special Recovery (NSR) and the Plutonium Storage Facility (PSF) were initiated in the early 1980's. The PSF installation was mechanically complete in 1987. Checkouts continued through 1990 when permission was pursued with the Department of Energy (DOE) to allow facility start-up to store plutonium bearing materials. Several delays occurred which prevented a timely start-up. In 1991, PSF was in a position to begin storage operations but start-up was delayed pending start-up action resolutions in NSR. PSF and NSR share some common support systems with an important operational one being a Material Access Area (MAA). In an effort not to impact mobility of the workers in NSR, the PSF start-up was put on hold until both facilities were ready to operate. In 1993, a decision was made by the DOE not to pursue start-up of the PSF. The facility was then placed in an indefinite cold standby.

PSF provides storage for up to 428 thirty (30) gallon, fifty-five (55) gallon, and/or eighty-four (84) gallon shipping containers. The drums are automatically placed (horizontal orientation) in a predetermined rack space by a mechanical, mobile stacker/retriever controlled by a software program. Inventory can be taken via the same stacker/retriever moving about the rail system in conjunction with a bar code system. The facility has state-of-the-art Non-Destructive Assay (NDA) equipment and a satellite laboratory contained within the facility structure. A separate glovebox line is available within PSF to unload/load shipping containers and to perform Safeguard & Security (S&S) verifications.

Operational Status

Operating

Historical Information

Occurrence Reports:

The FB-Line facility did not experience any occurrences related to or involving HEU or U233 in the past 2 years.

Other Regulatory Concerns:

(see Weaknesses)

SITE: Savannah River Site	FACILITY (Building or Location) FB Line
	FUNCTION: Pu Processing and Storage
Question 1: SITE	

DNFSB Concerns: Recommendation 94-1

List Authorization Basis

(Refer to WSRC-IM-93-61, "NMPD Authorization Basis Lists (U)", Rev. 19, 03/21/96)

DPSTSA-200-10-SUPP-9, Safety Analysis Report (April, 1988)

WSRC-RP-93-1102, FB-Line Basis for Interim Operation (BIO), Revision 1, (12/95)

DPW-85-101, "Operational Safety Requirements for 200-F and 200-H Separations Areas (Excluding Tritium, Waste Management and HB-Line)" , Revision 3 (7/95)

221-F Technical Standards (U), WSRC-TM-93-17 (7/93):

- DPSTS-221-21.03, Rev. 3/74
- DPSTS-221-42.01, Rev. 12/16/80
- DPSTS-221-42.03, Rev. 5/74
- DPSTS-221-42.04, Rev. 05/05/75
- DPSTS-221-42.06, Rev. 5/74
- DPSTS-221-42.08, Rev. 2/73
- DPSTS-221-42.10, Rev. 2/73
- DPSTS-221-70.03, Rev. 06/10/75
- DPSTS-221-70.06, Rev. 9/75
- DPSTS-221-70.09, Rev. 9/75

DPSTS-221-0.09 SUP, "Nuclear Criticality Safety Supplement - Building 221-F, JB-Line"

- NCSS #1, Rev. 11/11/85
- NCSS #2, Rev. 02/05/92
- NCSS #3, Rev. 01/13/92
- NCSS #4, Rev. 09/30/86
- NCSS #5, Rev. 03/24/80
- NCSS #6, Rev. 02/02/95
- NCSS #7, Rev. 08/05/76
- NCSS #8, Rev. 01/02/74
- NCSS #9, Rev. 11/10/80
- NCSS #10, Rev. 07/10/85
- NCSS #11, Rev. 01/30/79
- NCSS #12, Rev. 07/05/89
- NCSS #13, Rev. 11/04/83
- NCSS #14, Rev. 09/01/71
- NCSS #15, Rev. 08/30/89
- NCSS #16, Rev. 10/27/77
- NCSS #17, Rev. 02/08/85
- NCSS #18, Rev. 08/02/88
- NCSS #19, Rev. 07/29/75
- NCSS #20, Rev. 11/10/81
- NCSS #21, Rev. 02/03/81
- NCSS #22, Rev. 02/11/81

NCSS #23, Rev. 12/14/81
NCSS #24, Rev. 05/10/85
NCSS #25, Rev. 03/21/85
NCSS #26, Rev. 07/02/86
NCSS #27, Rev. 02/18/88
NCSS #28, Rev. 02/07/86
NCSS #29, Rev. 12/16/88
NCSS #31, Rev. 03/02/92

DPSTS-NIM-85, Nuclear Incident Monitors Technical Standard, Rev. 01/86

DOE/EIS-0220, Interim Management of Nuclear Materials, Environmental Impact Statement, October 20, 1995

Describe Important or Unique Design Features

Twenty (20) systems owned by FB-Line have been identified as Safety-Related as well as eight (8) systems that are required for the FB-Line safety envelope but are owned and maintained by the F-Canyon facility. The FB-Line Safety Analysis Report (SAR) and Basis for Interim Operation (BIO) were used as a basis for the selection of the systems.

Ventilation/Room Exhaust

The room exhaust system functions to keep the rooms at a negative pressure with respect to the airlocks and corridors. This pressure gradient ensures that air is flowing from the radiologically clean areas to areas with potential for radioactive contamination. Various hard wire interlocks activate as required to protect the environment and workers.

Ventilation/Cabinet Exhaust

The cabinet exhaust system is a part of the confinement system. For the wet cabinet system, air is supplied by in leakage into the cabinets from the rooms, the inlet High Efficiency Particulate Air (HEPA) filters and barometric dampers. The Mechanical Line is supplied by a dedicated fan system that supplies dried air to the dry cabinets. All cabinets are kept at a negative pressure with respect to the rooms. In addition, the cabinet exhaust system is designed to maintain a negative pressure in the cabinets with panel(s) removed. The cabinet exhaust fans provide the motive force for the system. Various hard wire interlocks activate as required to protect the environment and workers.

Ventilation/Third Level Exhaust

The third level exhaust system consists of the two (2) FB-Line third level exhaust interlocks and the 3rd and 4th level main supply air dampers. The third level exhaust system interlocks are part of the confinement system and function to close the 3rd and 4th level main supply dampers to reduce the potential for pressurization of the 3rd and 4th level areas. The 3rd and 4th level main supply dampers moderate the air supply from the 221-F Canyon center section header to the FB-Line 3rd and 4th levels. The third level exhaust fans pull a vacuum on certain contaminated areas (the third and fourth level vaults and Neptunium areas.) The 221-F Canyon Exhaust system ensures a pressure gradient between the third and fourth level rooms, the airlocks and corridors. These pressure gradients ensure that air is flowing from the radiolo[illegible]

Process Hazards/Ion Exchange Temperature Instruments

Dry, irradiated and unvented ion exchange resin can rapidly decompose at temperatures in excess of 60 degrees Centigrade. The instruments monitor either the fissile material feed temperature or the resin bed temperature. Should the temperature exceed the setpoint, the interlock will activate. The interlock closes the fissile material feed valve.

F-Area Common Systems/221-F Canyon Exhaust Tunnel, 291-F Stack and Stack Liner

The design function of the exhaust tunnel is confinement of the F-Canyon/FB-Line ventilation flow to the sand filter and then to the 291-F stack. The 221-F building has been designed as a blast resistant structure and is not expected to be significantly damaged by earthquakes with an intensity of less than MM VIII. The exhaust tunnel was built to the same standard as the 221-F building. The exhaust tunnel provides a ventilation envelope within which radioactive material can be contained. The exhaust tunnel serves this function as primary containment. The stack and liner direct the F-Canyon/FB-Line ventilation filtered air from the discharge of the canyon exhaust fans to the atmosphere. The stack liner shall withstand a 0.04g earthquake.

F-Area Common Systems/221-F Canyon Exhaust System

The design function of the 221-F Canyon Exhaust System is to provide flow through the sand filter to the 291-F stack. Two of the four fans are powered by diesel generators on a continuous basis. The remaining two fans are powered by normal electrical power with diesel power backup. One of the two normal power fans automatically transfers to diesel power on loss of normal power. During a loss of normal power, the three diesel operated fans provide an adequate flow to maintain sand filtration.

F-Area Common Systems/Sand Filters

The 294-F and 294-1F Sand Filters provide the final reduction of particulate in the F-Canyon/FB-Line ventilation exhaust stream before it is exhausted through the 291-F stack. The SAR offsite consequences are calculated with the Sand Filter on-line and no operable HEPA filters. The operating efficiency of the Sand Filter as stated in the SAR is, at a minimum, 99.51%. This filtration reduces the offsite dose to the public to be within the regulatory limits.

F-Area Common Systems/281-6F Segregated Water Monitors

The 281-6F Water Monitors are intended to monitor the segregated water return from the 221-F Canyon and FB-Line and alarm on increased activity. Both audible and visual High Activity, Low Flow and System Trouble Alarms are provided to the 221-F Canyon Fourth Level Control Room and 281-6F Monitor House. Each Water Monitor Sample Flow System has a sample hold tank into which monitored cooling water is automatically captured when either the alpha or gamma monitor indicates activity above the divert alarm level. This sample provides the method to confirm the alarm condition. FB-Line contributes to the segregated cooling water discharge stream from the cooling coils of a vessel in Cation.

F-Area Common Systems/281-4F Circulated Water Monitors

The 281-4F Water Monitors are intended to monitor the circulated water return from the 221-F Canyon and FB-Line and alarm on increased activity. Both audible and visual High Activity, Low Flow and System Trouble Alarms are provided to the 221-F Canyon Fourth Level Control Room and 281-4F Monitor House. Each Water Monitor Sample Flow System has a sample hold tank into which monitored cooling water is automatically captured when either the alpha or gamma monitor indicates activity above the divert alarm level. This sample provides the method to confirm the alarm condition.

F-Area Common Systems/Segregated Cooling Water Diversion Valves

The Segregated Cooling Water (SCW) Diversion Valves (DE-36 and DE-37) serve to divert the flow of contaminated SCW from the 221-F Canyon and FB-Line to the 281-8F Retention Basin and/or 241-97F Holding Basin instead of through the normal route for clean SCW to the 281-5F Delaying Basin and on to Four Mile Creek. The diversion of

contaminated water ensures radiological limits are not exceeded at the plant boundary. FB-Line contributes to the segregated cooling water discharge stream from the cooling coils of a vessel in Cation.

F-Area Common Systems/Circulated Cooling Water Diversion Valves
The Circulated Cooling Water (CCW) Diversion Valves (DE-33 and DE-34) serve to divert the flow of contaminated CCW from the 221-F Canyon and FB-Line to the 281-8F Retention Basin and/or 241-97F Holding Basin instead of through the normal route for clean CCW through the 281-2F Pump Basin and back to the 285-F Cooling Tower. The diversion of contaminated water ensures that the cooling water supply at 285-F does not get contaminated, thereby preventing contaminated water from overflowing at 285-F to the creek c: from generating airborne releases at 285-F.

F-Area Common Systems/291-F Stack Monitors
The 291-F Stack Alpha, beta-Gamma and Radio-Iodine Monitors are designed to detect radioactive releases from the 221-F Canyon and FB-Line ventilation exhaust through the 291-F Stack. The system is provided with alarms for High Activity, Low Flow, and Count Rate Meter (CRM) Trouble. The 291-F Stack Monitor Room in 292-F contains visual alarms only. The 221-F Canyon Fourth Level Control Room contains both audible and visual alarm indication.

Describe Weaknesses in the Design Basis
At the site level WSRC has sufficient control in place to ensure compliance with the large number of requirements specified in DOE Order 6430.1A, General Design Criteria. NMPD is in compliance with the DOE order from a site generic perspective, and, therefore at a facility level. Through implementation of the site and division level manuals and procedures all the requirements of DOE Order 6430.1A should be addressed for any new facility or modifications to an existing facility. Compliance and Order applicability for older facilities, such as FB-Line, is addressed in the current site Directives Assessment and Compliance Plan (WSRC-RP-90-12).

Specific FB-Line concerns include the following:

Seismic Issue:

SR--WSRC-SEPGEN-1996-0001, 3/1/96, Potential Inadequacy in Safety Analysis Regarding Canyon Building Structural Response to an Evaluation Basis Earthquake (EBE) (U)

Currently, a PISA documents inaccurate assumptions in the structural evaluation of the F-Canyon and H-Canyon building. The frequency of earthquake has been estimated to increase from once every 5000 years to once every 2000 years. This change in frequency results in an increased risk for the facilities. A Justification for Continued Operations (JCO) was approved by WSRC to allow continued stabilization of materials in the F-Canyon and H-Canyon and FB-Line and HB-Line to support the DOE 94-1 Implementation Plan. This JCO was issued to DOE on 5/1/96 for approval.

Safe, Interim Storage of Plutonium Bearing Materials
The Department of Energy (DOE) is coordinating efforts to address the interim and long term issues associated with the storage of plutonium bearing materials until final disposition plans can be devised and implemented. SRS and FB-Line personnel are involved in the studies and discussions on plutonium storage. Successful conclusion of these studies will help the DOE determine the material form and packaging desired for interim to long term storage. FB-Line is one of several DOE Complex facilities that may need to treat, stabilize, and/or process excess plutonium.

Fire Hazards Assessment
A Fire Hazards Assessment for the FB-Line has been performed and approved. The absence of an automatic fire suppression system throughout the building is the most visible deficiency that could contribute to the loss of life and

property losses that exceed the damage limits established in DOE Order 5480.7A, Fire Protection. FB-Line has noncombustible construction, noncombustible interior finish, predominanantly noncombustible interior contents, and houses an aqueous chemical process. Additional areas of concerned identified by the assessment team include the risks associated with a propagated fire and the control of transient combustibles in the entire facility. With the correction of the FHA identified life safety and National Fire Protection Association (NFPA) code deficiencies that are categorized as significant, the facility will satisfy the intent of the DOE Orders and program objectives for fire protection and related perils.and JCO are being documented to recognize and permit continued stabilization of

Structural Design

Reinforced concrete Class I Explosion Design

Partitioned Areas of HEU within facility

4th Level Vault

Description of Partitioned Areas

4th level Vault - The 4th level vault contains various solid forms of transuranic materials. The vault is separated from all other FB-Line operating areas and has a material inventory that is well defined.

The 4th Level vault partitioned area consists of one vault. The partitioned area boundaries are identified as the vault room itself. The room exhaust air is double HEPA filtered prior to being exhausted out the stack. The vault is used to store fissile materials of various forms and compositions in various types of containers. Materials that are stored include:

- On site product buttons
- Off-standard on site and off site plutonium buttons
- On site and off site plutonium metal scrap
- On site and off site slag and crucible
- On site and off site cabinet sweepings
- Off site plutonium alloy buttons
- Off site plutonium and plutonium/uranium oxides
- Off site plutonium scrap

The vault has three types of storage areas; 1) wall mounted racks with 672 can locations, 2) Maximum Unit storage areas, (572 item locations) and 3) the shipping container storage area. A Maximum Unit is the maximum amount of fissile material permitted based on the H/X (hydrogen to fissile atom) ratio. There are three types of Maximum Unit storage areas in the vault: 100 wall mounted storage bins (hold 4 pails each), 38 floor spaces (hold 4 pails each) and 5 FL-10-1 cylinder racks (hold 4 canisters each).

The wall mounted racks are used for storage of individual cans of material. Material stored in the Maximum unit storage areas may be in cans inside five gallon pails, shipping containers or various other arrangements. The shipping drum storage area is a dedicated area of floor space used to store multiple shipping containers.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

Hazardous Material: Makeup/Process Area: Amount:

SITE: Savannah River Site

FACILITY (Building or Location) HB Line

FUNCTION: Pu Proces

Question 1: SITE

Ascorbic Acid	Cold Feed Prep 6th Level/ Precipitator Operation	dry - 50 kg drum liquid - 42 liter Mix Tank of 16. liquid - 2-113 liter Head Tanks
sol		
Sodium Nitrite	Cold Feed Prep 6th Level (Solid stored on roof in NSR Chemical Feed Building)/ Recovery Operations	dry - 50 lbs liquid - 61 liter Mix Tank of 30% in sol liquid - 25 liter Adjustment Fee
Sulfamic Acid	Cold Feed Prep 6th Level/ Cation & Precipitator Operations	dry - 50 lbs. liquid - 61 liter Mix Tank of 14.9% in sol liquid - 2-113 liter Head Tanks of 1.7% in sol liquid - 575 liter Precipitant Mal
0.94% in sol		liquid - 2-318 liter Elutriant Mix
2.5% in sol		liquid - 2-64 liter Head Tanks o
sol		
Sodium Sulfate	5th Level Coupling Maintenance Room 2	dry - 90 lbs
Calcium Flouride	Dissolver Maintenance Room 6th Level	dry - 115 lbs
Hydroflouric Acid	Reagent Prep 6th Level/ Precipitator Operations	liquid - 100 lbs. carboy liquid - 575 liter Precipitant Mak
10.4% in sol		liquid - 2-113 liter Head Tanks
sol		liquid - 120 liter Mix Tank of 1.6
sol		liquid - 2-64 liter Head Tanks o
		liquid - 27 liter Head Tank of 1.
Hydroxylamine Nitrate	Cold Feed Prep 6th Level/ Cation Operations	55 gallon drum liquid - 2-550 liter Reconditionir
of 0.48% in sol		liquid - 1211 liter U Elutriant Mi:
0.44% in sol		
Nitric Acid 64%	Reagent Prep 6th Level/ Cation, Recovery & Precipitator Operations	Recv'd from OF liquid - 1014 liter Head Tank of 64% in sol liquid - 2-550 liter Reconditionin

Storage

in

SITE: Savannah River Site

FACILITY (Building or Location): [illegible]

PARTITIONED ~~AREA~~: 4th Level Vault

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]

- [ ] Gloveboxes
- [ ] Transfer System
- [ ] Duct
- [ ] Filter
- [Y] Vault
- [ ] Room
- [ ] Hot Cell/Canyon
- [ ] Hood
- [ ] Piping
- [ ] Shielding
- [Y] Distance
- [ ] Respiratory Protection
- [ ] Protective Clothing
- [ ] Remote Handling
- [ ] Confinement System
- [ ] Burial Ground
- [ ] Tanks
- [ ] Alarm System
- [ ] Temporary Barriers
- [ ] Other-specify

Storage Container

- [N] None

Public/Environmental Barrier [2]

- [ ] Facility/Building Boundary
- [Y] HVAC/Confinement
- [ ] Liquid Containment/Dike
- [ ] Bay, Cells, Magazines
- [ ] Canyons
- [ ] Pads
- [Y] Site Boundary
- [ ] Trenches
- [Y] Storage Vault
- [ ] Alarm System
- [ ] Fire Suppression
- [ ] Other - Specify

Criticality [1,2]

- [Y] Double Contingency Applied
- [ ] Double Contingency Not Applied (specify)

(e.g., Mass
Absorbers
Geometry
Interaction
Concentration
Moderation
Enrichment
Reflection
Volume)

Administrative Barrier [3]

- [Y] Procedure: Operation, Maint.
- [Y] Material Limts
- [Y] Monitoring
- [Y] Configuration Control
- [ ] Quality Assurance
- [Y] Conduct of Operations
- [Y] Authorization Basis
- [Y] Training
- [Y] Organization
- [Y] Lessons-Learned
- [Y] Testing
- [ ] Trending
- [Y] Records
- [ ] Standards
- [ ] External Regulation
- [Y] Surveillance
- [Y] Personnel Reliablity Assurance Program
- [Y] Worker/Access Occupancy Limits
- [Y] Emgergency Response
- [Y] Other-specify

Nuclear Safety Specialist (NSS)

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. [illegible] are included in Question 6.

SITE: Savannah River Site	FACILITY (Building or Location): FB Line
	PARTITIONED AREA: 4th Level Vault

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Material Limits:
Fissile material mass limits are posted for storage locations.

Combustible loading limits are maintained in the vicinity of the vaults to reduce the potential for spread of a fire into the vaults. Fire watch rounds are performed at a defined frequency.

Monitoring:
Nuclear Incident Monitors are available in the respective transport zones to indicate if a criticality occurs and to warn personnel to evacuate to avoid the dose of a second possible burst.

Configuration Control:
Configuration control exists for Safety Class and Safety Significant equipment.

Conduct of Operations:
Applicable Conduct of Operations is in place.

Authorization Basis:
Authorization Bases are current and approved.

Organization & Lessons-Learned:
Organization is defined and a lessons-learned program has been implemented.

Records:
Records are maintained per the RIDS schedule.

Testing:
The vault storage location geometries were sampled and statistically evaluated to show that the dimensions met the tolerance required by the NCSEs.

Surveillance:
Routine monitoring and surveillance of vault storage containers is in place.

Worker Access Occupancy Limits:
Worker access is controlled by security at the entrance to the material access area (MAA) and to the vault area. The vault is normally closed and locked, and requires authorization from Wackenhut Security, Radiological Control and Operations management prior to entry. At least one person entering the vault must be PSAP (Personnel Security and Assessment Program) qualified.

Two-person rule is in place for vault entries and material handling.

Personnel Reliability:
At least one person entering the vault must be PSAP qualified.

Training:
All personnel are trained to current procedures and are qualified as fissile material handlers.

Other:
A Nuclear Safety Specialist (NSS) is assigned to each shift to provide additional nuclear safety oversight to Operations.

SITE: Savannah River Site	FACILITY (Building or Location)	FB Line
	PARTITIONED AREA:	4th Level Vaul

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages
Metal	Enriched	Alloys EU-Pu alloy from Argonne (CZA-130)	, C2, , B0, , C0, ,	Vault	10 to 20 years	1

Cumulative Inventory Differences

0.0

Packaging Description

For the EU-Pu alloy mixture from Argonne, the material was placed into an inner slip lid can, sealed in a plastic bag, into an outer sealed rim can and then into a 5 gallon pail. The item was repackaged 12/17/92 into a 5 gallon pail - NO report of a damaged can at the time of the repackaging.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This 92% enriched EU-Pu alloy mixture from Argonne was categorized as Material Group 82 in the Pu Vulnerability Assessment (PuVA), Appendix B.1, Section B.1.2, page 4. The material is reported to be powder and one piece of rod, and to be contaminated with Si, C, Al, Rb and Ge. The Batch number was 8-8-1828-772 under Project #C-AF-1540-10-B.

No deformation of the rim can was observed during the 12/17/92 inspection. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the container seals or plastic bagging leading to HCl generation. The external pail container is stored in a controlled environment and is not expected to undergo corrosion.

Material Group 82 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-07 "Pu metals with major adverse conditions in FB-Line (age, high thermal heat, PVC plastic packaging, etc.)" (Appendix C.1, VAF#FB-07), #FB-14 "Materials that can not be monitored due to the outer packaging in FB-Line (5 gallon pails, shipping containers or pressure cookers)" (Appendix C.1, VAF#FB-14), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannah River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Alloys Pu-EU alloy from Argone CZA-126	C0, B2, C0	Vault	10 to 20 years	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

For the Pu-EU alloy mixture from Argonne, both items were placed in a mechanically sealed #2 can, placed inside a 20 mil PVC bag, then inside a mechanically sealed #3 can.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This 93% enriched EU-Pu-Zr alloy mixture from Argonne was categorized as Material Group 60 in the PuVA, Appendix B.1, Section B.1.2, page 5.

No failures of containers of this type of material are known. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the container seals or plastic bagging leading to HCl generation. The external container is stored in a controlled environment and is not expected to undergo corrosion.

Material Group 60 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-07 "Pu metals with major adverse conditions in FB-Line (age, high thermal heat, PVC plastic packaging, etc.)" (Appendix C.1, VAF#FB-07), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

ITE: Savannah River Site	FACILITY (Building or Location)	FB Line
	PARTITIONED AREA:	4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages
ietal	Enriched	Alloys EU-Pu alloy from Argonne (CZA-130)	, C2, , B0, , C0, ,	Vault	10 to 20 years	1

umulative Inventory Differences

0.0

ickaging Description

ır the EU-Pu alloy mixture from Argonne, the material was placed into an inner slip lid
n, sealed in a plastic bag, into an outer sealed rim can and then into a 5 gallon pail.
ıe item was repackaged 12/17/92 into a 5 gallon pail - NO report of a damaged can at
ə time of the repackaging.

iis packaging arrangement provides dual container protection such that containment is
ısured if the primary container fails.

aterial at Risk Description

iis 92% enriched EU-Pu alloy mixture from Argonne was categorized as Material Group
! in the Pu Vulnerability Assessment (PuVA), Appendix B.1, Section B.1.2, page 4.
ıe material is reported to be powder and one piece of rod, and to be contaminated with
, C, Al, Rb and Ge. The Batch number was 8-8-1828-772 under Project
C-AF-1540-10-B.

o deformation of the rim can was observed during the 12/17/92 inspection. However, it
possible for these containers to pressurize and/or for internal corrosion due to
ıdiolytic decomposition of the container seals or plastic bagging leading to HCl
eneration. The external pail container is stored in a controlled environment and is not
xpected to undergo corrosion.

Material Group 82 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment,
ınd this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject
ɔ an increase in source strength and heat buildup from daughter in-growth" (Appendix
C.1, VAF#FB-02), #FB-07 "Pu metals with major adverse conditions in FB-Line (age,
iigh thermal heat, PVC plastic packaging, etc.)" (Appendix C.1, VAF#FB-07), #FB-14
Materials that can not be monitored due to the outer packaging in FB-Line (5 gallon
ɔails, shipping containers or pressure cookers)" (Appendix C.1, VAF#FB-14), #FB-16
'Isotopic distributions of the FB-Line stored materials are different than assumed in
SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and
235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannah River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Alloys Pu-EU alloy from Argone CZA-126	C0, B2, C0	Vault	10 to 20 years	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

For the Pu-EU alloy mixture from Argonne, both items were placed in a mechanically sealed #2 can, placed inside a 20 mil PVC bag, then inside a mechanically sealed #3 can.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This 93% enriched EU-Pu-Zr alloy mixture from Argonne was categorized as Material Group 60 in the PuVA, Appendix B.1, Section B.1.2, page 5.

No failures of containers of this type of material are known. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the container seals or plastic bagging leading to HCl generation. The external container is stored in a controlled environment and is not expected to undergo corrosion.

Material Group 60 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-07 "Pu metals with major adverse conditions in FB-Line (age, high thermal heat, PVC plastic packaging, etc.)" (Appendix C.1, VAF#FB-07), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannan River Site

FACILITY (Building or Location)

PARTITIONED AREA: 4th Level Vau

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Package
Oxides	Enriched	Other EU-Pu Oxides FZC-552 & 564	, C0, , B2, , C0, ,	Vault	10 to 20 years	3

umulative Inventory Differences

0.0

ckaging Description

r the EU-Pu oxides high fired from Oak Ridge National Laboratory, the two C-DZA-552 items are packaged using the typical can-bag-can configuration and are red in the rack. The one FZC 564 item is also internally packaged as can-bag-can : is inside a 5 gallon pail with two other items.

s packaging arrangement provides dual container protection such that containment is sured if the primary container fails.

terial at Risk Description

s average 68% enriched EU-Pu oxide mixture from Oak Ridge was categorized as terial Group 70 in the PuVA, Appendix B.1, Section B.1.2, page 3.

failures of containers containing this type of material are known. However, it is sible for these containers to pressurize and/or for internal corrosion due to radiolytic omposition of the container seals or plastic bagging leading to HCl generation. ernal containers are stored in a controlled environment and are not expected to ergo corrosion.

erial Group 70 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject n increase in source strength and heat buildup from daughter in-growth" (Appendix , VAF#FB-02), #FB-13 "FB-Line materials with unknown composition or packaging figuration" (Appendix C.1, VAF-#FB-13), #FB-14 "Materials that can not be monitored to the outer packaging in FB-Line (5 gallon pails, shipping containers or pressure kers)" (Appendix C.1, VAF#FB-14), #FB-16 "Isotopic distributions of the FB-Line ed materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and -18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, #FB-18).

SITE: Savannan River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides EU-Pu Oxides from Argonne (CZA-124)	, C0, , B2, , C0,,,	Vault	10 to 20 years	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

For the EU-Pu oxide mixture from Argonne, both items were placed in a mechanically sealed #2 can, placed inside a PVC bag, then inside a mechanically sealed #3 can.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This average 76% enriched EU-Pu oxide mixture from Argonne was categorized as Material Group 76 in the PuVA, Appendix B.1, Section B.1.2, page 3. The material is PuO2/UO2 high fired pellets, 3/8" x 1/2" and chips. The material was pressed with beeswax prior to the firing of the pellets. A FB-Line Scrap Evaluation form indicates "beeswax should have been burned off in manufacturing process." No analysis was reported to support this assumption.

No failures of containers containing this type of material are known. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of internal beeswax, the container seals or plastic bagging leading to HCl and hydrogen generation. External containers are stored in a controlled environment and are not expected to undergo corrosion.

Material Group 76 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

ver Site | FACILITY (Building or Location) FB Line

PARTITIONED AREA: 4th Level

Question 3: HEU Holdings and Packaging

Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. Pacl
Enriched	Impure Oxides EU-Pu-Np Oxide from Lawrence Livermore (LZB-79)	P1, , B0, , B0,	Vault	10 to 20 years	

Differences

mixture from Lawrence Livermore Laboratory, the material was
astic jar 3 5/8" x 4" high, placed inside a 30 mil plastic bag,
then inside a 3 7/8" x 5 1/2" tin can.

nent provides dual container protection such that containment is
ontainer fails.

tion

u-Np oxide mixture from Lawrence Livermore Laboratory was
Group 77 in the PuVA, Appendix B.1, Section B.1.2, page 1.

containing this type of material are known. However, it is
ners to pressurize and/or for internal corrosion due to radiolytic
er container or plastic bagging leading to HCl and hydrogen
tainers are stored in a controlled environment and are not
osion. However, should the inner container and bagging fail,
y be attacked from within.

sessed in DOE/EH-0415, the Pu Vulnerability Assessment,
n vulnerability #FB-02 "Stored materials in FBL & 235-F subject
trength and heat buildup from daughter in-growth" (Appendix
; "Plutonium compounds (e.g., oxides) stored in direct contact
pendix C.1, VAF#FB-05), #FB-16 "Isotopic distributions of the
are different than assumed in SAR" (Appendix C.1,
"Aging and degradation of FB-Line and 235-F vault equipment"
8).

SITE: Savannan River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Ma (kg
Oxides	Enriched	Impure Oxides EU-Pu Oxides from HEDL (HRA-25)	C2, B2, B2, C0, V1,	Vault	10 to 20 years	30	

Cumulative Inventory Differences

0.0

Packaging Description

Thirty of the items from shipper account HRA-25 are packaged as follows: the material is placed in pint size paint cans, each individual can is then double bagged in 12 mil PVC, then placed in food pack cans, crimp sealed, and multiple crimp sealed cans are then placed in an FL-10-1 container which is welded shut. These 30 items are distributed amongst 9 FL-10-1 containers, which also contain Material Group 87 and 415 items.

These packaging arrangements provide dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This average 70% enriched EU-Pu oxide mixture from Hanford Engineering Deveopment Laboratory was categorized as part of Material Group 86 in the PuVA, Appendix B.1, Section B.1.2, page 4.

In October 1979, while unpackaging an FL-10-1 at SRS, cans were ejected from the end of the container resulting in personnel assimilations (SRP Separations Department Special Hazards Investigation No. 338 200-F Area). Failure of other weld sealed FL-10-1 tubes has not occurred. The EU-Pu oxide materials of HRA-25 contain impurities of carbides/silicon carbides. It is possible for the inner containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the inner container or plastic bagging leading to HCl, hydrogen and helium generation. External containers are stored in a controlled environment and are not expected to undergo corrosion. No weld sealed FL-10-1 has ruptured.

Material Group 86 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-15 "Material that may be unstable or result in high operator exposure during handling, unpackaging, and treatment (FB-Line & 235-F)" (Appendix C.1, VAF#FB-15), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannah River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mas (kg)
Oxides	Enriched	Impure Oxides EU-Pu High Fired Oxides From Hanford CSMO (HRA-25)	, C2. , B2. , B2, .	Vault	10 to 20 years	37	

Cumulative Inventory Differences

0.0

Packaging Description

Thirty-seven of the items from shipper account HRA-25 are packaged as follows: the material is placed in pint size paint cans, each individual can is then double bagged in 12 mil PVC, then placed in food pack cans, crimp sealed, and multiple crimp sealed cans are then placed in an FL-10-1 container which is welded shut. These 44 items are distributed amongst 11 FL-10-1 containers, which also contain Material Group 86 and 415 items.

These packaging arrangements provide dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This average 66% enriched EU-Pu oxide mixture from Hanford was categorized as part of Material Group 87 in the PuVA, Appendix B.1, Section B.1.2, page 4.

In October 1979, while unpackaging an FL-10-1 at SRS, cans were ejected from the end of the container resulting in personnel assimilations (SRP Separations Department Special Hazards Investigation No. 338 200-F Area). Failure of other weld sealed FL-10-1 tubes has not occurred. The EU/Pu/DU/NU oxide materials of HRA-25 contain impurities of carbides/silicon carbides. It is possible for the inner containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the inner container or plastic bagging leading to HCl, hydrogen and helium generation. External containers are stored in a controlled environment and are not expected to undergo corrosion. No weld sealed FL-10-1 has ruptured.

Material Group 87 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-15 "Material that may be unstable or result in high operator exposure during handling, unpackaging, and treatment (FB-Line & 235-F)" (Appendix C.1, VAF#FB-15), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannah River Site	FACILITY (Building or Location) FB Line
	PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides Pu-EU oxide from Oak Ridge National Laboratory FZC-584	U0, B0, U0, U1, D3,	Vault	10 to 20 years	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

For the Pu-EU oxide mixture from Oak Ridge National Laboratory, it is probable that the packaging is can, bag, can, can, 5-gallon pail. Last available data was 2 items inside beaker, inside PVC bag, inside isotopic shipper can, inside pail bag, inside 5 gallon pail.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This average 56% enriched Pu-Eu oxide mixture from Oak Ridge National Laboratory was categorized as Material Group 104 in the PuVA, Appendix B.1, Section B.1.2, page 3. This material is believed to be PuO2 scrap containing EUO2 (powder) with some Fe/Cr/Ni contaminants. The material is also believed to be high fired, therefore no oxidation is required.

No failures of containers containing this type of material are known. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the container seals or plastic bagging leading to HCl and H2 generation. External containers are stored in a controlled environment and are not expected to undergo corrosion.

Material Group 104 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment, and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-14 "Materials that can not be monitored due to the outer packaging in FB-Line (5 gallon pails, shipping containers or pressure cookers)" (Appendix C.1, VAF#FB-14), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

/er Site

FACILITY (Building or Location) FB Line

PARTITIONED AREA: 4th Level

Question 3: HEU Holdings and Packaging

Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. o Pack
Enriched	Impure Oxides EU High Fired CSMO Scrap Oxide from Hanford (HRA-25)	C2, B2, B2, C0, V	Vault	10 to 20 years	

Differences

shipper account HRA-25 are packaged as follows: the material is
t cans, each individual can is then double bagged in 12 mil PVC,
:k cans, crimp sealed, and multiple crimp sealed cans are then
ıntainer which is welded shut. These 5 items are distributed
tainers, which also contain Material Group 86 and 87 items.

gements provide dual container protection such that containment
y container fails.

ption

hed EU/NU/Pu oxide mixture from Hanford was categorized as
ıe PuVA, Appendix B.1, Section B.1.2, page 2. The materials are
ınium and Natural Uranium high fired oxides with potential Pu
, the accountability records show no accountable quantity of Pu.

ınpackaging an FL-10-1 at SRS, cans were ejected from the end
g in personnel assimilations (SRP Separations Department
gation No. 338 200-F Area). Failure of other weld sealed
ıccurred. These EU/Pu/NU oxide materials of HRA-25 are
atural uranium high fired oxides with slight Pu contamination. It is
ntainers to pressurize and/or for internal corrosion due to
of the inner container or plastic bagging leading to HCl,
neration. External containers are stored in a controlled
t expected to undergo corrosion. No weld sealed FL-10-1 has

assessed in DOE/EH-0415, the Pu Vulnerability Assessment,
hin vulnerability #FB-02 "Stored materials in FBL & 235-F subject
strength and heat buildup from daughter in-growth" (Appendix
12 "Stored compounds in FB-Line (e.g., oxides) with moderate
, packaged with PE plastic)" (Appendix C.1, VAF#FB-12),
ay be unstable or result in high operator exposure during
and treatment (FB-Line & 235-F)" (Appendix C.1, VAF#FB-15),
ıtions of the FB-Line stored materials are different than
ndix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of

SITE: Savannah River Site	FACILITY (Building or Locati
	PARTITIONED AREA:

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	F c

FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18).

SITE: Savannah River Site	FACILITY (Building or Location): FB Line PARTITIONED AREA: 4th Level Vault

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides EU-Pu Mixed Oxide From Batelle Memorial Institute (CAF-DZA-4)	, C0, , B2, , C0, ,	Vault	10 to 20 years	1	

Cumulative Inventory Differences

0.0

Packaging Description

For the EU-Pu mixed metal and oxide from Batelle, the item was placed in a mechanically sealed #2 inner can, placed inside a PVC bag, then inside a mechanically sealed #3 can and finally in a 5 gallon pail.

This packaging arrangement provides dual container protection such that containment is ensured if the primary container fails.

Material at Risk Description

This 92% enriched EU-Pu oxide mixture from Batelle was categorized as part of Material Group 94 in the PuVA, Appendix B.1, Section B.1.2, page 2.

No failures of containers containing this type of material are known. However, it is possible for these containers to pressurize and/or for internal corrosion due to radiolytic decomposition of the container seals or plastic bagging leading to HCl generation. External containers are stored in a controlled environment and are not expected to undergo corrosion.

Material Group 94 was assessed in DOE/EH-0415, the Pu Vulnerability Assessment and this material fell within vulnerability #FB-02 "Stored materials in FBL & 235-F subject to an increase in source strength and heat buildup from daughter in-growth" (Appendix C.1, VAF#FB-02), #FB-16 "Isotopic distributions of the FB-Line stored materials are different than assumed in SAR" (Appendix C.1, VAF#FB-16), and #FB-18 "Aging and degradation of FB-Line and 235-F vault equipment" (Appendix C.1, VAF#FB-18). The revised PuVA database now references three of the group's items as Material Group 480; the one remaining is the item identified in this assessment.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	FUNCTION: Storage Areas

Question 1: SITE

DOE Headquarters Facility Landlord: EM-60

DOE Headquarters Program Sponsor: EM-60

Facility Age: 45 Design Life: 0

Location of Facility on Site and Distance to Site Boundary

Building 235-F, constructed in 1952, was the first processing facility completed in F-Area at the Savannah River Site. The facility, a two story reinforced concrete structure, is located at the far east side of F-Area inside the Limited Area (LA). Along with the main 235-F structure, a dedicated sand filter (294-2F) and fan house (292-2F) constructed in 1985-87 are located within the 235-F Protected Area (PA). The 235-f Facility is located about 10 kilometers from the nearest Site boundary.

Design Mission, Interim Mission, Current Use

Building 235-F was constructed in the 1950s by DuPont as part of the original SRS Project and has been used for a variety of missions since that time. The only facilities that remain operational in Building 235-F are three vaults that provide storage of nuclear materials in support of various SRS missions. Building 235-F also houses the Plutonium Fuel Form (PuFF) Facility, an (old) metallography glovebox line that was part of the PuFF Facility, and the Plutonium Experimental Facility (PEF). These facilities were once used to fabricate heat sources from Pu-238 oxide powder for space program applications. A new Met Lab was constructed to support operations in the PuFF Facility and PEF but was never started up. Another facility, the Actinide Billet Line (AB Line), was most recently used to fabricate billets from Np-237 oxide powder for extrusion into reactor targets. There are no plans to activate any of these facilities, and the FSAR is based on the assumption that AB Line, PuFF Facility, PEF, and Met Lab will continue to satisfy the restrictions associated with the Cold Standby Mode as defined in the Operational Safety Requirements (Chapter 11)

Operational Status

In use (Vaults only)

Historical Information

The facility's initial mission (originally identified as the "C-Line") in 1952 was to accept Pu-239 metal from 221-FB-Line and cast/machine the metal into the desired geometric shapes necessary for the weapons stockpile. Operations associated with Pu-239 metal were never conducted. The building remained without a defined mission until the late 1950's.

In the late 1950's, plans were developed and construction began on the installation of a glove box/cabinet line consisting of twenty-six (26) gloves boxes and numerous smaller wing-cabinets that extended off the main configuration of glove boxes. A vault and a radiography facility were constructed in other areas within Building 235-F. The new facility within the 235-F building was named the Special Fabrications Line and occupied nearly all of the Radiologically Controlled Area (RCA) on the first level of the building. Processing equipment (unit operations) available in the facility consisted of a blender, a cold press, welding facilities, a hot press, furnaces, degreasing basins, and a Non Destructive Assay (NDA) cabinet. Building 235-F became known as the Special Fabrications Facility. In 1960, the line began operation producing various slugs and billets from the oxides of Np-237, U-235, U238, Pu-239, and Pu-242.

During the mid 1960's, a second glove box line was installed within the building at its far east end . This line, named the Alloy Line, was constructed primarily to cast and machine uranium alloyed metal cores for eventual insertion into aluminum housings for reactor targets. this line included, as equipment, an induction furnace (melter), a casting area, and a machining lathe. This facility was operated until the early 1970's. the facility was eventually Decontaminated and Decommissioned (D&D) in 1984-85.

stored. All vaults can store metals, oxides, and other solid forms/mixtures of plutonium, uranium, neptunium and thorium. Either standard DOT shipping containers or other storage containers not used for vehicle transit (e.g., primaries in a sealed container) can be stored depending on quantities.

List Authorization Basis

200 Area - Savannah River Plant - Separations Area Operations 238 PuO2 Fuel Form Facility (Sup1): DPSTSA-200-10-1, Rev. 6/83

200 Area - Savannah River Plant - Separations Area Operations - Building 235-F Vaults: DPSTSA-200-10-SUP-15, Rev. 8/86

Safety Analysis of the 238 PuO2 Experimental Facility: DPSTSA-700-30, Rev. 2/78

200 F-Area, Savannah River Site, Building 235-F: WSRC-RP-89-575 4/15/95 (Draft)

Operational Safety Requirements for 200-F and 200-H AREAS (Excluding Tritium and Waste Management): DPW-85-101, Revision 1 (6/88)

Technical Standards 237 Np Compact Billet Fabrication: DPSTS-235-F-NC, Revision 2 - 3/72, Sections: DPSTS-235-F-NC-1.00, Rev. 2/72, DPSTS-235-F-NC-1.03, Rev. 2/72, DPSTS-235-F-NC-1.06, Rev. 2/72, DPSTS-235-F-NC-1.09, Rev. 2/72

Technical Standards 238 PuO2 Fuel Form Facility, WSRC-TN-44, 0.01, Rev. 5, (11/93), Sections:DPSTS-235-F-PuFF-0.03, Rev. 4/80, DPSTS-235-F-PuFF-1.01, Rev. 1/83, DPSTS-235-F-PuFF-1.02, Re. 4/90, WSTC-TN-44, 1.03, Rev. 11/93, DPSTS-235-F-PuFF-1.04, Rev. 5/89, DPSTS-235-F-PuFF-1.05, Rev. 11/78,DPSTS-235-F-PuFF-3.01, Rev. 11/78, DPSTS-235-F-PuFF-5.11, Rev. 11/78, DPSTS-235-F-PuFF-7.01, Rev. 4/80

Technical Standards for Plutonium Experimental Facility: DPSTS-235-F-PEF, Rev. 4/78, Sections: DPSTS-235-F-PEF-1.01, Rev. 4/78, DPSTS-235-F-PEF-1.03, Rev. 4/78, DPSTS-235-F-PEF-1.05, Rev. 4/78, DPSTS-235-F-PEF-3.01, Rev. 4/78

Nuclear Criticality Safety Supplements: None

Basis for Interim Operation/Justification of Continued Operation: None

Test Authorization: None

Nuclear Incident Monitors Technical Standard: DPSTS-NIM-85, Rev. 1/86

DPSTS-235-F-PuFF-1.04, Rev. 5/89, DPSTS-235-F-PuFF-1.05, Rev. 11/78,DPSTS-235-F-PuFF-3.01, Rev. 11/78, DPSTS-235-F-PuFF-5.11, Rev. 11/78, DPSTS-235-F-PuFF-7.01, Rev. 4/80

Technical Standards for Plutonium Experimental Facility: DPSTS-235-F-PEF, Rev. 4/78, Sections: DPSTS-235-F-PEF-1.01, Rev. 4/78, DPSTS-235-F-PEF-1.03, Rev. 4/78, DPSTS-235-F-PEF-1.05, Rev. 4/78, DPSTS-235-F-PEF-3.01, Rev. 4/78

Nuclear Criticality Safety Supplements: None

Basis for Interim Operation/Justification of Continued Operation: None

Test Authorization: None

Nuclear Incident Monitors Technical Standard: DPSTS-NIM-85, Rev. 1/86

Describe Important or Unique Design Features

The 235-F reinforced concrete structure was originally designed and built as a blast resistent structure and has been shown to satisfy current DBE (Design Basis Earthquake) and Design Basis Tornado (DBT) criteria.

Building 235-F was designed and constructed in the early 1950s with applicable Du Pont Engineering Standards in effect. The facility and process systems have undergone many upgrades and modifications since initial construction. The 235-F building structure was designed as an MR structure, the highest structural classification at SRS. MR structures are built to resist loss of confinement integrity in all Design Basis Accidents (DBAs), including those from natural phenomenon or process related accidents such as explosions.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	FUNCTION: Storage Areas

Question 1: SITE

The facility, service systems, and process systems were designed in accordance with nationally recognized codes and standards as implemented using Du Pont Standards and Site Specifications. Presently, the principal design criteria for nonreactor nuclear facilities are established in DOE Order 6430.1A. Building 235-F is considered a "high hazard" facility for the purpose of determining applicability of DOE criteria that are a functionof facility hazard classification

Based on process hazards assessments, certain systems and components were determined to be important or critical to increasing process or facility safety and decreasing risk. These systems and components were designed with additional safety margins using higher factors of safety, component redundancy, or acceptance criteria than those in established national codes.

The 235-F systems, structures, and components were also designed to comply with federal government requirements established under the various cognizant agencies having plant oversight, such as the Atomic Energy Commission (AEC), the Energy Research and Development Agency (ERDA), and DOE. These agencies established general design criteria for the facilities within the weapons complex including those at SRS. Presently, the principal design criteria for use at nonreactor nuclear facilities are established in DOE Order 6430.1A. Verbatim compliance of older 235-F system components and structures to DOE Order 6430.1A guidelines is not possible in some cases; the increased risks associated with the noncompliant items must be acceptably small, or system upgrades and redesign are implemented.

Seismic: The design basis equthquake (DBE) for high hazard facilities (such as 235-F) at SRS is specified by DOE in UCRL 15910 as having a peak ground acceleration (PGA) of 0.19 g. The DBE has an estimated frequency of exceedance of 2 E-04 per year (5000 year return interval). The design basis tornado (DBT) for high hazard facilities at SRS os specified by DOE in UCRL 15910 as having a fastest speed of 137 mph. An importance factor of 1.35 is also specified which has the effect of increasing the fasted-mile wind speed to 185 mph for the purpose of estimating wind impact forces. UCRL 15910 also defines the atmosphereic pressure change and wind-driven missles that are assumed to accompany the DBT. The DBT has and estimated frequencey of exceedance of 2 E-05 per year (50,000 year return interval)

Ventilation:The primary ventilation design objective is control of airborne acitvity. This is achieved by maintaining the entire building (235-F) at a slight subatmospheric pressure and maintaining areas of increasing potential contamination (within the building) at progressively lower pressures.

Physical barriers separate the building into clean areas and radiologically controlled areas (RCAs). Each of these areas is served by a separate once-through ventilation systems consisting of supply and exhaust fans operating in a "push-pull" configuration.

Air locks are installed at interfaces between clean areas and RCAs to allow personnel to pass without loss of separation. The system exhausts air from rooms in the RCA; redundant fans located in Building 292-2F draw air into an exhaust tunnel, through a sand filter, and discharge to an elevated exhaust stack.

Process enclosures are exhausted by the system; redundant fans draw air through dual High Efficiency Particulate Air (HEPA) filters and discharge to the same exhaust tunnel that carries room exhaust to the sand filter and stack. Within most RCAs, air is supplied through ceiling panels and exhausted through wall-mounted registers near floor level. This sweeps particulate airborne contamination downward and away from operating personnel and also minimizes disturbance of loose surface contamination.

Interlocks based on exhaust tunnel vacuum prevent pressurization and partial sand filter bypass. Other interlocks

ɔressurizing the RCA above clean area pressure or decreasing clean area pressure below the t

.

enclosures were originally designed to be filled with inert gas. Thes process enclosures were s
tion systems for gas purification and cooling, and pressure was controlled by regulating the qu
ɜm. Most of the inert gas systems are no longer operational since the facilities are shut down
these process enclosures from an adjoining room and is discharged to the process exhaust sy
ɛPA filter. This maintains the process enclosures at a pressure slightly below room pressure.
lled at the inlets to the process enclosures to protect against back flow of contaminated air.

ɔower: Building 235-F normally receives electric power from the 200-F Area power loop via two
ners. One transformer is located at the ourtdoor substation designated as Building 252-20F. T
n Building 235-F. Both transformers are required in order to supply all loads; however, distribu
ıged so that redundant equipment such as the exhaust fans are powered from different transfo

generator, located in a separate structure adjacent to the south side of the building, provides s
ıg 235-F. The diesel is started automatically upon loss of normal power to any of the busses t
important process or auxiliary equipment. Dedicated batteries furnish an assured source of di

house (Building 292-2F) receives power from the 200-F Area loop via either of two transformers
ner (the normal feed) is locate in the ECR. The second transformer (alternate feed) is located
to the east side of Building 292-2F. Manual switches are used to transfoer loads from the nor
transformer. A diesel generator inside Building 292-2F automatically provides standby power
fans and the stack monitorinfg system during outages on the area loop.

ɔved lightning-arrestor system was install on the 13.8-kV loop in 1974. Since that time, the frec
utages due to lightning has been lower by a factor of about ten.

tection: Operating facilities have independent Halon fire systems designed for automatic opera
nd air-atmosphere process enclosures are equipped with smoke detectors, fixed temperature d
rate-of-temperature rise detectors. The detectors in each zone activate the Halon fire suppres
ıat zone. Halon is not supplied to AB Line cabinets because it in incompatible with one of the
ım powder) that was processed during prior operations. Halon systems have predischarge aları
a short time during which activation can be aborted from manual switches.

on systems serving each fire zone have a soak time of two to three minutes, depending on the
d. Each zone has promary and backup Halon supplies. In each of the process cell zones and
ɜr zones, two cylinders are supplied. The primary cylinder is automatically acutated by the dete
kup is manually actuated.

hazard in AB Line, PuFF Facility, PEF, and new Met Lab process enclosures is negligible beca
ent is deenergized, common combustibles are not present in the enclosures, and heat-producing
oxide) is no longer present in significant quantities.

ıreas of Building 235-F are not equipped with either fire detection or suppression systems, althou
nguishers are located throughout the building. Fire hydrants are located at the southeast and n
of the building, but there are no fire water lines inside the building.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	FUNCTION: Storage Areas

Question 1: SITE

The nearest fire station, located at the entrance to F Area, approximately one-half mile away, responds to fires in Building 235-F. The fire station is continously manned and backup is available from tow additional onsite fire stations.

Shielding: In general, shielding in Building 235-F facilities limits exposure to less than 0.5 mrem per hour in continuously occupied areas and less than 5 mrem per hour in intermittently occupied areas. These criteria comply with the requirements of DOE Orders 6430.1A and 5480.11. Specific shielding criteria and bases for each facility are listed below.

AB Line-The shielding design bases are to limit dose rates to 0.5 mrem per hour in the operating room and 15 mrem per hour or less in the mainntenance room. Maintandnce room shieleing recommendations assure that workers do not spend more than 10% of the work day in this area.

PEF-PEF shielding requirements were based on AEC Minimum Design Critwria for plutonium facilities, Technical Standard DPSTS-RN-0-02, and ALAP Design Concepts. In applying these criteria, the operating area was considered to be intermittently occupied. PEF shielding is provided only on the operation side of the line and is designed to limit radiation doses to 5 mrem per hour. Detailed shield design bases are no longer applicable because the facility is deactivated with only residual contamination remaining inside the process enclosures.

New Met Lab-the shielding design basis is not applicable because no radioactive material is present in the Met Lab.

PuFF-The PuFF Facility shielding requirements were based on AEC Minimum Design Criteria for Plutonium Facilities and Technical Standard DPSTS-RH-0.02. The radiation design dose rate and less than 0.5 mrem per hour in the continuously occupied control area (Shift Operating Base), less than 5 mrem per hour in intermittently occupied maintenance ares outside the cells, and 300 mrem per hour in the infrequently accessed annulus space under the cells, six inches from the storage compartments. The use of remote handling capabilities facilitated the attainment of operating area design dose rates with the less than 0.5 mrem per hour whole body guideline. Detailed shield design bases are no longer applicable because the facility is deactivated with only residual contamination remaining inside the process enclosures.

Vaults-In all facility vaults, occupancy time is controlled to meet the 1 rem per year design objective for DOE Order 6430.1A.The cooled storage array in one of the vaults is shielded to control radiation dose rates from the storage source well to less than 5 mrem per hour in the intermittently occupied area adjacent to the storeage well insid ethe vault and less than 0.5 mrem per hour in adjacent rooms. The basis for the shielding calculations is 100 storage positions in a 20 by 5 array. The current configuration is 71 positions on a 4 by 18 array.

Describe Weaknesses in the Design Basis

The 235-F systems, structures, and components were also designed to comply with federal government requirements established under the various cognizant agencies having plant oversight, such as the Atomic Energy Commission (AEC), the Energy Research and Development Agency (ERDA), and DOE. These agencies established general design criteria for the facilities within the weapons complex including those at SRS. Presently, the principal design criteria for use at nonreactor nuclear facilities are established in DOE Order 6430.1A. Verbatim compliance of older 235-F system components and structures to DOE Order 6430.1A guidelines is not possible in some cases; the increased risks associated with the noncompliant items must be acceptably small, or system upgrades and redesign are implemented.

Structural Design

Blast resistant

Partitioned Areas of HEU within facility

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	FUNCTION: Storage Areas

Question 1: SITE

PEF Material Balance Area

Description of Partitioned Areas

HEU Partioned Areas in 235-F

-Vaults-Vaults Barriers: 235-F building is a two-story windowless, reinforced-concrete structure approximately 224 ft long, 109 ft wide, and 28 ft high. It was originally designed and built as a blast-resistant structure and has since been evaluated to meet current design basis tornado and earthquake criteria.

There are two first-level vaults and one second-level vault. They have reinforced walls and other security devices. The majority of the material in the vaults is packaged in approved shipping containers, which provide the prrimary level of confinement. Secondary confinement is the vault walls, and tertiary confinement is the exterior structure of 235-F. The vaults' sole function is storage of material. No processing of materials is allowed in the vaults. The storage capacities of the vaults is based on Nuclear Criticality Safety calculations for the type of materials and the types of shipping containers stored in each vault.

-PEF Material Balance Area (MBA)

PEF MBA includes several first level rooms: the Non-Destructive Assay room, the New Met Lab, West Maintenance side of PuFF, and the Maintenance side of ABL. The PuFF and ABL room exhausts are connected to the exhaust system and flow through HEPA filters, the sand filter, and the stack. This reduces any type of release from the facility due to a materials release in one of these rooms. New Met Lab and the Shuffler room are in cleam areas and exhaust to the roof directly. Thes rooms have either small standards, or items is new packaging , with minimal chance of a release. Barriers: one (1) U-235 standard is stored in a shipping container, and several small U-235 standards are stored in a locked cabinet in the PEF MBA. These standards will be used to calibrate and set up Assay equipment in the 235-F facility. Functions: used as part of TRU waste assay equipment and Unmeasured Inventory project. Processes: used for the two projects above

Storage Capacities: these items are in temporary storage in 235-F, until the waste assay equipment and the Unmeasuered Inventory Project does not need the standards.

-Process Areas/Ventilation System

Process Area Barriers: PEF, ABL and the Old Met Lab contains glove boxes. PuFF contains heavily shielded concrete processing cells. The primary barrier is individual cells or wing cabinets designed to be leak-tight enclosures. The secondary barrier is the cell annulus which consists of the space between the process cells and their shield walls. The third barrier is the walls and the airlocks enclosing the regulated areas of the facility. The final barrier is the outer structure of 235-F. The ventilation system barriers: the dual HEPA filters before and after the process cells or wing cabinets, followed by the sand filter and finally the 235-F exhaust stack. All the process areas are currently out of service and contain only residual amounts of contamination. Initial assays of the ventilation system indicate small amounts of holdup material in several locations in the ductwork near the process areas.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

Currently there are no known hazardous materials collocated or comingled with HEU in the 235-F facility.

Process Material Transfers

All of the process areas in 235-F and currently shut down , so there are no process material transfers in the facility

SITE: Savannah River Site	FACILITY (Building or Location)	235F
	FUNCTION:	Storage Areas

Question 1: SITE

Shipping containers and other types of packaging are moved out of the vaults to the NDA Room for assay, and then transported back to the vaults. The current SAR will not allow unpacking of shipping containers in the facility.

Items received by the facility must be in approved shipping containers to be eligible to be stored in the vaults.

On-Site Transportation

Onsite transportation of materials to or from 235-F affects only the vaults. SOP 235-F-8060A, "Receipt, Relocation, Movement, or Transfer of Accountable Nuclear Materials (U)" is used by the facility to handle materials transfers into or out of the facility. Any packge moved onsite has to be approved and documented by the Packaging and Transportation Group up in 700-A.

Staff Levels & Experience

	Number of Employees	Average Building Experience (yr)	Range (yr)
Supervisory	6	10	5-20
Technical	4	3	0-5
Operators	4	10	5-20
Maintenance	4	5	3-10
Rad Technicians	2	3	0-5

Applicable References

'E: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: Vaults

estion 2: What barriers are used to protect the workers, the public and environment from HEU?

each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment.
) below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[ ] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[Y] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emgergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: Vaults

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Material confinement (the inner storage container or pail) is the first line barrier to the worker.

Most Shipping Containers (SC's) have multiple layers of containment.

The vault walls are designed to prevent worker exposure outside this containment barrier

The exhaust ductwork is designed to prevent worker exposure outside this containment barrier

Respiratory protection is used for worker protection when the risk is so justified

Public/Environment Barrier Narrative:

The facility boundary/building is the first line barrier to the environment.

The HVAC/confinement is designed to exhaust the process area airflow through HEPA filters, and then the facility sand filter, preventing a significant release to the environment

The site boundary provides an additional barrier between the facility and the public.

Criticality Barrier Narrative:

The vaults' sole function is storage of material. No processing of materials is allowed in the vaults. Storage capacitites and materria spacings used in the vaults are based on Nuclear Criticality Safety calculations for the specific types shipping containers and/or other types of containers stored in the vaults.

Criticality-DPSTSA-200-16, Sup 15 lists a credible scenario for a criticality being improperly storing three (3) five-gallon pails in a critical array. In the analysis used for the pending SAR, WSRC-RP-89-575, criticality is considered an incredible event.

Administrative Barrier Narrative:

The implementation of a Conduct of Operations program in 235-F teaches personnel to be inquisitive and be alert for unusual conditions or signs of adverse reactions.

Training of personnel on vault related activities provides them with a knowledge base of the materials and conditions within the vault.

Procedures are used for all vault activities and provide appropriate safety instructions which alert the worker to potential adverse situations. Procedures typically call for contamination surveys of items to be handled prior to work being performed.

Lessons learned from other facilities and across the Complex are utilized in alerting workers to potential stored material hazards and when applicable are implemented into procedures.

SITE: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: PEF Material Balance Area

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[ ] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limits
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[Y] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[ ] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[Y] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[ ] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Ba
2. Ba
3. Inc as

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site

FACILITY (Building or Location):

PARTITIONED AREA:

Question 3: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed; should be noted.

BARRIER TYPES			
Worker Barrier	Public/Environmental Barrier	Criticality [1]	Administrative Controls [2]
Y Gloveboxes	Y Facility/Building Boundary	Double Contingency Applied	Y Procedures
Transfer System	Y HVAC Confinement	Y Double Contingency Not Applied (Justify)	Y Maintenance
Y Duct	Liquid Containment/Dike	(e.g., Mass, Absorption, Geometry, Interaction, Concentration, Moderation, Enrichment, Reflection, Density)	Y Monitoring
Y Filter	Bay, Cells, Magazines		Y Configuration Control
Vault	Canyons		Y Quality Assurance
Y Room	Pads		Y Control of Operations
Hot Cell/Canyon	Y Site Boundary		Y Authorization Basis
Hood	Trenches		Y Training
Piping	Storage Vault		Organization
Y Shielding	Y Alarm System		Y Lessons Learned
Y Distance	Y Fire Suppression		Y Testing
Y Respiratory Protection	Y Other - Specify		Trending
Y Protective Clothing	Stack and sand filter		Records
Remote Handling			Standards
Confinement System			External Regulation
Burial Ground			Y Surveillance
Tanks			Personnel Reliability Assurance Program
Y Alarm System			Y Worker/Access Occupancy Limits
Temporary Barriers			Y Emergency Response
Other-specify			Other-specify
None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

cause significant "clean up" efforts.

Site Boundary: The facility is located 6.25 miles from the nearest site boundary line.

Alarm System: The regulated exhaust system is constantly monitored for release of contamination. Alarms sound within the facility proper (in the Shift Operating Base and the RCO Office) and remotely in the 221-F Canyon Control Room. Both the facility operating base and the Canyon Control Room are manned 24-hours a day. The Area Emergency Coordinator (AEC) is immediately aware of any potential release of air borne contamination.

Fire Suppression: The process areas are covered by fire detection and suppression (Halon) systems. However, as the old process areas are cleaned of combustible materials and electrical systems are de-energized, many of the Halon systems have been disconnected. The detection alarms are still active and sound alerts within the facility and the F-Area Fire Department. Both workareas are manned on a 24-hour basis.

Other — Sand Filter: The Sand Filter is also a very substantial concrete facility. Fans draw air from the 235-F facility, through the sand filter and exhaust the filtered air through a stack. The sand filter contains several feet of multi-sized stone and sand.

Criticality Barrier Narrative:

CRITICALITY —

The amount of fissionable material in the process areas is controlled to preclude the event of criticality. Materials outside of the vault storage areas must be 1) in nuclear safe shipping/storage packages and/or 2) proposed movements reviewed and approved by Separations Engineering and Nuclear Safety Group. The amount of material in "process holdup" (cabinets, gloveboxes, ductwork) does not present criticality concerns. Holdup in Process ductwork and in cells, cabinets and glove boxes in the old facilities in 235-F has been surveyed using several types of assay equipment. Conservative estimates of holdup in the facility have shown the amounts of holdup to be less than the critical mass of all isotopes processed in the facility.

Administrative Barrier Narrative:

ADMINISTRATIVE BARRIERS —

Procedures: Routine operations and maintenance activities are controlled and documented by Standard Operating Procedures. Special tasks, either planned or resulting from required corrective actions or maintenance, are controlled and documented by Special Procedures. These procedures contain appropriate steps (criticality safety, contamination control, etc.) to protect worker and facility safety.

Material Limits: Process areas that contain more than 15 grams of fissionable material (for either storage or NDA measurements) are controlled by posted Nuclear Safety Control Limits. The postings typically defined the material types, amounts and any spacing restrictions applicable to the room.

Monitoring: Various safety system alarms, such as, ventilation, emergency generator, high activity (air borne), fire detection, are sounded in the facility Shift Operating Base. This workarea is manned on a 24-hour basis. Additionally, routine building rounds are conducted on a 24-hour shift to monitor the status, operability of various safety alarms.

Configuration Control: The facility has Separations Engineering review pending activities for Unreviewed Safety Questions using the Authorization Basis documents for the facility.

Quality Control: The facility has Quality Assurance representatives that review activities and procedures used by the facility.

Conduct of Operations: The implementation of a Conduct of Operations program in 235-F teaches personnel to be inquisitive and be alert for unusual conditions or signs of adverse reactions.

Authorization Basis: The facility has an approved set of Authorization Basis documents that is used for evaluations of operating and maintenance procedures, facility modifications, and other types of proposed activities in the facility.

Training: Training of personnel on facility specific activities provides them with a knowledge base of the materials and conditions within the process areas. The implementation of a Conduct of Operations program in 235-F teaches personnel to be inquisitive and be alert for unusual conditions or signs of adverse reactions.

Lessons-Learned: Lessons learned from other facilities and across the Complex are utilized in alerting workers to potential material hazards and when applicable are implemented into procedures.

Testing: The facility uses approved ooerating procedure for routing testing, maintenance and calibration of equipment. Other types of tests require an approved special procedure, including a review of the activity by Separation Engineering against the Authorization Basis documents for the facility.

SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: Process Areas/Ventilation System

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Surveillance: Building surveillance tours (with procedurally controlled checklists) are conducted on a 24-hour basis by Operations personnel. Daily, weekly and monthly surveillance routines (with procedurally controlled checklists) are conducted by Radiological Control Organization (RCO) personnel.

Worker/Access Occupancy Limits: Facility access is limited to personnel assigned to the facility and others (support groups, auditors, etc.) required to perform work. Personnel requiring limited access to the facility must be approved by an Operations representative — the security posture (Category I Storage Area) prevents unauthorized entry.

Emergency Response: The facility is normally staffed at minimal levels (two operators and a "roving" supervisor during off-shifts). As such, the facility is manned to only monitor and make immediate responses to alarm or unusual conditions. In the event of a declared emergency, the facility falls under the control of the Area Emergency Coordinator (AEC). The AEC, i.e., the F-Canyon Senior Supervisor, is authorized to assign appropriate area personnel (RCO, E&I, etc.) to control and mitigate the emergency condition within the 235-F facility.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 115	, C0, , B0, , C0, ,	Vault	>20	1	0.00

Cumulative Inventory Differences

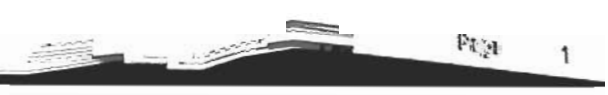
0.0

Packaging Description

Can, bag, can, in 5 gal pail

Material at Risk Description

EU-Pu-Zr alloy
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94, Appendix B.2.2, p. 4
Material Group 115
Potential adverse condition-plastic degradation due to heat



SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 411	, U0, , D3,,	Vault	>20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, in 10 gal drum

Material at Risk Description

EU-Pu compound
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 411
Adverse condition-plastic degradation due to heat, corrosive compounds

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 117	, C0. , B0. , C0. ,	Vault	>20		

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 5 gal pail

Material at Risk Description

EU-Pu-Ti alloy
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 117
Potential adverse condition-plastic degradation due to heat

1.
2.
3.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 569	, C0, , B2, , C0, ,	Vault	10-15	8	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can in 55 gal drum

Material at Risk Description

EU-Pu compounds
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 569
Potential adverse condition-plastic degradation due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 411	, U0, , X1,... , W1,	Vault	>20	1	0

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging in 110 gal drum

Material at Risk Description

EU-Pu compound
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 411
Adverse condition-plastic degradation due to heat, corrosive compounds

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 569	, C0, , B2, , C0, ,	Vault	10-15	8	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can in 55 gal drum

Material at Risk Description

EU-Pu compounds
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 569
Potential adverse condition-plastic degradation due to heat

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Holdup	All	Materials in pipes, tanks. ducts, etc 392/400/408	, T0.	Process Area	>30	1	0

Cumulative Inventory Differences

0.0

Packaging Description

Small amount of EU in ductwork holdup in process areas.

Material at Risk Description

Small amount of EU in old process ductwork
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 4
Material Groups 392/400/408

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 177/409	, C0, , B2, , , C0,	Vault	>20	3	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (3 PVC bags), can, in 55 gal drum

Material at Risk Description

EU-DU-Pu material, EU-Pu compound
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Groups 177/409
Adverse condition-plastic degradation due to heat, corrosive compounds

SITE: Savannah River Site

FACILITY (Building or Location) 235-

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 437	, B0, , D3, , 7	Vault	10-15	1	

Cumulative Inventory Differences

0.0

Packaging Description

Material in plastic sheets, inside 7A, (5 gal pail)

Material at Risk Description

HEU VA Assessment Item
Converter plate from unirradiated fuel assembly encased in plastic sheets

Material Group 437
Potential adverse condition-material in contact with plastic

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 217	, C0, , B0, , C0, ,	Vault	>20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 5 gal pail

Material at Risk Description

HEU VA Assessment Item
EU-C-P-S alloy (passivated), contaminated with Pu
Material Group 217
Potential Adverse condition-oxidation of material

SITE: Savannah River Site

FACILITY (Building or ... on) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 197	, C0, , B0, . C0, .	Vault	15-20	9	[illegible]

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 55 gal drum

Material at Risk Description

HEU VA Assessment Item
EU alloy contaminated with Pu
Material Group 197
Potential adverse condition-oxidation of material

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 186	C0, B0, C0, D3,	Vault	>20	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 5 gal pail

Material at Risk Description

HEU VA Assessment Item
EU-Zr alloy, contaminated with Pu
Material Group 186
Potential adverse condition-oxidation of material

SITE: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Pure metal 163/191	, U0, , D2,,	Vault	>20	2	000

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, 30 gal drum

Material at Risk Description

U metal, formed Pu metal
Discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 1
Material Groups 163,191
Potential adverse condition-oxidation, plastic degradation due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Alloys 164	, C0, , B0, , C0, .	Vault	>20	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

can, bag, can in 55 gal drum

Material at Risk Description

Pu-EU alloy
Discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 4
Materials Group 164
Adverse conditions-plastic degradation due to heat, container degradation due to corrosive compounds.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Pure metal 173	, C0, , B2, , C0, ,	Vault	>20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

an, bag (PVC), can, in 55 gal drum

Material at Risk Description

U-Pu metal and powder
iscussed in WSRC-TR-94-0299, Pu VA, 8-31-94
ppendix B.2.2, p. 2
laterial Group 173
otential adverse condition-degradation of plastic due to heat

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 187	, C0, , B2, , C0, ,	Vault	>20	1	0

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can, in 5 gal pail

Material at Risk Description

EU-Pu-Ti alloy passivated, with Zr oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 187
Adverse conditions-large surface area of material, degradation of plastic due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 191	, U0, , D2,	Vault	15-20	4	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, in 30 gal drum

Material at Risk Description

EU-Pu metal, formed
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 1
Material Group 191
Potential adverse conditions-degradation of plastic due to heat

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Impure 187	, C0, , B2, , C0, ,	Vault	>20	1	

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can, in 5 gal pail

Material at Risk Description

EU-Pu-Ti alloy passivated, with Zr oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 187
Adverse conditions-large surface area of material, degradation of plastic due to heat

SITE: Savannah River Site	FACILITY (Building or Lo[illegible]n) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Alloys 194	, C0, , B2, , C0, ,	Vault	>20	13	0(

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can in 5 gal pail

Material at Risk Description

EU-Pu-Zr alloy
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 4
Material Group 194
Adverse conditions-large surface area of materials, degradation of plastic due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Alloys 194/185	, V3, , V5. , X3,	Vault	>20	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Steel cylinder sealed with screwed plug and elastomer O-ring, inside a steel cylinder sealed with a bearing plate, inside a metal tubing framework (birdcage)

Material at Risk Description

Pu-EU-Zr alloy-compound
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 4
Material Groups 194/185
Adverse conditions-large surface area of materials, degradation of plastic due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Pure metal 215	, D3, , D1,,	Vault	>20	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

inner container is 15 gal drum,
outer container is 55 gal drum

Material at Risk Description

recastable pure enriched uranium metal or oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 1
Material Group 215
Potential adverse conditions-oxidation, unknown packaging

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA. Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Metal	Enriched	Pure metal .l-area Std	, C0. , B0, , C0, ,	Other-specify PEF MBA	?	1	

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 55 gal drum

Material at Risk Description

HEU VA Assessment Item
HEU metal from M-Area to use for Shuffler calibration
Can, in 6M-2R inner container, inside 55 gal drum
Potential adverse condition-oxidation

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 176	, C0, , B0, , C0, ,	Vault	15-20	9	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can, in 10 gal drum

Material at Risk Description

HEU VA Assessment Item
EU high fired oxide contaminated with Pu
Material Group 176
Potential adverse conditions-large surface area of material

SITE: Savannah River Site

FACILITY (Building or Location 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 860	, U0. , D2., , W1,,	Vault	>20	24	

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging , in 30 gal drums

Material at Risk Description

HEU VA Assessment Item
EU-Pu oxides
Category 860
Potential adverse conditions-large surface area of material, unknown packaging

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 168	, C0, , B0, , C0, ,	Vault	15-20	4	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can in 55 gal drum

Material at Risk Description

HEU VA Assessment Item
Pu-EU oxide
Material Group 168
Potential adverse condition-oxidation, large surface area of material

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 169	, U0, , D2,	Vault	5-10	21	0

Cumulative Inventory Differences

0.0

ackaging Description

nknown packaging, 30 gal drum

aterial at Risk Description

U-Pu oxide, Am-241
scussed in WSRC-TR-94-0299, Pu VA, 8-31-94
ppendix B.2.2, p. 1
aterial Group 169
dverse conditions-plastic degradation due to heat, container degradation due to
rrosive materials

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 172	, U0, , D3,	Vault	>20	3	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, 10 gal drum

Material at Risk Description

EU-Pu-Zr oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 172
Adverse conditions-large surface area of material

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 189	. C0. , B0. , C0. ,	Vault	>25	7	[illegible]

umulative Inventory Differences

0.0

ckaging Description

n, bag, can in 5 gal pail

terial at Risk Description

-Pu compound
cussed in WSRC-TR-94-0299, Pu VA, 8-31-94
pendix B.2.2, p. 1
terial Group 189
tential adverse conditions-plastic degradation due to heat

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 198/216	, U0, , D3,	Vault	15-20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, in 10 gal drum

Material at Risk Description

Pu oxide, impure EU oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 1, 2
Material Groups 198/216
Potential adverse conditions-plastic degradation due to heat, unknown packaging

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 199	, U0, , D2,	Vault	15-20	24	

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging in 30 gal drum

Material at Risk Description

EU-Pu oxides, high fired
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 199
Adverse conditions-large surface area of materials, plastic degradation due to heat, container degradation due to corrosive materials

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 242	, B0, , C0, , B0, ,	Vault	10-15	5	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Bag, can, bag, in 30 gal drum

Material at Risk Description

EU-Pu oxides, high fired
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 242
Adverse conditions-Plastic in contact with materials, plastic degradation due to heat, container degradation due to corrosive materials

SITE: Savannah River Site

FACILITY (Building or Location) 3F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 417	, U0, , D3,, , W1,	Vault	>20	1	

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging in 10 gal drum

Material at Risk Description

EU-Pu oxides, high fired
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 417
Potential adverse conditions-unknown packaging

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 417	, B2, , B2, , C0, ,	Vault	>20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Bag (PVC), bag (PVC), can, in 10 gal drum

Material at Risk Description

EU-Pu oxides, high fired
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 417
Potential adverse conditions-unknown packaging

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 46/47/428	, C0, , B2, , C0, ,	Vault	>20	4	

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can, in 55 gal drum

Material at Risk Description

EU-Pu oxides and compounds
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Groups 46/47/428
Adverse conditions-large surface area of materials, plastic degradition due to heat, container degradation due to corrosive materials

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Oxides	Enriched	Impure Oxides 413	, U0, , D3,	Vault	>20	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging , in 10 gal drum

Material at Risk Description

EU-Pu oxides
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 413
Adverse conditions-plastic degradition due to heat, container degradation due to corrosive materials

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages
Oxides	Enriched	801	, U0, , D2,	Vault	10-15	9

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging in 30 gal drum

Material at Risk Description

EU-Pu oxides
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 801
Adverse conditions-large surface area of materials, plastic degradition due to heat, container degradation due to corrosive materials, unknown packaging

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 119	, C0, , B0, , C0, ,	Vault	>20	3	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag, can in 5 gal pail

Material at Risk Description

EU-Pu-Th alloy, -20 mesh
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 119
Potential adverse condition-plastic degradation due to heat

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Wgt (Kg)
Compounds	Enriched	Other 158/285	, C0, , B2, , C0, ,	Vault	>20	2	

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can in 55 gal drum

Material at Risk Description

EU-Pu compounds, DU-Pu oxide
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Groups 158, 285
Potential adverse condition-plastic degradation due to heat, also high material surface area

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 184	, U0, , D3,	Vault	>20	15	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging in 5 gallon pail

Material at Risk Description

EU Desicoolers residues, offsite and local
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 184
Adverse condition-corrosive compounds, hig material surface area

Savannah River Site

FACILITY (Building or L ...tion) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Compounds	Enriched	Other 185	, C0, , B2, , C0, ,	Vault	>20	1	

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can, in 5 gal pail

Material at Risk Description

EU-Pu-Zr compound
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 4
Material Group 185
Potential adverse condition-plastic degradation due to heat

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Other 183	, C0, , B2, , C0, ,	Vault	>20	1	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Can, bag (PVC), can in 5 gal pail

Material at Risk Description

Pu-EU lab residue
Discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 2
Material Group 183
Adverse conditions-large surface area of materials, plastic degradition due to heat

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Unirradiated 178/298/570	, U0, , D3,,	Vault	>20	4	

Cumulative Inventory Differences

0.0

Packaging Description

Unknown packaging, in 5 gal pail

Material at Risk Description

EU-Pu reject fuel rods
discussed in WSRC-TR-94-0299, Pu VA, 8-31-94
Appendix B.2.2, p. 3
Material Group 178
also Material Groups 298, 570-contains Uranium nitrides
Adverse conditions-plastic degradition due to heat, container degradation due to corrosive materials, unknown packaging

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other 427	, P0, , B0, , D4, ,	Vault	5-10	2	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Plastic bottle in 5 gal pail

Material at Risk Description

HEU VA Assessment Item
EU Standards
Material Group 427
Potential adverse condition-materials in contact with plastic

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other 212	P2, D3,	Vault	5-10	2	1

Cumulative Inventory Differences

0.0

Packaging Description

Plastic bottle in 5 gal pail

Material at Risk Description

HEU VA Assessment Item
EU Standards
Material Group 212
Potential adverse condition-materials in contact with plastic

SITE: Savannah River Site

FACILITY (Building or Location) 235F

PARTITIONED AREA: Vaults

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Sealed Sources 319	, P2, , W1, , B0,	Other-specify PEF MBA	10-15 ?	31	0.00

Cumulative Inventory Differences

0.0

Packaging Description

J standrds from 247-F, in plastic containers, inside cardboard cartons, inside plastic bag

Material at Risk Description

HEU VA Assessment Item
J standards from 247-F, in plastic containers, inside cardboard cartons, inside plastic bag
Material Category 319
Potential adverse condition-materials in contact with plastic

Question 4: POTENTIAL CAUSES

container, which is subsequently placed within the celotex lined steel shipping drum. In this arrangement, adverse reactions such as the thermal breakdown of the plastic bag will generate gases (hydrogen and HCl) in the atmosphere between the two cans. This pressure may cause failure of the containment boundry provided by one or both of the can, and possibly the shipping container containment boundary as well. This can result in the loss of a containment barriers and potential exposure to the worker. The situation may be further compounded by secondary reactions between the gases and the plutonium materials that can occur if the inner can fails. For example, the reaction of hydrogen with plutonium metal produces plutonium hydride, a potentially hazardous species.

-Pyrophoricity, In this arrangement, the thermal breakdown of the plastic bag will generate gases (hydrogen and HCl) in the atmosphere between the two cans. This pressure may cause failure of the containment boundry provided by one or both of the cans. If the inner can on a metal item fails, the gases will be allowed to come in contact with the metal, generating of potentially hazardous species. This can result in the loss of a containment barriers and exposure of potentially pyrophoric materials to the environment contained within the shipping container.

-Radiolysis- Breakdown of the plastic material (from both radiation and heat) will create various gaseous species which can pressurize the innermost plastic bag and react with the stored metal. The plastic is constantly bombarded by the plutonium alpha radiation causing severe damage to the plastic. This radiolysis process can quickly degrade the organic material and possibly result in containment failure. The likelyhood of seconday reactions is also present. The majority of the materials stored in 235-F are packaged in shipping containers with can-bag-can packing providing the innermost containment barriers. Shipping containers range in size from 10 to 55 gallons. In this arrangement , the thermal breakdown of the plastic bag will create gases. If the seals on the cans are good, the gases will pressurize the volume between the two cans. Over time, the gases will build pressure and jeopardize one, or both, of the containment barriers provided by the cans. Failure of the outer can may result in pressurization of the 2R, and dispersal of the hazardous species developed during the breakdown of the plastic within the 2R.

It is unlikely that the pressures developed during H and HCl gas generation will be sufficient to violently rupture the 2R containment vessel. However, a breach of the 2R resulting from radiolytic decomposition of seal material or corrosion is more probable. It is unlikely that the leak would be large enough to allow an on-rush of air sufficient to cause a fire due to hydride material oxidation. However, a leak of this nature provides a path for contamination to reach the inside wall of the steel shipping container. Because of the age of many of the shipping containers in storage, if contamination reaches the inside walls of the containers, it is possible that it will ultimately show up on the ouside surfaces. The path being through container-lid interface and/or vent plugs.

Once the inner can has failed, the plastic packing between the two cans will potentially be directly exposed to the plutonium alpha radiation. This will cause radiolytic, in addition to the therrmal, degradation of the plastic packaging. The result being another method by which H, and possibly HCl gases, will be generated from the plastic bags, adding to the presurization of the outer container. The likelyhood of seconday reactions is also present.

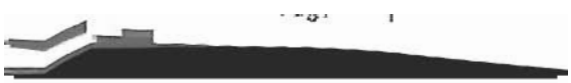
For the purposes of grouping, HEU materials with any type of plastic used in the packaging or if the packaging is unknown are considered to pose a similar higher risk for adverse events. Materials groups in this category include groups 437, 860, 427, 212, and the 247-F HEU standards

-Oxidation, As inner packaging fails on metal items in storage, the metal is exposed to additional atmosphere, resulting in oxidization and volumetric expansion. This expansion can jeopardize additional containment barriers. The materials in groups 427, 212, 247-F HEU standards,have significant amounts of powdered material or contain small enough pieces to have a high ratio of surface area to mass, and subsequently a high propensity to oxidize.

Inadequate Configuration Knowledge-

The Authorization Basis prohibits opening of shipping containers within the facility. The inability to view the inner packing and container contents eliminates our ability to detect a suspect container, thus increasing the risk to workers from a potential container rupture and contamination release.

Currently, the only surveillance performed on stored containers is a random survey for surface contamination.



SITE: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: Vaults

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[ ] Fire	[ ] Criticality	[ ] Loss of Site Integrity
[ ] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[Y] Breach of Packaging	[Y] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criiticality
[ ] Leakage/Spills	[ ] Other-specify	
[ ] Other Accidents-specify		
[ ] Structural Failure		
[ ] Equipment Failure		
[Y] Material Release		
[ ] Increased Radioactivity Level		
[ ] Other-specify		

Describe Each Effect Identified Above:

Breach of Container, causing Material Release and Contamination

The degradation of packaging materials due to aging and radiolysis coud cause pressurization of a primary container. Shipping containers provide an extra layer of protection, due to their secondary containers enclosing the primary containers, and the outer shipping container enclosing the secondary container. The main uncertainty here is not being able to inspect the inner containers, since the current SAR of the facility will not allow unpacking and repacking of shipping containers.

This vulnerability could result in a release from the facility, as discussed in the 235-F SAR (DPSTSA-200-10, SUP-15). The SAR contains an estimate of the dose associated with a release due to primary container rupture as a result of pressurization. The estimate is based on the maximum quantity of material allowed in a primary container becoming airborne as a result of a catostrophic container failure. (The isotopic distribution of the material studied is described in the SAR.) The SAR estimates the frequency of this occurrence to be .024/year with associated consequences of 14 REM exposure to the operator . The maximum dose to an offsite individual is estimated to be 1.2 x 10-4 REM.

This scenario is based on a maximum amount of Plutonium oxide being released and dispersed in one of the vaults. A release of HEU would have a lesser effect due to the U-235 particle size being larger than Pu-238 or Pu-239. This makes U-235 less likely to become airborne, and lowers the amount of material that would be respirable to an operator. This also lowers the amount of material that could be released offsite.

SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: PEF Material Balance Area

Question 5: POTENTIAL EFFECTS

Facility	Material	External
☐ Fire	☐ Criticality	☐ Loss of Site Integrity
☐ Explosion	☐ Material Release	☐ Loss of Building Integrity
☐ Contamination	☒ Breach of Packaging	☐ Release of Materials
☐ Criticality	☐ Fire	☐ Radiation and Releases from Criiticality
☐ Leakage/Spills	☐ Other-specify	
☐ Other Accidents-specify		
☐ Structural Failure		
☐ Equipment Failure		
☐ Material Release		
☐ Increased Radioactivity Level		
☐ Other-specify		

Describe Each Effect Identified Above:

A vulnerability does not exist for the PEF MBAs due to the small quantities of material contained in the 247-F sources, and their configuration (atomic swipe, inside a plastic bag, inside a cardboard carton). The M-Area source is metal, sealed in an inner can inside an outer shipping container. This container is not opened in the facility, so there is no identified release mechanism.

SITE: Savannan River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Material Release (Material)	Y	Y		Y					

Explanation

Material Release in Vaults Caused by Breach of Container

This vulnerability could result in a release as discussed in the 235-F SAR (DPSTSA-200-10, SUP-15). The SAR contains an estimate of the dose associated with a release due to container rupture as a result of pressurization. The estimate is based on the maximum quantity of material allowed in a shipping container becoming airborne as a result of a catostrophic container failure. (The isotopic distribution of the material studied is described in the SAR.) The SAR estimates the frequency of this occurrence to be .024/year with associated consequences of 14 REM exposure to the operator . The maximum dose to an offsite individual is estimated to be 1.2 x 10-4 REM.

This scenario is based on a maximum amount of Plutonium oxide being released and dispersed in one of the vaults. A vulnerability exists for the worker. Release of Uranium material is not specifically described in the current SAR. For the purpose of this assessment, it is assumed that Uranium can be released from the facility and can reach the ground outside the facility. Therefore, it is assumed that there is no vulnerability to the water, air, or public.

Applicable References

(Building or Location): 435

PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public	
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure
Contamination (Facility)	Y	Y		Y				

Explanation

Applicable References

Page 1

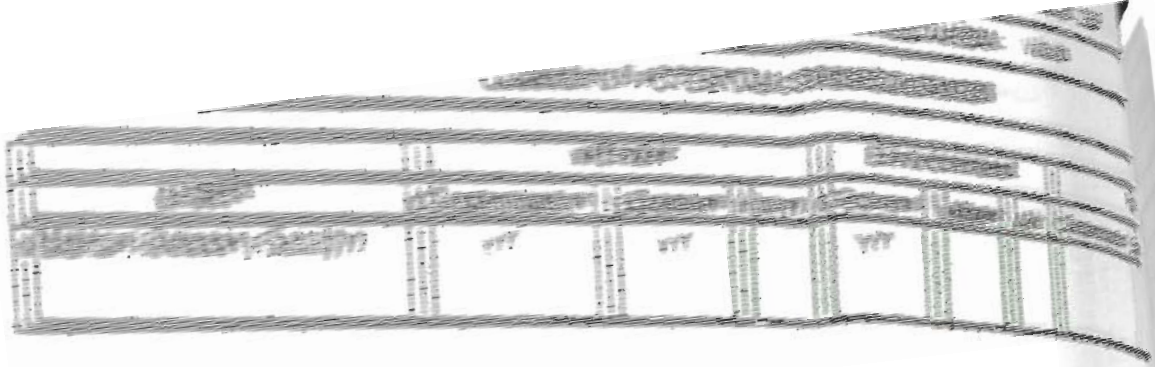
SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Release of Materials 0				Y					

Explanation

Applicable References



SITE: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
each of Packaging	Y	Y		Y					

Explanation

Applicable References

SITE: Savannah River Site

FACILITY (Building or Location): 235F

PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Material Release (Facility)	Y	Y		Y					

Explanation

Applicable References

SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: Vaults

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Breach of Packaging	Y	Y		Y					

Explanation

Applicable References

SITE: Savannah River Site	FACILITY (Building or Location): 235F
	PARTITIONED AREA: PEF Material Balance Area

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public	
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure
Breach of Packaging								

Explanation

A vulnerability does not exist for the PEF MBAs due to the small quantities of material contained in the 247-F sources, their configuration (atomic swipe, inside a plastic bag, inside a cardboard carton). The M-Area source is metal, sealed inner can, inside an outer shipping container. This container is not opened in the facility, so there is no identified release mechanism.

Applicable References

Question 7: Site Summary

Site: Savannah River Site

Provide an overall assessment of the site ES&H vulnerabilities.

Important ES&H Concerns

Storage Areas

Certain stored materials in the 235-F vaults may be packaged such that the metal SNM is in direct contact with plastic bags or containers. While this configuration is not known to exist, the lack of sufficient packaging information allows this to be a suspected arrangement. Since the metal is in very close proximity to the plastic, radiolysis and thermal breakdown of the plastic can occur at a rapid pace, resulting in the generation of hydrogen, and possibly HCl, gases. These gases will cause pressurization of the immediate confinement barrier, and are able to react with the metal forming corrosive and pyrophoric materials. Over time the degradation of the plastic will result in a loss of containment barriers, possible ignition of the pyrophoric species, and subsequent increased risk to the worker for release of contamination.

Description of HEU activities.

The highest risk activity in the 235-F facility is storage of HEU materials in containers with unknown packaging or plastic in contact with the materials.

Current planned actions.

Plans are in place to either repackage or process the HEU stored in the 235-F vaults. SRS is currently authorized per the SRS Site Integrated Stabilization Management Plan, Rev. 3, dated 3/20/96, to stabilize the HEU material by the end of FY-2002.

Noteworth program or practices.

SRS Site Integrated Stabilization Management Plan, Rev. 3

[illegible]

DOE Headquarters Facility Landlord:
DOE Headquarters Program Sponsor: [illegible]
Facility Age: 10

Location of Facility on site and distance to site boundary

The 247-F Fuel Material Facility (FMF) is located in the [illegible] kilometers from the nearest plant boundary.

Design Mission, Interim Mission, Current Use

The mission of the 247-F Facility was to convert [illegible] Nuclear Propulsion Program. This mission [illegible] the 247-F Facility. At different times [illegible] (SAR) Addendum and Operational Safety Requirements [illegible] anticipated missions. Recent DOE budget [illegible] the surveillance & maintenance expenditures [illegible] formally Deactivate the 247-F Facility. Facility operations [illegible] shutdown.

Operational Status

Not operating

Deactivating

Historical Information

The Naval Fuel Manufacturing Facility (247-F) was [illegible] Department of Energy office through which Naval Reactors [illegible] was built in the early to mid 1980s for an estimated cost of [illegible] million. [illegible] uranium feedstock into a useable fuel form in support of the Navy's Nuclear Propulsion Program. In September of 1989 the decision was made to shut down the Savannah River Site's 247-F Facility and continue to operate Naval Fuel Services, Inc. (NFS), a privately-owned fuel fabrication plant in Oak Ridge, Tennessee. Naval Reactors initially directed that the 247-F Facility be placed in an "environmentally sound, non-operational status capable of restart". On October 31, 1989, a Shutdown Plan [illegible] and letter to proceed were issued for the shutdown of the 247-F Naval Fuel Facility.

Facility shutdown was completed per the plan. Process systems were taken out of service. Facility support systems, such as the Heating, Ventilation, and Air-Conditioning (HVAC) System, the Instrument Air (IA) System, the diesel generator, and various monitoring systems were left as-is. Utility services were left as-is. Equipment modifications were made to accomplish individual system layups. Wastes generated as a result of the shutdown were properly dispositioned. Environmental permits were canceled or revised to suit new facility conditions. Drums of hazardous chemicals were removed from the facility while all process systems were flushed, drained, and certified to be at or below Shutdown Plan clean limits. A thorough assay was performed on all process systems at the end of the shutdown effort (around August 1990). This assay concluded there was a significant quantity of uranium still unaccounted for. It is also likely that some "unaccounted for" uranium can be attributed to inaccuracies in the determination of system uranium content. Shutdown and stabilization efforts were further simplified by the absence of asbestos containing materials in the facility. Electrical and mechanical shop areas, the lunchroom, the computer rooms, the administrative office area, and other non-process areas remain are utilized by Nuclear Material Stabilization Program (NMSP) personnel. The Naval Fuel Facility is now funded by EM, the Office of Environmental Management.

Since the facility was shut down, a mission to store fissile material in the 247-F Vault has been considered. A Safety Analysis Report (SAR) addendum was prepared and Operational Safety Requirements were generated in support of the anticipated mission. Required support systems, with their associated overhead costs, were left in service.

The mission to use the 247-F Vault is no longer being considered, and the facility is pursuing formal Deactivation. Studies are currently underway to determine whether the Hazard Category of the facility can be lowered from Category 2. This redetermination is needed to finalize the Deactivation Plans and Schedules.

List Authorization Basis

Safety Analysis Report: Naval Fuel Manufacturing Facility - 200-F Area - Savannah River Plant: DPSTSA-200-26, August 1985.
Operational Safety Requirements for the Naval Fuel Manufacturing Facility: DPW-88-101, 3-30-88.
Technical Standards, Naval Fuel Material Facvility: DPSTS-247, 2-21-89
Nuclear Criticality Safety Supplements: None
Basis for Interim Operation/Justification for Continued Operation: None
Test Authorization: None
Nuclear Incident Monitors Technical Standard: DPSTS-NIM-85, Rev. 01/86.

Describe Important or Unique Design Features

The 247-F Facility was constructed in the early to mid 1980s. It is a steel frame structure with concrete slab floors. Exterior walls are constructed of foam filled metal sandwich panels.
Original roofs are built up on metal decking of foam insulation and elastomeric membrane with either a protective stone cover or, in areas where equipment is installed, a concrete slab cover. Recently, major areas of the elastomeric membrane roofing was replaced with a built up modified bitumen roofing system.The administrative wing is standard two story construction. Part of the main process area is also two story, with each story apoproximately 20 feet high. The process area consists of 27,800 square feet of space on the first level and 12,000 square feet on the second level. The balance of the building is one story.

DuPont, DOE and national specifications were used in the design of the facility. A listing of these specifications is included in section 3.1 of the SAR.

The building was constructed in accordance with DOE Order 6430 with the exception that the wind design criteria is for 100 year wind speeds instead of 1000 year speeds. This exception was consistent with NRC regulations for similar licensed facilities, and authorized by DOE-SR.

The processing rooms of the manufacturing building containing uranium processing operations and the outside recovery facilities are high resistance per Site Specification 7096, Section II, p.4. High resistance criteria are gravity loads per Standard Building Code, 100 year wind loading, and seismic loading of 0.45g. Other areas are standard construction, except that their structural integrity has been enhanced by application of 100 year wind criteria to the entire building.

The process area is arranged in parallel lines of containment cabinets. These cabinets are separated by alternating operating and maintenance aisles or rooms. The process area is designed in this manner for contamination control.

Building ventilation air is designed to flow from the cleanest areas to the more contaminated areas. Outside air enters the operating aisles, passes through the maintenance aisles, processing cabinets, the high efficiency particulate air (HEPA) filters and then is vented through the stack. These cabinets include leaktight wet and dry processing cabinets or glovebox enclosures which contain only closed vessels and processing equipment, and fume hoods. Ventilation interlocks are provided which shut down supply fans in the event that an indication of loss of exhaust is received.

The ground level floor is designed to be exceptionally level to provide for uniform dispersal of spills. This dispersal

was provided to prevent puddling of spilled solutions which might result in criticality. The floor on the second level is sloped such that liquids spilled on the second level would flow to the stairs , and ultimately to the geometrically favorable ground level floor.

Criticality prevention was primarily controlled through equipment design (materials, geometry, spacing, etc.). Double Contingency criterion was met in the FMF. Meaning that at least two unlikely, random simultaneous events must occur before criticality was possible. In most process operations, the double contingency was exceeded meaning that more than two events were necessary to initiate criticality. Criticality control issues and individual Nuclear Criticality Safety Evaluations are available in DPSTCR-200-16.

During processing, Halon fire suppression was provided in cabinets where chemical fuels were present. For areas outside containment, fire suppression was provided by building water sprinkler systems. Additionally manual fire extinguishers are provided throughout the facility.

A number of other safety interlocks were provided to support the operating process. These interlocks are currently out of service with the process shutdown. Examples of some of these interlock functions include shutdown furnaces on high pressure, prevent furnace startup if furnace is open, prevent opening furnces while hot, etc. These and other interlocks that are currently out of service are discussed in the SAR, Section 6.3.

Describe Weaknesses in the Design Basis

The 247-F Facility will not withstand a Design Basis Earthquake or a Design Basis Tornado without sustaining some level of damage. Damage resulting from these accidents can compromise barriers between the holdup remaining in the facility and workers, the enviornment and the public.

Structural Design

Steel frame

Partitioned Areas of HEU within facility

Process Core
Waste Assay/Storage

Description of Partitioned Areas

Process Core

The process core consists of the operating and maintenance aisles, and all cabinets and glove boxes contained within these aisles. Additionally, the regulated and cabinet exhast systems up to and including the HEPA filters are included within this partitioned area. The material contained within this partition consists of the holdup that remains in the process after all cleaning and flushing performed at shut down was completed. The exhaust systems are included because holdup has been identified in sections of these systems up to the HEPA filters.

The barriers that exist include the boundary of the tanks and equipment containing the holdup; the cabinet or glovebox which contains the equipment; the walls, floors and ceilings of the process core structure, and the ventilation ductwork and HEPA filters.

Waste Assay/Storage

This partition addresses the standards used to calibrate and check operation of the Low Density Waste Assay System.

The barriers that exist include the boundary provided by the standard packaging (bags, cans, or pipe), the building structure and ventilation system.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There are no known hazardous material colocated or comingled with the HEU in the 247-F Facility.

It should be noted that holdup associated with a section of ductwork was cleaned in the 1989/90 timeframe. The material removed was found to contain low level of hazardous material which had leeched out of the stainless steel ductwork. This material was cleaned from the duct and properly disposed of. However it is possible that residual quantities remain in this section of duct. Additional information on this issue can be provided if necessary.

Process Material Transfers

All of the processing within the facility is shutdown. As a result there are no active process material transfers in the facility.

The only handling of material would be in the form of collecting, packaging, assaying, and tranferring low level waste to the burial ground. This low level waste consists primarily of the job control waste (shoe covers, gloves, swipes, etc.) associated with the present level of surveillance and maintenance activities.

On-Site Transportation

No on-site transportation occurs associated with Process Core partition.

Normal on-site transportation of waste from the facility to the burial ground is associated with the Waste Assay/Storage partition.

Staff Levels & Experience

The staff supporting the 247-F Facility is the same staff supporting 235-F. Refer to 235-F for details.

Applicable References

- Safety Analysis Report: Naval Fuel Manufacturing Facility - 200-F Area - Savannah River Plant: DPSTSA-200-26, August 1985.
- Operational Safety Requirements for the Naval Fuel Manufacturing Facility: DPW-88-101, 3-30-88.
- Technical Standards, Naval Fuel Material Facvility: DPSTS-247, 2-21-89
- Nuclear Criticality Safety Evaluations contained in DPSTCR-200-16.

FACILITY (Building or Location): 247F

PARTITIONED AREA: Process Core

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES			
Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative [3]
[Y] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[ ] Material Limits
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[ ] Alarm System		[ ] Lessons Learned
[Y] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[Y] Tanks			[ ] Personnel Reliability Assurance Program
[Y] Alarm System			[Y] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Process Core

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Note: Process operations have been shutdown and the equipment, tanks purged of all readily removeable materials, leaving only quantities of holdup in the Process Core.

Tanks and other pieces of process equipment provide a primary barrier between the worker and the heldup material.

Gloveboxes and cabinets provide a barrier between the material and the worker. In some cases this is the primary barrier when the holdup is fixed inside the glovebox/cabinet, in others it's a secondary barrier when the holdup is inside equipment/tanks within the glovebox/cabinet.

Filters - Inlet HEPA filters on cabinets and gloveboxes are aligned to filter air in the event of an air reversal, thus providing a barrier for the worker.

Ducts provide a primary barrier between the facility worker and holdup contained within them.

Protective Clothing requirements are in place for access to the Process Core. The protective clothing provides an obvious barrier between the worker and contamination. In some areas, respiratory protection is required as well. Again the protection provided is obvious.

Distance - The holdup contained within tanks and equipment which are within cabinets and gloveboxes, provides a distance barrier between the facility worker and the holdup within the process equipment.

Alarms - In the event of airborne activity the High Volume Constant Air Monitoring System is currently in service. This system will warm workers to leave an area if activity is present. Additionally in the event of a criticality, the facility's Nuclear Incident Monitoring System is in service.

Public/Environment Barrier Narrative:

The building structure exists as an obvious barrier between the materials inside the building, the environment and it's possible carrier to the offsite public.

The buildings exhaust system ensures that air movement is maintained from clean areas to prgressively dirtier areas. Additionalty the HEPA filters will ensure that any contamination picked up in the exhaust stream will be filtered prior to release.

The fact that the site boundary is approximately 10 kilometers from the facility provides a barrier that will work to minimize any release from the facility.

Criticality Barrier Narrative:

Favorable geometry, spacings, mass, and procedural control all apply to the various processing steps of the former processing operations to provide a minimum of a double contingency. Due to the fact that operations are shutdown, processes have been purged of all materials except for residual quantities that remain, a detailed discussion of the double contingency is not provided here. The details are available for review in DPSTCR-200-16.

Administrative Barrier Narrative:

Access to the Process Core is limited to surveillance rounds and maintenance of systems in service. Access is controlled by locking the doors to the core, and placing control of the key with the on duty shift supervisor.

Procedures control the limited operations (surveillance and maintenance) that are performed in the Process Core today.

Training on Radcon issues, and good Conduct of Operations are additional barriers to initiation of accidents that could lead to release of the holdup.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Waste Assay/Storage

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Co
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint
[ ] Transfer System	[ ] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[ ] Material Limits
[ ] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[ ] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[ ] Other-specify
Packaging of waste and standards			
[N] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Waste Assay/Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Workers handlling standards will be in one degree of protective clothing (PC) or another depending on where within the facility the handling is taking place. PCs provide an obvious barrier between the worker and the material.

The sources/standards included in the partition are 12 can sources, 31 "pillow" standards and 11 pipe standards totalling gram quantities of 235U. The packaging of these standards provides a barrier between the worker and the material. The can sources are swipes of material in a screw top can. The pillow sources are swipes sealed in two plastic bags, and the pipe standards are in small sections of CPVC pipe with caps glued on to each end.

Public/Environment Barrier Narrative:

In addition to the packaging boundary that provides a barrier for the worker, the facility itself provides a second barrier. The distance to the site boundary will further mitigate any releases offsite.

Criticality Barrier Narrative:

Criticality is addressed within the facility by maintaining approved spacings prior to assaying of waste. However, as far as this assessment is concerned, criticality is not considered credible with the standards covered in this partition. The total mass of all sources is far less than the eversafe mass for 235U.

Administrative Barrier Narrative:

Waste handling, and use of the standards, are performed by operators in accordance with approved procedures. Use of procedures to govern these operations is an effort to ensure that the activities performed are safe and within the operating envelope approved for the facility.

SITE: Savannah River Site	FACILITY (Building or Location) 247F
	PARTITIONED AREA: Waste Assay/Stora

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Wa (kg

made. As a result no concerns exist associated with volume expansion or the development of pyrophorics during oxidation.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Process Core

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[ ] Aging	[ ] Fire
[ ] Inadvertent Transfers	[ ] Container Seal Degradation	[ ] Explosion
[Y] Aging/Degradation	[ ] Pressurization	[Y] Earthquakes
[ ] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[Y] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[ ] Aircraft Crash
[ ] Water Sources	[ ] Toxicity	[ ] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[ ] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[Y] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

When 247-F operations were shutdown, extensive efforts were undertaken to acid flush, rinse and clean the facility of residual materials. The estimated amount of HEU remaining in the facility is in the form of holdup. Based on the extent of the cleaning efforts, it is believed that the majority of the holdup that remains is tightly adhered, and not readily transferrable.

Earthquakes and high winds (DBE and DBT) will damage the facility structure and possibly expose some of the holdup to the environment. Fires could result in increased worker exposure and also possibly expose some of the holdup to the environment.

The process related accidents discussed in the SAR are no longer possible. The initiators were eliminated when the facility was shutdown.

With the facility approaching deactivation, aging facilities provide another potential concern. However, when deactivated,

routine surveillance tours will be maintained (at a lesser frequency) to look for signs of degradation in confinement barriers that need to be addressed. Of particular interest will be any evidence that the barrier provided by the facility structure (walls, floors, and roof) is showing signs of degradation.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Waste Assay/Storage

Question 4: POTENTIAL CAUSES

Facility

- ☐ Process Material Transfer
- ☐ Inadvertent Transfers
- ☐ Aging/Degradation
- ☐ Equipment Failure
- ☐ Change in Mission
- ☐ Other Collocated Hazards
- ☐ Corrosion/Embrittlement
- ☐ Inadequate Configuration Knowledge
- ☐ Combustible Loading
- ☐ Inadequate Seals
- ☐ Water Sources
- ☐ Inadequate Drains
- ☐ Preventive Maintenance Failure
- ☐ Administrative Control
- ☐ Human Error
- ☐ Chemical Reactions
- ☐ Contamination
- ☐ Inadequacy of Design Basis
- ☐ Design Deficiency
- ☐ Flooding
- ☐ Fire
- ☐ Other SAR Accidents

- ☐ Other-specify

Material

- ☐ Aging
- ☐ Container Seal Degradation
- ☐ Pressurization
- ☐ Pyrophoricity
- ☐ Radioactivity
- ☐ Chemical Reactivity
- ☐ Radiolysis
- ☐ Volumetric Expansion
- ☐ Oxidation
- ☐ Flammability
- ☐ Toxicity
- ☐ Hydroloysis
- ☐ Crystallization
- ☐ Other - Specify

External

- ☐ Fire
- ☐ Explosion
- ☐ Earthquakes
- ☐ Subsidence
- ☐ Winds
- ☐ Floods
- ☐ Extreme Temperature
- ☐ Snow
- ☐ Ash Loading
- ☐ Aircraft Crash
- ☐ Vehicle Accident
- ☐ Onsite Transporation
- ☐ Adjacent Facility Accident
- ☐ Other-specify

Describe Each Potential Cause Identified Above:

Because of the small quantities involved, there is not anticipated to be any offsite concerns associated with the standards described in this partition. Building structural damage in an earthquake or tornado could possibly lead to release of some of this material. It is considered that the effects of a DBA (discussed under the Process Core partition) adequately cover the standards. This is based on the relative small quantity of material in this partition vs the Process Core.

SITE: Savannah River Site

FACILITY (Building or Location): 247F

PARTITIONED AREA: Process Core

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[Y] Fire	[ ] Criticality	[ ] Loss of Site Integrity
[ ] Explosion	[Y] Material Release	[Y] Loss of Building Integrity
[Y] Contamination	[ ] Breach of Packaging	[Y] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criticality
[ ] Leakage/Spills	[ ] Other-specify	
[ ] Other Accidents-specify		
[Y] Structural Failure		
[ ] Equipment Failure		
[Y] Material Release		
[ ] Increased Radioactivity Level		
[ ] Other-specify		

Describe Each Effect Identified Above:

Design Basis Accidents could cause a breach in the facility structure (*containment*) resulting in release of the holdup. Additionally, these accidents can possibly rearrange tanks and equipment in the wet side of the old process resulting in a criticality.

Breach of equipment/tanks and enclosures (wet and dry) due to a DBA would spread contamination within the facility and/or lead to worker exposure.

If the Facility was breached as well, due to structural failure during a DBA, contamination released within the facility would be available for release outside of the facility.

If tanks on the wet side of the process area were rearranged, a criticality cannot be ruled out. The SAR analyzed the potential this criticality and estimated that it was possible because it could not predict how tanks might rearrange themselves in an earthquake. (It is noted that the SAR analysis was looking at tanks with significantly more material than is present today. Currently a study is underway to support deactivation. The study is preliminarily indicating that a criticality is not credible given the present quantities and locations of all of the holdup. Only the wet side is discussed in terms of criticality. The SAR determined that dry cabinets could not be sufficiently rearranged to form a critical array. Additionally, these dry cabinets contain significantly less material than was considered in the SAR.)

From the SAR			
Accident	Frequency	SRP Consequence	Offsite Consequence
Winds (Tornado	7.7E-7	1.1E00	4.3E-01
Earthquake	1.5E-5	1.2E+01	7.3E00
Criticality	1.5E-05	9.8E+02	7.3E00
Fire*	1.0E-03	7.2E-4	2.5E-3

* Data presented is based on the fire with the highest frequency and consequences presented in the SAR. Frequency units are probabilities per year, consequences are mrem/event except for SRP wind consequence which is man-rem/event.

The results of an earthquake induced criticality are estimated to kill two individuals in the facility who are within 7 meters of the criticality.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Waste Assay/Storage

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[ ] Fire	[ ] Criticality	[ ] Loss of Site Integrity
[ ] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[Y] Breach of Packaging	[ ] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criiticality
[ ] Leakage/Spills	[ ] Other-specify	
[ ] Other Accidents-specify		
[ ] Structural Failure		
[ ] Equipment Failure		
[ ] Material Release		
[ ] Increased Radioactivity Level		
[ ] Other-specify		

Describe Each Effect Identified Above:

External events (DBA) would be necessary to release the materials contained within these standards. For the purpose of this assessment, it is considered that the material in this partition is addressed in the DBA results discussed for the Process Core partition. The material quantity in this partition adds insignificantly to the Process Core quantity and the release mechanism would be identical in a DBA.

FACILITY (Building or Location): 247F

PARTITIONED AREA: Process Core

Question 6: POTENTIAL CONSEQUENCES

Effect	Worker			Environment			Public	
	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure
Fire (Facility)	Y	Y	Y	Y		Y	Y	Y

Explanation

A fire in the Process Core could possibly breach containment and result in a release that could possibly impact the w worker, as well as the public and the environment. The SAR anaylses a number of process related fires. However, the fires are not possible today because the process is shut down and the initiators have been removed. For the purpose assessment, the worst fire (highest frequency and consequences) evaluated in the SAR is presented in question 5 as worst possible consequence of a fire in the 247-F facility. This is considered to be a bounding case based on the fact the analysis is performed with process quantities of material vs. the holdup present today.

Applicable References

247-F SAR (DPSTSA-200-16), Scrap Recovery Solvent Fire, Section 5.1.3.12

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Process Core

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Criticality (Facility)		Y	Y						

Explanation

The SAR does not rule out the possibility of a criticality due to a rearrangement of tanks in the wet processing areas due to an earthquake. The SAR does identify that the dry cabinets can not be seismically rearranged during an earthquake to the extent that a criticality could occur. As discussed in the SAR, a criticality could lead to worker injury, including death for anyone within 7 meters of the criticality.

Additionally as summarized under question 5, a criticality could lead to public exposure.

While the SAR does not rule out this possibility, it is noted that the analysis was performed on quantities of material significantly above those present today in the form of holdup. Currently studies are underway to determine whether a criticality is a credible event given the present quantity and location of material. Until the results of this ongoing analysis are approved and published, a criticality will be considered to be a credible concern. After receiving the draft study, the SAT and WGAT have concluded that a criticality is not a credible event.

Applicable References

Section 5 of the 247-F SAR, DPSTSA-200-16.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Process Core

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	
Structural Failure (Facility)			Y						

Explanation

As discussed in Section 5 of the SAR, the facility will sustain structural damage during design basis earthquakes and tornados. These event will damage equipment and enclosures that presently contain material in the form of holdup. The results being that releases outside the barrier provided by the facility itself are possible in DBAs and worker injury due to falling structures is a possibility. These concerns are addressed under SRS/247-F/SAT/001.

Applicable References

Section 5.0 of the 247-F SAR, DPSTSA-200-16.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Process Core

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Material Release (Material)	Y	Y		Y	Y	Y	Y	Y	

Explanation

Design Basis Accidents can damage the facility and the containment boundaries that are present today. The net result being a release of material that can lead to worker contamination, and possibly offsite consequences depending on the nature and extent of the damage.

Applicable References

Reference Section 5 of the Facility SAR, DPSTSA-200-16.

FACILITY (Building or Location):	DAF
PARTITIONED AREA:	Process Cell

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public	
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure
Loss of Building Integrity	Y	Y	Y	Y	Y	Y	Y	Y

Explanation

A Design Basis Earthquake or Tornado could cause a breach of the facility, equipment and/or enclosures [illegible] the holdup. Compromising these barriers could lead to release of material within the facility resulting in worker [illegible] and/or increased exposure. A breach in the facility could lead to a release of materials outside the facility [illegible] contamination of the environment, both air and ground. Contamination on the ground could possibly find its way [illegible] the form of runoff. While the quantity of material present in the form of holdup is much less than when processing operation, a release that impacted the offsite population is possible and discussed in the SAR. Additionally worker [illegible] could result from falling equipment/structures during a DBA which is severe enough to damage the facility.

This vulnerability is addressed under SRS/247-F/SAT/001.

Applicable References

SAR (DPSTSA-200-16) description of the effects of DBEs and DBTs on the facility in section 5.

SITE: Savannah River Site	FACILITY (Building or Location): 247F
	PARTITIONED AREA: Waste Assay/Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury

Explanation

Applicable References

Question 7: Site Summary

Site: Savannah River Site

Provide an overall assessment of the site ES&H vulnerabilities.

Important ES&H Concerns

Process Core

The facility, process enclosures, and equipment can sustain damage during DBAs resulting in breaching barriers between held up material and the worker, the environment, and possibly the offsite population.

Waste Storage/Assay

There are no significant concerns within this partition.

Description of HEU activities.

There are no ongoing activities which add to or initiate risks to the worker, public, or environment within the 247-F facility. The risk is derived from the fact that material is present, in the form of holdup, and it can potentially be released during DBAs to the extent that it impacts workers, the public and the environment.

Current planned actions.

Planned actions against material release are to continue an appropriate level of surveillance and maintenance of the facility to ensure that any of the present barriers are not compromised, and pursue formal deactivation until such time that formal D&D is accomplished.

A study showing that criticality is incredible in 247-F is being developed and is expected to be issued in July, 1996.

Noteworth program or practices.

None.

SITE: Savannah River Site	FACILITY (Building or Location) H Canyon
	FUNCTION: Material Storage

Question 1: SITE

DOE Headquarters Facility Landlord: EM-60
DOE Headquarters Program Sponsor: EM-60
Facility Age: 41
Design Life: 0

Location of Facility on Site and Distance to Site Boundary

The Savannah River Plant is located in South Carolina on an approximately circular site of about 780 square kilometers, bounded on the southwest by the Savannah River, and centered approximately 40 kilometers southeast of Augusta, Ga. The plant reservation occupies parts of Aiken, Barnwell, and Allendale Counties. The H-Canyon facility is located in H-area. The distance of the facility to the closest site boundary is approximately 11.8 kilometers (700-Area).

Design Mission, Interim Mission, Current Use

Facility Function (Design Mission, Interim Mission, Current Use)

H-Canyon was designed primarily for recovery of plutonium-239 from irradiated or unirradiated feed materials using the Purex process (started July 1955). This mission was modified (H-modified or HM process) in May 1959, to accomodate the recovery of uranium-235 from spent reactor fuel, and again in 1963 to permit recovery of neptunium as well as enriched uranium. However, other isotopes have been recovered through special campaigns. In a separate process system, the Frames, irradiated neptunium targets were dissolved and plutonium-238 and neptunium were separated from fission products and from each other by a series of anion exchange columns. The Frames are no longer installed in H-Canyon. However, the Frame Waste Recovery process is now operated as an intermediate processing step in HB-Line's production of Plutonium-238 for NASA space missions. 211-H, Outside Facilities is comprised of a number of processes and services that support H-Canyon operations.

The canyon facilities have undergone some modernization with replacement of the cranes and installation of a distributed control system. The process equipment utilizes the HM process and consists of two chemical dissolvers, a centrifuge for feed clarification, and several solvent extraction cycles. The first solvent extraction cycle separates uranium, neptiunium and fission products from the dissolved solution, and then partitions neptunium from uranium. The second uranium solvent extraction cycle is used for further purification of the recovered uranium. A second product cycle is used for further purification of the recovered neptunium. The uranium stream is then sent to A-Line tanks in outside facilities where it is stored, awaiting further conversion to an oxide or metal. The cycle flowsheets can be modified for special campaigns such as the the recovery Pu-242 (Mk-42 campaign) or the recovery of thorium and U-233 (Thorex campaign).

The HM process is currently in standby, with restart planning in progress. The current mission of the 221-H Canyon Facility is to support the HB-Line mission (recovery of Pu-238) and to maintain stored plutonium, uranium and neptunium solutions in a safe configuration awaiting disposition. Future operations will include dissolving and stabilizing materials recovered from remaining irradiated site reactor and offsite reactor spent fuels.

The H-Canyon building is 835 ft long, 122 ft wide, and 66 ft high. The building is comprised of 18 separate sections, one section 85 ft long and 17 sections 43 ft long, separately poured on reinforced concrete foundation slabs. Expansion joints are provided between adjacent sections. These sections, numbered 1-18, serve as references for

SITE: Savannah River Site	FACILITY (Building or Location)	H Canyon
	FUNCTION:	Material Storage

Question 1: SITE

DPSTSA-200-10 Supp 5 Addendum 5, H-Canyon SAR Addendum for Evaluation of Earthquake Induced Resin Fire in H-Canyon Frame Waste Recovery (U) May 1995.
DPSTSA-200-10 Sup 11, Rev. 1, Safety Analysis - 200 Area Savannah River Site, Separations Area Operations, Building 211-H Outside Facilities, January 1993

Operational Safety Requirements:
Operational Safety Requirements for 200-F and 200-H Areas (Excluding Tritium and Waste Management, and HB-Line): DPW-85-101, Revision 3, July 1995
WSRC-RP-90-568, Operational Safety Requirements, Separations Area Operations, Building 211-H Outside Facilities, Uranyl Nitrate Storage Facility, September 1992.

Technical Standards:
DPSTS-221-H-HM Series - HM Process Technical Standards
DPSTS-221-H-SP Series - Frames Process Technical Standards
DPSTS-221-H-HFR-400, Anion Exchange, Revision 8/94.

Test Authorization:
WSRC-TA-94-00002-2, Use of Concentration Nuclear Safety Technical Standards While Solids are Present in Tanks 12.1 and 18.3, Approved 5/12/94

Nuclear Incident Monitors Technical Standard:
DPSTS-NIM-85, Rev. 01/86.

Describe Important or Unique Design Features

The H-Canyon, 221-H Building is equipped with a number of physical and administrative features to prevent, detect or mitigate accidents. These features in turn protect the worker, environment and public. Engineered safety features associated with the canyon operations include the ventilation system, diversion of segregated or circulated cooling water, and secondary confinement. Administrative features include the Authorization Basis documents (Safety Analysis Report, Operational Safety Requirements, Technical Standards, etc.) that define the safety envelope for the facility.

The ventilation system is designed to prevent spread of airborne contamination to clean areas. This is accomplished by maintaining positive static pressure in clean areas, atmospheric pressure in areas low contamination potential, and slight vacuum in areas with high contamination potential. The Process Vessel Vent system is used to exhaust expelled vapors from canyon tanks.

The diversion system is designed to divert contaminated segregated or circulated cooling water to a retention basin. For each system, there is a monitor station that continually checks for alpha and beta-gamma activity. When activity above limits is detected, the water return stream is diverted to a retention basin.

Secondary confinement is designed to contain releases of radioactive liquid inside the canyon building. The canyon cell floors are sloped toward collection sumps. Liquid spills are flushed to the sumps and transferred to appropriate vessels in Rerun. The concrete walls and roof of the canyon were designed to be radiation shields.

The Outside Facilities is equipped with a number of physical and administrative features to prevent, detect or mitigate accidents. Engineered safety features include the recycle vent system, cooling water diversion and confinement barriers.

Facility (Building or Location): H-Canyon
FUNCTION:
Questionnaire: [illegible]

The recycle vent system provides a means to filter contaminated air from tanks or vessels (tanks as well as third level feed tanks in the canyon) before discharge to the 291-H stack.

The cooling water diversion system is the same system as described above in the 291-H section.

The confinement barriers include liquid confinement, radiation shielding, Nuclear Incident Monitors (NIM), and radiation detectors.

A list of safety class / safety significant systems has been developed for H-Canyon and Outside Facilities (NMP-ENG-95-0011, Rev 2). This list contains the following items:

Building 221-H structure, Canyon ventilation system, Canyon exhaust vacuum header, fan interlock, 291-H emergency diesel generator and associated switchgear, HVAC, 291-H stack, stack liner, and continuous sampling and monitoring systems, reactor fuel storage racks, Mark XIII, HFBR, 100 Area, diesel oil storage, boiler oil heating coil in chemical dissolvers, head and strike tank level transmitter and low level steam jacket alarm, feed end evaporator feed tank level transmitter and recorder chart, HWU evaporation feed tank level transmitter and recorder chart, neutron monitors on mixer-settler banks, canyon sump level gages in CWC for HC sumps 2H-3H and WC sumps 12W-16W, nuclear safety blanks listed on aspect list, temperature probes in fissile material storage tanks in A-Line, circulated cooling water activity monitors and alteration valves, level and specific gravity transmitters and recorder charts for fissile material storage tanks, NIM remote units, 291-S diesel generator, cell exhaust fan, process vessel vent, segregated cooling water activity monitors, diversion basin, and diversion valve, dissolver offgas system, mixer-settler feed temperatures, ambient weather temperatures, evaporator high-pressure steam interlocks, indication of agitation on process vessels, instrument air indication on evaporators, flat-sheet nozzles, and the design feature of canyon vessels that prevent overturning or rupture during an earthquake.

Describe Weaknesses in the Design Basis
In early 1992 it was discovered that an earthquake with an intensity of 0.[illegible]g could collapse the 291-H stack (The design base earthquake has an intensity of 0.2g). This was documented in an Unreviewed Safety Question (USQD-FCAN-92-135), and analyzed in FAR, Addendum 3, Stack Liner Collapse.

Presently, the principal design criteria for use at nonreactor nuclear facilities are established in DOE Order 6430.1A. Verbatim compliance of older H-Canyon system components and structures to DOE Order 6430.1A guidelines is not possible in some cases; the increased risks associated with the noncompliant items must be acceptably small, or system upgrades and redesign are implemented.

Currently, a Potential Inadequacy in Safety Analysis (SR-WRRC-SEPCI-N-1993-0001, Occurrence Report, Potential Inadequacy in Safety Analysis Regarding Canyon Buildings Structural Response to an Evaluation Basis Earthquake (EBE (UU)) documents inaccurate assumptions in the structural evaluation of the F&H canyon buildings [illegible] frequency of an earthquake has been estimated to increase from once every 5000 years to [illegible]. This change in frequency represents an increased risk for the facilities. A WSRC Justification for Continued Operation (JCO) (NMS-ENG-96-0032, Justification for Continued Operation of NMSF Facilities of Canyon Structrual Analysis (U)) was approved by WSRC to allow continued stabilization of the canyons and B-Lines to support the DOE 94-1 Implementation Plan. The [illegible] approval.

Structural Design
Canyon

Partitioned Areas of HEU within facility

1 Hot Canyon
2 Warm Canyon
3 Receiving and Storage
4 Outside Facilities
5 Ventilation

Di
Th
ac
Mi
m
sy
Cl
re
th

Pr
Th
fi
al
cl
C
cl
w

pr
pr
S
pr
al
cl

221-H is supplied by three ventilation systems: the canyon air system, the center section air system, and the gang valve corridor air system. Air supplied by these systems is exhausted by five separate systems: canyon air exhaust, center section exhaust, B-Line exhaust, process vessel vent system and recycle vessel vent system.

Simplified Sketch of the Containment Barriers (See Diagram 2).

Amount & Location of Hazardous Material Collocated or Commingled with HEU

The amount of chemicals (hazardous materials) which may come into contact with the material in solution is based on the Head Tank capacities which have the capability of being valved to the appropriated storage vessels. All head tanks associated with the Uranyl Nitrate Storage vessels are maintained empty.

Hot Canyon Partition Area:
50% Nitric Acid - In Solution plus additional access of 1152 gallons
Potassium Permanganate - 1091 gallons
30% Sodium nitrite - 61 gallons
50% Sodium Hydoroxide - 61 gallons
Manganous Nitrate - 61 gallons
Mercuric Nitrate - In solution, no additional access.
Boron - In solution, no additional access
Aluminum Nitrate - In solution, no additional access.

Warm Canyon Partition Area:
50% Nitric Acid - In solution plus additional access of 215 gallons
40% Ferrous Sulfamate - 215 gallons

Receiving and Storage Partition Area:
Domestic water is the only chemical which is added to this partition area.

Outside Facilities - 211H Partition Area:
Nitric Acid in Solution approx. 1800 pounds

The Ventilation and Other Partion Areas are not subject to any significant amounts of Hazardous chemicals or materials.

Process Material Transfers

High pressure steam, through a series of gang valve operations, is used as a transfer medium to jet process solution through stainless steel pipes, located within the confines of the hot and warm canyon partitioned areas, from one canyon vessel to another. The piping routes are monitored, using the hot and warm canyon cranes, during the transfer of process solution for potential leaks. If leaks are detected, transfers are stopped and the solutions can be recovered by flushing sumps in the canyon floors to appropriate recovery vessels.

Solutions which are transferred to or within the 211-H outside facilities partition area are pumped from one vessel to another through stainless steel jacketted process piping. These transfers are monitored from the 211-H control room using the 211-H distributed control system (DCS).

On-Site Transportation

Currently no large batch transportations of Uranyl Nitrate solutions takes place at Savannah River Site. When analysis of process solutions are required, samples (typically 10 ml sample vials) of the solutions are transported to

St

SR-WSRC-HCAN-1993-0055, Failure to Calculate New 10.2 NSC Limit

Partition References 2
WSRC-TR-94-0299 Summary Report, Department of Energy, Plutonium ES&H Vulnerability Assessment, Savannah River Assessment Team Report, August 31, 1994.
SRS Fault Tree Databank search.
SR-WSRC-HCAN-1993-0105, Inadvertent transfer of Tank 11B to Tank 9.8 (U).
SR-WSRC-HCAN-1992-0054, Activation of 7.7E Column Differential Pressure Interlock.

Partition References 3
WSRC-TR-94-0299 Summary Report, Department of Energy, Plutonium ES&H Vulnerability Assessment, Savannah River Assessment Team Report, August 31, 1994.
SRS Fault Tree Databank search. There are several incidents of Neptunium targets or urainium fuel bundles failing (being dropped) while being handled by the hot crane.
Memorandum, NMS-EHA-950181, "H-Canyon Bundle Storage Sample results for Oct. - Nov. 1995 (U)

Partition References 4
WSRC-TR-94-0299 Summary Report, Department of Energy, Plutonium ES&H Vulnerability Assessment, Savannah River Assessment Team Report, August 31, 1994.
SR-WSRC-HCAN-1995-0011, 211-H Inventory Differences - U235 Inventory Outside Alarm Limits
SR-WSRC-HCAN-1992-0028, Violation of a single Nuclear Criticality Safety Contingency Specification for the B-3 basin at 211-H Outside Facilities.
SI-1983-3-33, Inadvertent Transfer of Product Solution to Tank E1-1.

Partition References 5
WSRC-TR-94-0299 Summary Report, Department of Energy, Plutonium ES&H Vulnerability Assessment, Savannah River Assessment Team Report, August 31, 1994.
SRS Fault Tree Databank search. There are several incidents of a canyon exhaust fan failing however, there has not been a complete failure of the canyon exhust system.

STR

DCE

or
so

FACILITY (Building or Location):

PARTITIONED AREA: 1 Hot Ca

Question 2: BARRIER TYPES

bo its intended protective functions,

ting direct worker contact with the material stored in tanks in the h
essels installed in the hot and warm sides of H-Canyon.

on, tanks, confinement, containment:
ent and liquid containment. Releases of radioactive liquid are contained with
ps in each canyon section. The hot and warm canyon each have a
hrough Rerun. There is a potential for some liquid to be released to
. This design provide a barrier which protects the worker as well

and are designed to provide radiation shielding to facility work
inner wall is 5.5 feet thick, shielding personnel in the center s

ing installed cranes. The crane ... connections between the proce
... onnected to nozzles on the canyon wall. The fact that operations
remotely is

Worker Bar
The canyon ... nt the spread of airborne contamination to clean areas. This confinement is
maintaining ... atmospheric pressure in areas with low contamination potential, and slight
high contami

Public/En

Public/Enviro ... ondary, Canyon:
The H-Canyo ... physical barrier between the material in solution, located in the hot canyon, and the
Process solut ... ial are contained in tanks installed in the hot and warm sides of H-Canyon.

Public/Enviro ... /Confinement):
Hot canyon air and process ve ... rent streams are discharged through the building exhaust (HVAC
filtered prior to discharge from t ... 91-H stack, thereby creating a barrier to the discharge of airborne

Public/Environment Barrier; Site ... ndary:
The distance from H-Canyon to ... ite boundary creates a buffer zone between the potential release point and the public
does not have access onto the s

Public/Environment Barrier; Oth
The cooling water diversion syst ... f radioactive contamination enters either the segregated or th
streams can be diverted to retan ... basins. For each stream, a monitor station continuously check
release of contaminated water to ... public/environment

Criticality Barrier Narrative:

Mass and Concentration control are the primary means of protecting against a criticality in this partitioned area. T
apply. Vessels containing uranium bearing solutions are monitored on routine rounds every shift by operations p
updated on all storage vessels on a weekly basis. Management reviews trending information on vessels every w

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures : All unit operations are performed using approved operating procedures. Procedures exist for monitoring c
radioactive solutions, for responding to high canyon sump alarms and for airblowing canyon evaporator instrument air li
Reference: Canyon and Outside Facility Roundsheets, Alarm Response Procedures
Events: Explosion, Leakage/Spills, Criticality, Breach of Container

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Material Limits - Operational Safety Requirements and Technical Standards provide limits for nuclear safety, which limit the fissile material by mass, concentration or areal density. Procedures involving fissile material contain nuclear safety controls (NSCs) which are more conservative limits.

Reference: DPW-85-101, Operational Safety Requirements
DPSTS-221-H-HM Series Technical Standards
Events: Criticality

Training - Control room and building personnel receive training during fifth shift on unit operations, facility equipment, radcon and etc. This training includes information on potential events, causes and responses. Operators become certified in various positions by successfull completion of an Oral Board Qualification Program.

Reference: NMPT Department
Events: Explosion, Worker Exposure, Leakage/Spills, Criticality, Fissile Material Release, Breach of Container

Conduct of Operations - Facility personnel are trained on conduct of operations, and facility management emphasizes its application for facility operations.

Reference: 2S Manual - Conduct of Operations Manual
Events: All identified in question set 5.

Authorization Basis - The H-Canyon authorization basis defines a safety envelope for all canyon operations.

Reference: WSRC-IM-93-61, NMPD Authorization Basis Lists
Events: All identified in question set 5.

Lessons Learned - The discovery of solids in F-Canyon product tanks has resulted in H-Canyon implementing additional surveillance methods for H-Canyon tanks containing fissile material, such as control charts.

Reference: Control Chart binder in H-Canyon control room
Events: Criticality

Monitoring and Surveillances - Important parameters in the H-Canyon control room are recorded on roundsheets several times a shift to ensure operations are within prescribed limits of the safety envelope.

Reference: H-Canyon Roundsheets
Events: Leakage/Spills, Criticality, Breach of Containment

Interlocks - Interlocks are used to limit specific process variables with potential safety concerns. They are usually hardwired into the system, and can only be reset when the process variable is within its normal range.

Reference: OPS-STH-900321, H-Canyon Process Interlocks, RC Dhom to TG Campbell, November 30, 1990.
Events: Criticality, Fire, Explosion

Emergency Preparedness/Emergency Management - Facility Emergency Preparedness Implementation Procedures (EPIPs), Emergency Preparedness Administrative Procedures (EPAPs), and Emergency Action Levels (EALs) have been developed to provide guidance during emergency situations. Facility personnel are trained on the procedures and emergency drills are conducted. Procedures also exist for operational emergencies. Examples include procedures for nuclear incident evacuations, total cooling water failures, loss of process vessel vent fans and etc.

Reference: EPIP-HSEP Series procedures
EPAP-HSEP Series procedures
SOPs 221-H-9526, 221-H-9403, 221-H-9439
Events: All identified in question set 5.

Safety Systems - A safety system is one whose failure could adversely affect the environment or the safety and health of the public. These systems receive a higher level of attention due to the potential adverse impacts associated with their failure.

Reference: Memorandum NMP-ENG-95-0011, Safety Class and Safety Significant Systems for Separations Facilities, JS Evans to SL Johnson, Oct. 24, 1995
Events: Leakage/Spills, Criticality, Breach of Containment

Alarm Systems - Gamma monitors and nuclear incident monitors are located in designated areas to warn personnel of increased radiation levels in the area.

Reference: DPSTSA-200-10 SUP 5, Safety Analysis - 200 Area, Savannah River Plant, H-Canyon Operations, February 1986
Events: Exposure, Criticality

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 2 Warm Canyon

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limits
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[Y] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[Y] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[Y] Other - Specify		[ ] Trending
[ ] Protective Clothing	Cooling Water Diversion System		[ ] Records
[Y] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[Y] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[Y] Other-specify
Canyon Ventilation System			Interlocks, Safety System Alarm Systems.
[N] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 2 Warm Canyon

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Worker Barrier; Hot Cell/Canyon:
The warm canyon provides a physical barrier preventing direct worker contact with the material stored in tanks in the warm canyon. Process solutions containing radioactive material are contained in tanks installed in the hot and warm sides of H-Canyon.

Worker Barrier, Public/Environment Barrier; Canyon, tanks, confinement, containment:
The canyon building was built to provide confinement and liquid containment. Releases of radioactive liquid are contained within the canyon through the design of sloped canyon floors with collection sumps in each canyon section. The hot and warm canyon each have a tank designed to receive the content of these sumps, which is then processed through Rerun. There is a potential for some liquid to be released to a clean area through expansion joints which are installed between canyon sections. This design provide a barrier which protects the worker as well as the public/envrionment.

Worker Barrier; Shielding:
The walls of the warm canyon are made of concrete, and are designed to provide radiation shielding to facility workers. The outer wall is 2 feet thick, shielding personnel in the gang valve corridor. The inner wall is 4.25 feet thick, shielding personnel in the center sections of the canyon building.

Worker Barrier; Remote Handling:
Work in the warm canyon is performed remotely using installed cranes. The cranes make connections between the process equipment in the canyons with services, and with solution transfer lines that are connected to nozzles on the canyon wall. The fact that most operations in the warm canyon are performed remotely is a worker barrier.

Worker Barrier; Other
The canyon ventilation system is designed to prevent the spread of airborne contamination to clean areas. This confinement is accomplished by maintaining positive static pressure in clean areas, atmospheric pressure in areas with low contamination potential, and slight vacuum in areas with high contamination potential.

Public/Environment Barrier Narrative:

Public/Environment Barrier; Facility/Building Boundary, Canyon:
The H-Canyon facility structure also provides a physical barrier between the material in solution, located in the warm canyon, and the public/environment. Process solutions containing radioactive material are contained in tanks installed in the hot and warm sides of H-Canyon.

Public/Environment Barrier; (HVAC/Confinement):
Warm canyon air and process vessel vent streams are discharged through the building exhaust (HVAC/Confinement) system. This exhaust stream is filtered prior to discharge from the 291-H stack, thereby creating a barrier to the discharge of airborne materials to the public/environment.

Public/Environment Barrier; Site Boundary:
The distance from H-Canyon to the site boundary creates a buffer zone between the potential release point and the public/environment, since the public does not have access onto the site.

Public/Environment Barrier; Other:
The cooling water diversion system. If radioactive contamination enters either the segregated or the circulated cooling water return systems, these streams can be diverted to retention basins. For each stream, a monitor station continuously checks for alpha and gamma activity. This prevents the release of contaminated water to the public/environment.

Criticality Barrier Narrative:

Mass and Concentration control are the primary means of protecting against a criticality in this partitioned area. Instrumentation such as Colorimeters, Neutron monitors, flow instrumentation, and conductivity meters are used as secondary controls in this partitioned area. Vessels containing uranium bearing solutions are monitored on routine rounds every shift by operations personnel. Surveillance charts are updated on all storage vessels on a weekly basis. Management reviews trending information on vessels every week.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures - All unit operations are performed using approved operating procedures. Procedures exist for monitoring canyon Vessels containing radioactive solutions, for responding to high canyon sump alarms and for airblowing canyon evaporator instrument air lines.
Reference: Canyon and Outside Facility Roundsheets, Alarm Response Procedures
Events: Explosion, Leakage/Spills, Criticality, Breach of Container

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 2 Warm Canyon

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Material Limits - Operational Safety Requirements and Technical Standards provide limits for nuclear safety, which limit the fissile material by mass concentration or areal density. Procedures involving fissile material contain nuclear safety controls (NSCs) which are more conservative limits

Reference: OPW-85-101, Operational Safety Requirements
DPSTS-221-H-HM series Technical Standards

Events: Criticality

Training - Control room and building personnel receive training during fifth shift on unit operations, facility equipment, [illegible] etc. This training includes information on potential events, causes and responses. Operators become certified in various positions [illegible] completion of the Board Qualification Program.

Reference: NMPT Department

Events: Explosion, Worker Exposure, Leakage/Spills, Criticality, Fissile Material Release, Breach of Cont

Conduct of Operations - Facility personnel are trained on conduct of operations, and facility management emphasizes operations.

Reference: 2B Manual - Conduct of Operations Manual

Events: All identified in question set 6.

Authorization Basis - The H-Canyon authorization basis defines a safety envelope for all canyon operations

Reference: WSRC-IM-93-61, NMPO Authorization Basis Lists

Events: All identified in question set 5.

Lessons Learned - The discovery of solids in F-canyon product tanks has resulted in H-Canyon implementing H-Canyon tanks containing fissile material, such as control charts.

Reference: Control Chart binder in H-Canyon control

Events: Criticality

Monitoring and Surveillances - Important parameters in H-Canyon operations are within prescribed limits of the saf

Reference: H-Canyon Roundsheets

Events: Leakage/Spills, Criticality, Breach

Interlocks - Interlocks

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 3 Receiving and Storage

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[ ] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[ ] Material Limts
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[Y] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[ ] Conduct of Operations
[Y] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[Y] Trending
[ ] Protective Clothing			[ ] Records
[Y] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 3 Receiving and Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Worker Barrier; Hot Cell/Canyon:
The canyon building provides a physical barrier preventing direct worker contact with the material in the hot canyon. Reactor fuel bundles are stored in water in the bundle storage area of the hot canyon.

Worker Barrier, Public/Environment Barrier; Canyon, confinement, containment:
The canyon building was built to provide confinement. Releases of radioactive liquid are contained within the canyon through design. Bundle storage is a concrete basin lined with stainless steel that contains reactor fuel bundles stored in water.

Worker Barrier; Shielding:
The walls of the hot canyon are made of concrete, and are designed to provide radiation shielding to facility workers. The outer wall is 4 feet thick, shielding personnel in the gang valve corridor. The inner wall is 5 feet thick, shielding personnel in the center sections of the canyon building.

Worker Barrier; Remote Handling:
Work in the hot canyon is performed remotely using installed cranes. The cranes handle the fuel bundles which are charged to the dissolvers or stored in bundle storage area. The fact that operations in the hot canyon are performed remotely is a worker barrier.

Public/Environment Barrier Narrative:

Public/Environment Barrier; Facility/Building Boundary, Canyon:
The canyon building provides a physical barrier between the fuel stored in bundle storage in the hot canyon, and the public/environment.

Public/Environment Barrier; Liquid Containment:
Bundle storage area is a concrete basin lined with stainless steel that contains water. Reactor fuel bundles are stored in an installed stainless steel rack in the basin. The canyon building was built to provide liquid containment. This provides a barrier to the release of radioactive liquids to the public/environment.

Public/Environment Barrier; Canyon:
The H-Canyon facility structure prevents the uncontrolled release of materials (airborne or liquid), thereby providing a physical barrier to the public/environment.

Public/Environment Barrier; Site Boundary:
The distance from H-Canyon to the site boundary creates a buffer zone between the potential release point and the public/environment, since the public does not have access onto the site.

Criticality Barrier Narrative:

Mass is the primary means of protecting against a criticality in this partitioned area. Geometry is used as a secondary controls in this partitioned area. The Bundles of material strored here are in geometrically favorable racks which provides sufficient spacing between bundles in this partitioned area. Bundles are restricted by mass of special nuclear materials in the event they are mishandled. Fuel bundles can only be moved one at a time and this is administratively controlled.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures - All unit operations are performed using approved operating procedures. Procedures exist for placing reactor fuel bundles in bundle storage for adding water and for sampling the water in bundle storage.
Reference: SOPs 221-H-954, 221-H-942, 221-H-920
Events: Breach of Container, Criticality

Lessons Learned - Reactor targets are known to be corroding in the reactor disassembly basins, and corrosion is evident on the targets stored in bucket storage area in F-Canyon. Although H-Canyon is storing reactor fuel bundles, the potential for damage from corrosion exists. As a result, a water sampling program was initiated to monitor the water for corrosion parameters.
Reference: Separations Engineering files
Events: Breach of Container

Monitoring, Surveillances and Trending Analysis - Samples of the bundle storage water are obtained and analyzed once every quarter for the following: density, pH, alpha and gamma activity, aluminum, chloride, copper, iron, mercury and conductivity. These results are trended over time, and compared to results from the RBOF basin for an indication of adverse conditions. Limits have been established for the above parameters based on past sample

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 3 Receiving and Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

analysis.

Reference: SOP 221-H-920
Events: Breach of Container

Emergency Preparedness/Emergency Management - Facility EPIPs, EPAPs and EALs have been developed to provide guidance during emergency situations. Facility personnel are trained on the procedures, and emergency drills are conducted.

Reference: EPIP-HSEP Series procedures
EPAP-HSEP Series procedures
Events: Criticality

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 3 Receiving and Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Worker Barrier; Hot Cell/Canyon:
The canyon building provides a physical barrier preventing direct worker contact with the material in the hot canyon. Reactor fuel bundles are stored water in the bundle storage area of the hot canyon.

Worker Barrier, Public/Environment Barrier; Canyon, confinement, containment:
The canyon building was built to provide confinement. Releases of radioactive liquid are contained within the canyon through design. Bundle storage a concrete basin lined with stainless steel that contains reactor fuel bundles stored in water.

Worker Barrier; Shielding:
The walls of the hot canyon are made of concrete, and are designed to provide radiation shielding to facility workers. The outer wall is 4 feet thick, shielding personnel in the gang valve corridor. The inner wall is 5 feet thick, shielding personnel in the center sections of the canyon building.

Worker Barrier; Remote Handling:
Work in the hot canyon is performed remotely using installed cranes. The cranes handle the fuel bundles which are charged to the dissolvers or stored in bundle storage area. The fact that operations in the hot canyon are performed remotely is a worker barrier.

Public/Environment Barrier Narrative:

Public/Environment Barrier; Facility/Building Boundary, Canyon:
The canyon building provides a physical barrier between the fuel stored in bundle storage in the hot canyon, and the public/environment.

Public/Environment Barrier; Liquid Containment:
Bundle storage area is a concrete basin lined with stainless steel that contains water. Reactor fuel bundles are stored in an installed stainless steel rack in the basin. The canyon building was built to provide liquid containment. This provides a barrier to the release of radioactive liquids to the public/environment.

Public/Environment Barrier; Canyon:
The H-Canyon facility structure prevents the uncontrolled release of materials (airborne or liquid), thereby providing a physical barrier to the public/environment.

Public/Environment Barrier; Site Boundary:
The distance from H-Canyon to the site boundary creates a buffer zone between [illegible] does not have access onto the site.

Criticality Barrier Narrative:

Mass is the primary means of protecting against a criticality in this partition[illegible]. The Bundles of material stored here are in geometrically favorable racks [illegible]. Bundles are restricted by mass of special nuclear materials in the event that [illegible] administratively controlled.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures - All unit operations are performed using approved operating procedures for adding water and for sampling the water in bundle storage.
Reference: SOPs 221-H-954, 221-H-942, 221-H-920
Events: Breach of Container, Criticality

Lessons Learned - Reactor targets are known to be corroding in [illegible] storage area in F-Canyon. Although H-Canyon is storing reactor [illegible] sampling program was initiated to monitor the water for corrosion [illegible].
Reference: Separations Engineering files
Events: Breach of Container

Monitoring, Surveillances and Trending Analysis - Samples [illegible] density, pH, alpha and gamma activity, aluminum, chloride [illegible] to results from the RBOF basin for an indication of adverse [illegible].

Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 4 Outside Facilitis - 211

Question 2: BARRIER TYPES

pe each barrier identified above and its intended protective functions.

r & Barrier Narrative:

Barrier; Piping. Tanks, Confinement:
liquid confinement is provided by the normal process boundary. This includes the process tanks and process piping which accommodates s of solutions between tanks in Outside Facilities, and transfers of solution to and from H-Canyon.

Barrier; Respiratory Protection/Protective Clothing:
tory Protection/Protective Clothing is used as specified by the Radiological Control Organization to prevent worker from coming into direct with uranyl nitrate solutions (contamination control).

Barrier; Confinement System:
confinement barriers have been provided in Outside Facilities to reduce the probability of releasing radioactive materials to the environment. liquid confinement is provided by the normal process boundary. Secondary barriers confine liquids that escape from a primary barrier. e confinement is provided by the process boundary and by the recycle vessel vent filters.

Barrier; Shielding:
g is used to reduce the radiation dose to personnel working in the H-Area Outside Facilities. Shielding is provided in the 211-H Control Building und various tanks, sumps and etc.

:/Environment Barrier Narrative:

Environment Barrier; (HVAC/Confinement):
e confinement is provided by the process boundary and by the recycle vessel vent filters.

Environment Barrier; Liquid Containment:
confinement barriers have been provided in Outside Facilities to reduce the probability of releasing radioactive materials to the environment. liquid confinement is provided by the normal process boundary. Tanks are provided with level alarms, radiation alarms, an overflow system, nnections to the recycle vessel vent system, where appropriate. Secondary barriers confine liquids that escape from a primary barrier and include curbs, sumps, and basins. The vessel containing the majority of radioactive solutions is encased in an annulus. This annulus provides an additional boundary which protects the public/environment as well as the worker.

Public/Environment Barrier; Site Boundary:
The distance from H-Area Outside Facilities to the site boundary creates a buffer zone between the potential release point and the public/environment, since the public does not have access onto the site.

Public/Environment Barrier; Other:
The cooling water diversion system. If radioactive contamination enters either the segregated or the circulated cooling water return systems, these streams can be diverted to retention basins, and then to ETF. For each stream, a monitor station continuously checks for alpha and gamma activity. This prevents the release of contaminated water to the public/environment.

Criticality Barrier Narrative:

Mass and Concentration control are the primary means of protecting against a criticality in this partitioned area. The need for secondary controls do not apply. Monthly process samples are obtained from the vessels to meet Operational Safety Requiremens Compliance for EUS vessel. Bimonthly samples are pulled on both vessels for accountability purposes for direct concentration measurements. Vessels containing uranium bearing solutions are monitored on routine rounds every shift by operations personnel. Surveillance charts are updated on all storage vessels on a weekly basis. Management reviews trending information on vessels every week.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures - All unit operations are performed using approved operating procedures.
Reference: 221-H/211-H Procedure Index
Events: All in-facility and material events identified in question set 5.

Material Limits - Consequences and frequencies have been assessed for the various, credible accidents. The resulting risks (the product of the consequence and frequency) have been determined and compared to accepted risk limits. These have been documented in the H-Canyon Outside

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 4 Outside Facilitis - 211

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barriers [3]
[ ] Gloveboxes	[ ] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limits
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[Y] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[Y] Other - Specify		[ ] Trending
[Y] Protective Clothing	Cooling Water Diversion System		[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[Y] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[Y] Other-specify Safety Systems and Alarm Systems
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 4 Outside Facilitis - 211

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Worker Barrier; Piping, Tanks, Confinement:
Primary liquid confinement is provided by the normal process boundary. This includes the process tanks and process piping which accommodates transfers of solutions between tanks in Outside Facilities, and transfers of solution to and from H-Canyon.

Worker Barrier; Respiratory Protection/Protective Clothing:
Respiratory Protection/Protective Clothing is used as specified by the Radiological Control Organization to prevent worker from coming into direct contact with uranyl nitrate solutions (contamination control).

Worker Barrier; Confinement System:
Specific confinement barriers have been provided in Outside Facilities to reduce the probability of releasing radioactive materials to the environment. Primary liquid confinement is provided by the normal process boundary. Secondary barriers confine liquids that escape from a primary barrier. Airborne confinement is provided by the process boundary and by the recycle vessel vent filters.

Worker Barrier; Shielding:
Shielding is used to reduce the radiation dose to personnel working in the H-Area Outside Facilities. Shielding is provided in the 211-H Control Building and around various tanks, sumps and etc.

Public/Environment Barrier Narrative:

Public/Environment Barrier; (HVAC/Confinement):
Airborne confinement is provided by the process boundary and by the recycle vessel vent filters.

Public/Environment Barrier; Liquid Containment:
Specific confinement barriers have been provided in Outside Facilities to reduce the probability of releasing radioactive materials to the environment. Primary liquid confinement is provided by the normal process boundary. Tanks are provided with level alarms, radiation alarms, an overflow system, and connections to the recycle vessel vent system, where appropriate. Secondary barriers confine liquids that escape from a primary barrier and include curbs, sumps, and basins. The vessel containing the majority of radioactive solutions is encased in an annulus. This annulus provides an additional boundary which protects the public/environment as well as the worker.

Public/Environment Barrier; Site Boundary:
The distance from H-Area Outside Facilities to the site boundary creates a buffer zone between the potential release point and the public/environment, since the public does not have access onto the site.

Public/Environment Barrier; Other:
The cooling water diversion system. If radioactive contamination enters either the segregated or the circulated cooling water return systems, these streams can be diverted to retention basins, and then to ETF. For each stream, a monitor station continuously checks for alpha and gamma activity. This prevents the release of contaminated water to the public/environment.

Criticality Barrier Narrative:

Mass and Concentration control are the primary means of protecting against a criticality in this partitioned area. The need for secondary controls do not apply. Monthly process samples are obtained from the vessels to meet Operational Safety Requiremens Compliance for EUS vessel. Bimonthly samples are pulled on both vessels for accountability purposes for direct concentration measurements. Vessels containing uranium bearing solutions are monitored on routine rounds every shift by operations personnel. Surveillance charts are updated on all storage vessels on a weekly basis. Management reviews trending information on vessels every week.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Procedures - All unit operations are performed using approved operating procedures.
Reference: 221-H/211-H Procedure Index
Events: All in-facility and material events identified in question set 5.

Material Limits - Consequences and frequencies have been assessed for the various, credible accidents. The resulting risks (the product of the consequence and frequency) have been determined and compared to accepted risk limits. These have been documented in the H-Canyon Outside

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 4 Outside Facilitis - 211

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Facilities SAR. The risks associated with all of the credible accidents have been found to be acceptable with the assumed material limits. Thus, OSR for the facility were prepared to assure that the limits were not exceeded.

Reference: DPSTSA-200-10, SUP 11, Rev. 1, Safety Analysis, 200-Area Savannah River Site, Separations Area Operations, Building 211-H Outside Facilities, January 1993
WSRC-RP-90-568, Operational Safety Requirements, Separations Area Operations, Building 211-H Outside Facilities, Uranyl Nitrate Storage Facility, September 1992
DPW-85-101, Rev. 3, Operational Safety Requirements for 200-F and 200-H Areas (Excluding Tritium and Waste Management, and HB-Line), July 1995

Events: All events indicated in question set 5 as being addressed in SAR

Training - Control room and facility personnel receive training during fifth shift on unit operations, facility equipment, radcon and etc. This training includes information on potential events, causes and responses.

Reference: NMPT Department

Events: Explosion, Worker Exposure, Leakage/Spills, Criticality, Fissile Material Release, Breach of Container

Authorization Basis - For each separation facility at SRS, a list of authorization documents has been developed and published. The list is extensive and includes: Safety Analysis Reports and Addenda, Operational Safety Requirements, and Technical Standards.

Reference: WSRC-IM-93-61, NMPD Authorization Basis List

Events: All events indicated in question set 5 as being addressed in SAR

Monitoring and Surveillances - Important parameters in the Outside Facilities unit operations are recorded on roundsheets several times a shift to ensure operations are within prescribed limits of the safety envelope.

Reference: 221-H/211-H Procedure Index

Events: Leakage/Spills, Criticality, Breach of Containment

Emergency Preparedness/Emergency Management - Plans, procedures, and the organization for the preparation of actions to be taken during an emergency are described in detail in the SRS Emergency Plan Manual 6Q. This document applies to all SRS facilities and, therefore, provides a comprehensive and coordinated approach to individual facility and Site responses. This is particularly important for the preparation for potential external events.

Reference: Procedure Manual 6Q Vol. 1

Events: All events indicated in question set 5 as being addressed in SAR

Safety Systems - The Outside Facilities engineered safety features include a Recycle Vent System, cooling water diversion, confinement barriers (fixed and airborne), radiation shielding, and features specific to the Uranium Handling facility. These systems are designed to limit the release of radioactivity to the environment during normal and abnormal conditions.

Reference: DPSTSA-200-10, SUP 11, Section 3.3

Events: All events indicated in question set 5 as being addressed in SAR

Alarm Systems - Three pairs of nuclear incident monitors (NIMS) are located in the Outside Facilities. The purpose of the NIMS are to reduce the possibility of radiation exposure to personnel in the event of a nuclear incident. The instrument is designed to provide audible and visual alarms within one second after accidental assembly of a critical mass or any source of radiation exceeding a dose rate of 1 R/hr. In addition, various alarms are present to indicate the presence of abnormally high airborne or waterborne contamination and fire.

Reference: DPSTSA-200-10, SUP 11, Rev. 1, Sections 3.3 and 3.3.5

Events: All events indicated in question set 5 as being addressed in SAR

1.
2.
3.

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 5 Ventilation

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[ ] Material Limts
[Y] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[Y] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[Y] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[Y] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[Y] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[Y] Testing
[ ] Respiratory Protection	[Y] Other - Specify Filters		[ ] Trending
[ ] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits *
[ ] Temporary Barriers			[ ] Emgergency Response
[ ] Other-specify			[Y] Other-specify Preventative Maintenance Programs Interlocks, Safety Systems, and Alarm Systems
[ ] None			

Barriers between HEU and worker.
Barriers between HEU and public/environment.
Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 5 Ventilation

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Worker Barrier; Duct, Filters:
All hot and warm canyon tanks (excluding the dissolvers and their associated [illegible]) are vented to the process vessel vent system. Filtered hot and warm canyon vessel vent headers are the hot and warm canyon vessel vent filters which remove [illegible] of the radioactive material [illegible] the air. The (filtered) vessel vent air is then combined with the canyon exhaust air, filtered in the sand filter, and exhausted through the 291-H [illegible]. This filtering system helps to protect the on-site worker. For the Outside Facility vessels the Recycle Vessel Vent system provides a [illegible] contaminated air prior to discharge from the 291-H stack.

Worker Barrier; Hot Cell/Canyon:
The hot and warm canyon vessel vent filters are located in the hot and warm canyons, respectively. The worker is protected from any [illegible] radioactive material on these filters since the filters are located remotely in the canyons.

Worker Barrier; Piping:
Piping serves to protect the worker in that the canyon exhaust air is contained in [illegible] and therefore the worker is not contaminated [illegible] with this potentially contaminated air.

Worker Barrier; Filters, Shielding:
The hot and warm canyon vessel vent filters are located in the hot and warm canyons, respectively. The worker is protected from any [illegible] radioactive material on these filters through the shielding of the canyon walls.

Public/Environment Barrier Narrative:

Public/Environment Barrier; Facility/Building Boundary, Canyon:
The facility (221-H Canyon) contains the process vessel vent filters. Any accumulation of material in these filters is contained within the canyon [illegible] therefore the facility boundary functions to protect the environment and the public. The sand filters are [illegible] with approximately [illegible] filtering media. Activity removed from the air exhaust stream is [illegible] within these sand filters structures.

Public/Environment Barrier; (HVAC/Confinement):
The ventilation system and its filtering media serves to protect the public by removing [illegible] material from the exhaust.

Public/Environment Barrier; Site Boundary:
The distance of the 291-H stack from the site boundary is sufficient to disperse material released from the stack, and thereby serves to protect [illegible]

Public/Environment Barr[illegible]
The hot and warm canyon vessel vent filters are located in the hot and warm canyons, respectively. The public and environment is [illegible] accumulation of radioactive material on these filters since the filters are located remotely in the canyons.

Criticality Barrier Narrative:

Double contingency criteria not used for the ventilation partition area. The amount of material loaded on a filter medium (sand filters) via the system would not be significant with respect to a criticality event.

Administrative Barrier Narrativ[illegible]

Below is a Summary of Administra[illegible]

Procedures - Approved procedures [illegible] ration of the ventilation system. This includes procedures for [illegible] exhaust fan operation.

Reference: SOPs 221-H-7952
Events: Worker/Personnel Ra[illegible] Contamination

Conduct of Operations - Facility per[illegible] on conduct of operations, and facility manage[illegible] operations. As part of an ongoing Co[illegible] s improvement effort, training has been deve[illegible]

Reference: 2B Manual - Conduct of Operations Manual
Events: Worker/Personnel Radiation Exposure, Contamination

Monitoring and Surveillance - There are numerous surveillances relat[illegible] ntilation system. [illegible] efficiency, the stack is monitored for releases to the atmosphere contin[illegible] monitor is sourc[illegible]

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 5 Ventilation

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Flushed and changed out periodically. All HEPA filters are periodically DOP tested. The stack and sand filters are periodically visually inspected for signs of deterioration.

Reference: DPW-85-101, OSR's for 200-F and 200-H Separations Areas
DPSTSA-200-10-SUP 5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations
Events: Aging, Equipment Failure, Radioactivity, Chemical Reactivity, Explosion, Worker/Personnel Radiation Exposure, Contamination

Configuration Control of Design - Extensive configuration control is in place to ensure that changes, outages and problems are adequately controlled. This configuration control includes use of the Technical Review process, H-Canyon Operations Safety Committee and its Configuration Control subcommittee, the work control process and the configuration control board.

Reference: E7 Manual
Events: Aging, Equipment Failure, Explosion, Worker/Personnel Radiation Exposure, Contamination, Power Failure

Preventive Maintenance - There are numerous maintenance activities performed on the ventilation system. System instrumentation is periodically calibrated, fans are switched and PM work is performed on them, the process vessel vent filters are flushed and changed out periodically.

Reference: H-Canyon System Engineering Files
Work Management System (WMS) Database
Events: Aging, Equipment Failure, Contamination, Power Failure

Testing/Verification of Integrity - There are numerous test and surveillances related to the ventilation system. The sand filter is DOP tested annually to determine its efficiency, the stack is monitored for releases to the atmosphere continuously; the monitor is source checked daily. The process vessel vent filters are flushed and changed out periodically and all HEPA filters are periodically DOP tested. The ventilation system interlocks are functionally tested as well.

Reference: DPW-85-101, OSR's for 200-F and 200-H Separations Areas
DPSTSA-200-10-SUP 5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations
Events: Aging, Equipment Failure, Radioactivity, Explosion, Worker/Personnel Radiation Exposure, Contamination

Interlocks -- Interlocks are used to limit specific process variables with potential safety concerns. They are usually hardwired into the system, and can only be reset when the process variable is within its normal range. An example for the ventilation system would be: in the event a low vacuum is experienced in the exhaust tunnel the interlock would automatically shut down the canyon supply fans in Building 221-H

Reference: DPSTSA-200-10-SUP 5, Safety Analysis - 200 Area Savannah River
Plant H-Canyon Operations
Events: Worker/Personnel Radiation Exposure, Contamination

Emergency Preparedness/Emergency Management - Facility EPIPs, EPAPs and EALs have been developed to provide guidance during emergency situations. Facility personnel are trained on the procedures and emergency drills are conducted. Procedures also exist for operational emergencies. Examples include procedures for process vessel vent fan failure, vessel vent failure, responding to high stack alarms and etc.

Reference: EPIP-HSEP Series procedures
EPAP-HSEP Series procedures
SOPs 221-H-9439, 211-H-1537, 221-H-9438
Events: Worker/Personnel Radiation Exposure, Contamination

Safety Systems - A safety system is one whose failure could adversely affect the environment or the safety and health of the public. These systems receive a higher level of attention due to the potential adverse impacts associated with their failure.

Reference: Memorandum NMP-ENG-95-0011, Safety Class and Safety Significant Systems for Separations Facilities, JS Evans to SL Johnson, Oct. 24, 1995.
Events: Worker/Personnel Radiation Exposure, Contamination

Alarm Systems - Alarms sound in the canyon control room upon failure of various components of the ventilation system (for example, failure of a fan). Alarms exist for high activity as detected by the continuous alpha, beta-gamma and iodine monitors installed on the 291-H stack.

Reference: DPSTSA-200-10-SUP 5, Safety Analysis - 200 Area Savannah River
Plant H-Canyon Operations 221-H Control room panel board
Events: Equipment Failure, Radioactivity, Worker/Personnel Radiation Exposure, Contamination

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 6 Other

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[ ] Procedure: Operation, Maint
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[Y] Material Limits
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[ ] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify			[Y] Other-specify Safety Systems and Air Systems
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 6 Other

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

This partition area has no significant barrier which would benefit in the protection of the worker. No worker hazards associated with these areas.

Public/Environment Barrier Narrative:

Public/Environment Barrier; (HVAC/Confinement):
The canyon ventilation is discharged through the building exhaust (HVAC/Confinement) system. This exhaust stream is filtered prior to discharge from the 291-H stack, thereby creating a barrier to the discharge of airborne materials to the public/environment.

Public/Environment Barrier; Liquid Containment:
The canyon building was built to provide liquid containment. Releases of radioactive liquid are contained within the canyon through the design of sloped canyon floors with collection sumps. Stainless steel pans are installed under some vessels, like the high level waste evaporators, to protect the floor against corrosive spills and leaks. This provides a barrier to the release of radioactive liquids to the public/environment.

Public/Environment Barrier; Facility/Building Boundary, Canyon:
The H-Canyon facility structure prevents the uncontrolled release of materials (airborne or liquid), thereby providing a physical barrier to the public/environment.

Public/Environment Barrier; Site Boundary:
The distance from H-Canyon to the site boundary creates a buffer zone between the potential release point and the public/environment, since the public does not have access onto the site.

Criticality Barrier Narrative:

The Other Partition Area does not apply the double contingency principles for criticality due to no direct contact with the Uranyly Nitrate Solutions being assessed.

Administrative Barrier Narrative:

Below is a Summary of Administrative Barriers in place:

Material Limits - Consequences and frequencies have been assessed for the various, credible accidents. The resulting risks have been determined and compared to accepted risk limits. These have been documented in the H-Canyon and the Outside Facilities SAR's. The risks associated with all of the credible accidents have been found to be acceptable with the assumed material limits.

Reference: DPSTA-200-10, SUP-5, "Safety Analysis - 200 Area, Savannah River Plant, H-Canyon Operations", February, 1986.
DPW-85-101, Rev. 1, Operational Safety Requirements.
DPSTSA-200-10 Sup 11, Rev. 1, Safety Analysis - 200 Area Savannah River Site, Separations Area Operations, Building 211-H Outside Facilities, January 1993
WSRC-RP-90-568, Operational Safety Requirements, Separations Area Operations, Building 211-H Outside Facilities, Uranyl Nitrate Storage Facility, September 1992.

Events: All events indicated in question set 5 that are addressed in SAR

Conduct of Operations - Good technical practices are institutionalized in the Conduct of Operations program. This program can provide preventive measures as the facility will be prepared, in advance, for potential event consequences.

Reference: Manuals S1, 2S, and E7

Events: Snow/Ash Loading, Extreme Temperature Damage

Authorization Basis - For each separation facility at SRS, an list of authorization documents has been developed and published. The list includes: Safety Analysis Reports and Addenda, Operational Safety Requirements and Technical Standards.

Reference: WSRC-IM-93-61, NMPD Authorization Basis List

Events: All events indicated in question set 5 that are addressed in SAR

Emergency Preparedness/Emergency Management - Plans, procedures, and the organization for the preparation of actions to be taken during an emergency are described in detail in the SRS Emergency Plan Manual 6Q. This document applies to all SRS facilities and, therefore, provides a comprehensive and coordinated approach to individual facility and Site responses. An emergency program is particularly important for external events. Facility EPIPs, EPAPs and EALs have been prepared to provide guidance during emergency situations.

Reference: Procedure Manual 6Q Vol. 1

SITE: Savannah River Site

FACILITY (Building or Location) H Canyon

PARTITIONED AREA: 4 Outside Facilitis - 211

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Solutions	Enriched	Nitric acid	, , SS vessel, SS v,	Other-specify Storage Vessel	1 year	3	0.0000000

Cumulative Inventory Differences

0.0

Partitioned Area

Packaging Description

The stainless steel vessels are located at the outside facilities 211-H partition area and are vented via the recycle vessel vent system. The solutions in the vessels are agitated (and/or circulated) to maintain solution uniformity. The location of the larger amount of material provides worker, environment and public protection via a secondary vessel (annulus) which encompasses the first vessel. A smaller amount of material, located in two different vessels also have a secondary barrier which will confine solution which may escape the primary confinement barrier. The recycle vessel vent system provides a means of reducing the pressures which may be produced from hydrolysis and radiolysis of the solution in the vessels. These vapors from this system are filtered which provides protection to the environment and public. Shielding is also used as a means of reducing the radiation dose to personnel working in the outside facilities area.

Material at Risk Description

Enriched Uranyl Nitrate solution stored in stainless steel vessels. This solution has been fed through both the the First Cycle and Second Uranium Cycle, awaiting further disposition. This solution still contains nitric acid at a concentration of approximately 0.2 M. No other reactants are present which could lead to a container failure.

The long term storage of Uranyl nitrate solutions in the outside facility vessels is considered a potential vulnerability.

SITE: Savannah River Site	FACILITY (Building or Location)	H Canyon
	PARTITIONED AREA:	3 Receiving and Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Other Irradiated	Bundle storage B	Process Area	4 years	5	0.0000000

Cumulative Inventory Differences

0.0

Packaging Description

Concentric fuel tubes consisting of enriched uranium cores with aluminum cladding, assembled in aluminum bundles. These fuel bundles are stored underwater in a stainless steel storage rack located in the bundle storage area. The bundle storage area (basin) is also located in the hot canyon. The location of the material provides worker, environment and public protection via the shielding provided by the canyon walls. The canyon exhaust system provides filtering mechanism which provides protection to the worker, environment, and public.

Material at Risk Description

The HEU in this partition area has already been assessed in the Spent Fuel Working Group Report, Appendix D, Page 57, November 1993.

SITE: Savannah River Site | FACILITY (Building or Location): H Canyon | PARTITIONED AREA: 1 Hot Canyon

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages
Solutions	Enriched	Nitric acid	T3,	Process Area	4 years	1

Cumulative Inventory Differences

0.0

Partitioned Area

Packaging Description

The stainless steel vessels are located in the hot canyon and are vented via the process vessel vent system. The solutions in the vessels are agitated to maintain uniformity. The location of the material provides worker, environment and public protection via the shielding provided by the canyon walls. The process vessel vent system, as well as an overflow line to the canyon, provides a means of reducing the pressures which may be produced from hydrolysis and radiolysis of the solution in the vessels. These vapors from this system are filtered which provides protection to the environment and public.

Material at Risk Description

Enriched Uranyl Nitrate solution stored in a stainless steel vessel. This solution has not been processed through the entire Head End process. This solution contains boron, aluminum nitrate, fission products, plutonium, neptunium and mercuric nitrate. The nitric acid content is less than 4M. The nitric acid content as well as the small concentration of mercuric nitrate are the only potential reactive chemicals. No other reactants are present which could lead to a container failure.

There have been 143 coil failures in F and H Canyon during the time frame 1954 to 1993. The tanks that have had these coil failures are dissolvers, batch evaporators, continuous evaporators, and heated storage vessels. The canyon vessel containing this material in solution has the capability of being heated. Therefore; this canyon tank has the potential to fail but is unlikely when used for storage. The coils on this vessel have failed in the past when the cycle was in operation.

The long term storage of Uranyl nitrate solutions in canyon vessels is considered a potential vulnerability.

SITE: Savannan River Site	FACI' Building or Location) H Canyon
	PARTITIONED AREA: 2 Warm Canyon

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Solutions	Enriched	Nitric acid	. , T3, ,,	Process Area	7 years	1	0.0000000

Cumulative Inventory Differences

0.0

Partitioned Area

Packaging Description

The stainless steel vessels are located in the warm canyon and are vented via the process vessel vent system. The solutions in the vessels are agitated to maintain uniformity. The location of the material provides worker, environment and public protection via the shielding provided by the canyon walls. The process vessel vent system, as well as an overflow line to the canyon, provides a means of reducing the pressures which may be produced from hydrolysis and radiolysisof the solution in the vessels. This vapors from this system are filtered which provides protection to the environment and public.

Material at Risk Description

Enriched Uranyl Nitrate solution stored in a stainless steel vessel. This solution has been fed through the the Dissolving, Head End, and First Cycle processes and is awaiting feed to the Second Uranium Cycle. This solution still contains nitric acid at a concentration of approximately 5M. No other reactants are present which could lead to a container failure.

There have been 143 coil failures in F and H Canyon during the time frame 1954 to 1993. The tanks that have had these coil failures are dissolvers, batch evaporators, continuous evaporators, and heated storage vessels. The canyon vessel containing this material in solution are not heated. While a canyon tank failure is possible, it is not likely in a tank used for storage.

The long term storage of Uranyl nitrate solutions in canyon vessels is considered a potential vulnerability.

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 1 Hot Canyon

Question 4: POTENTIAL CAUSES

Facility	Material	External
[Y] Process Material Transfer	[ ] Aging	[ ] Fire
[Y] Inadvertent Transfers	[ ] Container Seal Degradation	[ ] Explosion
[Y] Aging/Degradation	[ ] Pressurization	[ ] Earthquakes
[Y] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[ ] Winds
[Y] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[Y] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[ ] Aircraft Crash
[ ] Water Sources	[ ] Toxicity	[ ] Vehicle Accident
[ ] Inadequate Drains	[Y] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[Y] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[ ] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

Inadvertent Transfers - The uranium solution in H-Canyon is in a static condition, as it is awaiting further processing. Therefore, inadvertent transfers of this material are not likely. However, an inadvertent transfer of an incompatible chemical into the tanks containing this solution could have an adverse impact on the material.

Aging/Degradation - The canyon tanks and facility barriers will experience some degree of degradation over time.

Equipment Failure - The failure of equipment or instrumentation associated with the tanks used to contain the material, or associated with the facility barriers could have an adverse impact.

Change in Mission - Prolonged storage of material in solution, in a facility not intended for that mission, could evolve into an adverse condition. Samples from canyon tanks have, in the past, revealed the presence of solids (corrosion products). The canyon mission has been to reprocess material, not to maintain solutions for indefinite periods of time.

Corrosion/Embrittlement - Canyon tanks are potentially subject to internal corrosion due to the presence of nitric acid. Nitric acid will slowly corrode the stainless steel walls of the canyon tanks containing the solution.

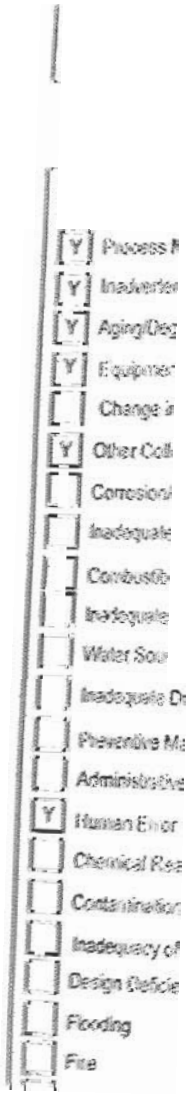
1. B
2. B
3. In as

Question 4: POTENTIAL CAUSES

Organic Nitric Acid Reaction - The solutions in H-Canyon are in nitric acid environments, and most have been through solvent extraction processing. While the amount of organic in these tanks has been determined to be very low, an inadvertent transfer could create the potential for a Tomsk-type organic nitric acid reaction.

Radiolysis - During storage and processing of radioactive solutions, radiolysis generates hydrogen gas, and destroys acid. Hydrogen evolution is a potential pressurization or fire concern. Uranium materials are highly soluble in Nitric acid.

Hydrogen Buildup - Radiolysis generates hydrogen gas, which if allowed to accumulate, can be a potential fire hazard. Canyon tanks are vented, so pressurization is not an issue.


[Y] Process
[Y] Inadverte
[Y] Aging/Deg
[Y] Equipmer
[ ] Change i
[Y] Other Coll
[ ] Corrosion/
[ ] Inadequate
[ ] Combustib
[ ] Inadequate
[ ] Water Sou
[ ] Inadequate D
[ ] Preventive Ma
[ ] Administrative
[Y] Human Error
[ ] Chemical Rea
[ ] Contamination
[ ] Inadequacy of
[ ] Design Deficie
[ ] Flooding
[ ] Fire

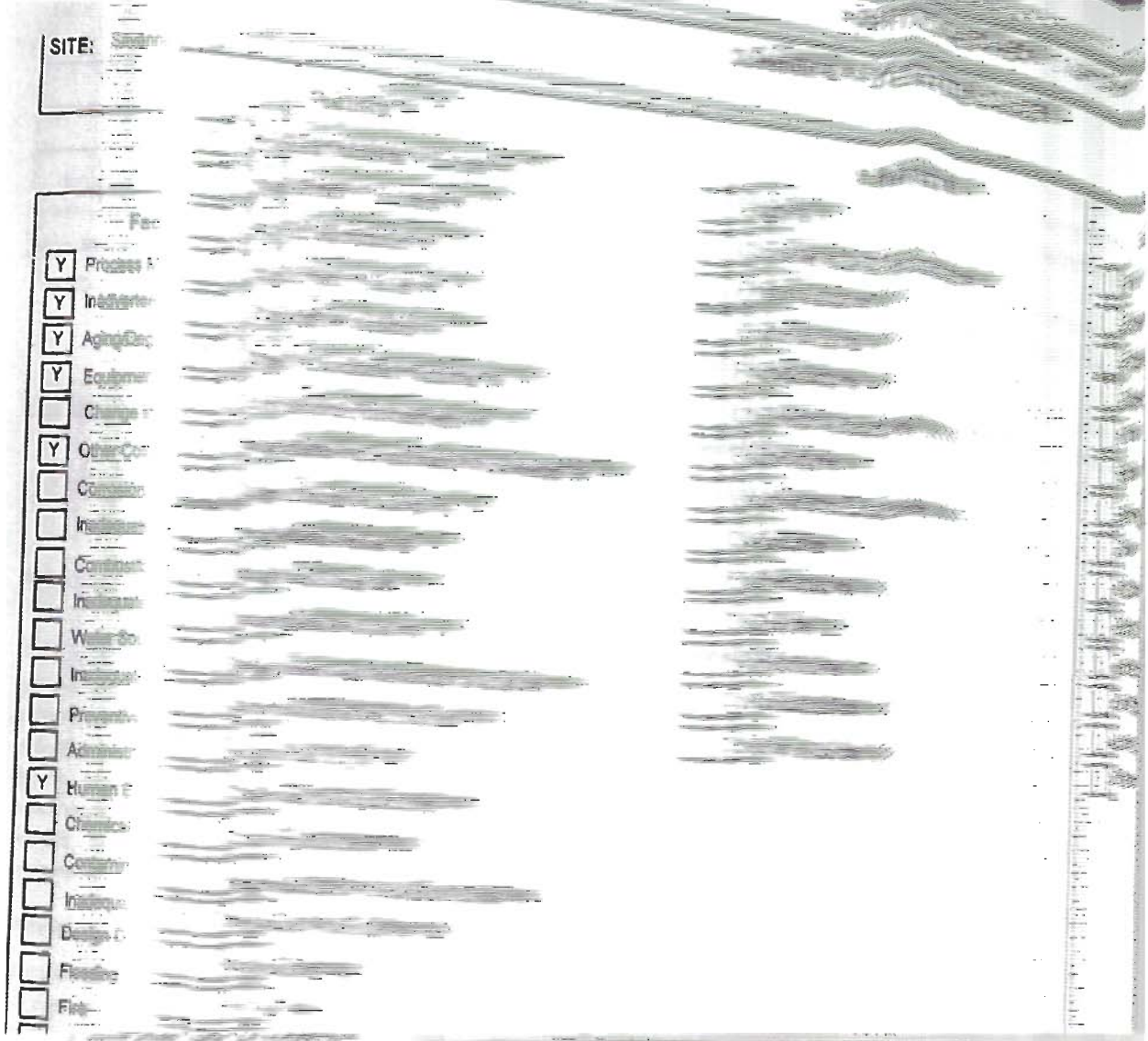
SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 2 Warm Canyon

Question 4: POTENTIAL CAUSES

Organic Nitric Acid Reaction - The solutions in H-Canyon are in nitric acid environments, and most have been through solvent extraction processing. While the amount of organic in these tanks has been determined to be very low, an inadvertent transfer could create the potential for a Tomsk-type organic nitric acid reaction.

Radiolysis - During storage and processing of radioactive solutions, radiolysis generates hydrogen gas, and destroys acid. Hydrogen evolution is a potential pressurization or fire concern. Uranium materials are highly soluble in Nitric acid.

Hydrogen Buildup - Radiolysis generates hydrogen gas, which if allowed to accumulate, can be a potential fire hazard. Canyon tanks are vented, so pressurization is not an issue.


SITE:
Y
Y
Y
Y
Y
Y

Question 4: POTENTIAL CAUSES

ion of this material.

on/Embrittlement - Outside Facilities tanks are potentially subject to internal corrosion due to the presence of nitric itric acid will slowly corrode the stainless steel walls of the canyon tanks containing the solution.

sis - During storage and processing of radioactive solutions, radiolysis generates hydrogen gas, and destroys acid. en evolution is a potential pressurization or fire concern.

en Buildup - Radiolysis generates hydrogen gas, which if allowed to accumulate, can be a potential fire hazard. A-Line re vented through the recycle vessel vent system, so pressurization is not an issue.

l or natural phenomena events will have minimal impact (adverse effect) on the HEU material stored in outside s (211-H).

on - Adjacent fires and explosions were eliminated from consideration because none of the nearby facilities is thought ble to impact this area.
PSTA-200-10, SUP-11, Section 5.1.2)

ake Damage - Earthquakes have the potential for severe damage to the tanks and piping in the Outside Facilities. h no specific seismic evaluations have been made for the facilities, it is conservatively assumed that the structures ssels are of "moderate hazard" design and construction. The onset of damage would be expected at a ground ation of 0.09 g (this is less than the 0.2 g Design Basis Earthquake) and is assumed to result in spilling 100 percent contents of the process vessels. The EUS tank has been seismically qualified for the outside facilities.
PSTA-200-10, SUP-11, Section 5.1.1.2)

n Damage - Not considered in current analyses. While weathering of surrounding soil (erosion) is not considered, the weathering of equipment (corrosion) is mentioned as a potential route for radioactive material to escape.
(Ref. DPSTA-200-10, SUP-11, Sections 5.1.3.10)

Wind Damage - High velocity winds, generated by seasonal storms or hurricanes, can impact the Outside Facility operations. The high winds have the potential to cause damage that might result in the release of radioactive and/or hazardous process chemicals. The high winds might also increase the spread of the materials and interfere with normal or emergency operations. Since the Site started operations, Hurricane Gracie passed north of the plant in 1959. Since the Site is located over 100 miles inland, the winds are not expected to exceed 100 mph. Tornadoes are possible for the Site and are assumed to result in the spillage of all Outside Facility contents.

Flood Damage - Not considered in present analyses. However, analyses for neighboring facilities (e.g. H-Canyon) discuss the fact that adjacent streams in broad valleys are more than 100 ft lower in elevation than the H-Area.
(Ref. DPSTA-200-10, SUP-5, Section 5.1.1.4)

Extreme Temperature Damage
Cold weather has little effect on the Outside Facilities except through its effect on auxiliary services. Below -8°C (for services located outside the building), lines plug, valves and pipes burst, alarms fail to operate, instrumentation may become ineffective and equipment with movable parts may become immobilized. Icing can be a prime cause of common mode failure. In addition to canyon services being impaired, activity release can occur through broken lines. Monitors in those lines may become inoperative due to freezing, thus reducing the effectiveness for detecting contaminated line breaks. Criticality implications may result from freezing Uranyl Nitrate Hexahydrate (UNH) solutions. Heat tracing is utilized on the outside facility vessels and piping to reduce the potential of this cold weather effect.
(Ref. DPSTA-200-10, SUP-11, Sections 5.1.1.4 and 5.4.1.4)

Snow/Ash Loading Damage - Snow represents an aggravation that can affect normal operations. The largest recorded

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 4 Outside Facilitis - 211

Question 4: POTENTIAL CAUSES

Facility

- [Y] Process Material Transfer
- [Y] Inadvertent Transfers
- [Y] Aging/Degradation
- [Y] Equipment Failure
- [ ] Change in Mission
- [Y] Other Collocated Hazards
- [ ] Corrosion/Embrittlement
- [ ] Inadequate Configuration Knowledge
- [ ] Combustible Loading
- [ ] Inadequate Seals
- [ ] Water Sources
- [ ] Inadequate Drains
- [ ] Preventive Maintenance Failure
- [ ] Administrative Control
- [Y] Human Error
- [ ] Chemical Reactions
- [ ] Contamination
- [ ] Inadequacy of Design Basis
- [ ] Design Deficiency
- [ ] Flooding
- [ ] Fire
- [ ] Other SAR Accidents

- [ ] Other-specify

Material

- [ ] Aging
- [ ] Container Seal Degradation
- [ ] Pressurization
- [ ] Pyrophoricity
- [ ] Radioactivity
- [ ] Chemical Reactivity
- [Y] Radiolysis
- [ ] Volumetric Expansion
- [ ] Oxidation
- [ ] Flammability
- [ ] Toxicity
- [Y] Hydroloysis
- [ ] Crystallization
- [ ] Other - Specify

External

- [Y] Fire
- [Y] Explosion
- [Y] Earthquakes
- [Y] Subsidence
- [Y] Winds
- [Y] Floods
- [Y] Extreme Temperature
- [Y] Snow
- [Y] Ash Loading
- [Y] Aircraft Crash
- [Y] Vehicle Accident
- [ ] Onsite Transporation
- [Y] Adjacent Facility Accident
- [Y] Other-specify

Rain & Lightning

Describe Each Potential Cause Identified Above:

H-Area Outside Facilities contains uranyl nitrate solution, segregated solvent, recovered acid, and miscellaneous waste.

Inadvertent Transfers - Outside Facilities makes many transfers while operating its various unit operations (cold chemical supply, acid recovery unit, general purpose evaporator etc.). No transfers are currently being made involving uranyl nitrate solution. However, an inadvertent transfer of an incompatible chemical into the tanks containing this solution could have an adverse impact on the material.

Aging/Degradation - The Outside Facilities tanks and facility barriers will experience some degree of degradation over time.

Equipment Failure - The failure of equipment or instrumentation associated with the tanks used to contain the material, or associated with the facility barriers could have an adverse impact.

Change in Mission - Prolonged storage of material in solution, in a facility not intended for that mission, could evolve into an adverse condition. Uranyl nitrate is being stored in Outside Facilities EUS and A-Line tanks because highway transport via tank truck is no longer authorized. The suspension of the Uranium Solidification Facility (USF) raises issues for the

Question 4: POTENTIAL CAUSES

snowfall of 18 inches fell in 1973. The average annual snowfall over the last 45 years has been about 0.9 inches. Alth some damage can result, the damage reported in the past is generally attributed to low temperatures. (Ref. DPSTA-200-10, SUP-11, Sections 5.1.1.4 and 5.4.1.4)

Aircraft Crash - The crash of a large aircraft in or near the Outside Facilities could result in release of radionuclides to t environment. The impact of the plane could rupture tanks and piping in several of the systems. The current analysis assumes a direct hit on the facility by a large aircraft with a 10,000 lbm fuel load. The aircraft is assumed to rupture tan and piping before the fuel tank ignites and destroys the facility (Ref. DPSTA-200-10, SUP-11, Section 5.1.2.1)

Vehicle Accident - A crash of a truck, car, crane, etc. into tanks or piping in the Outside Facilities would have a much sm effect than the crash of a large aircraft; however, similar release pathways are expected. Limited speeds reduce the frequency of a damaging crash. (Ref. DPSTA-200-10, SUP-11, Section 5.1.2.2)

Adjacent Facility Accident - Adjacent fires and explosions were eliminated from consideration because none of the nearby facilities is thought to be able to impact this area. (Ref. DPSTA-200-10, SUP-11, Section 5.1.2)

Power Failure - Not explicitly considered in current analyses. Stand-by power is mentioned but not credited. (Ref. DPSTA-200-10, SUP-11, Section 3.2.4.2)

Institutional/Regulatory Requirements - Not considered in current analyses.

Personnel Radiation Exposure - Not considered in current analyses.

Ex-Facility Fire - Not considered in current analyses.

Other, Rain - Rain can be both an aggravation to a deteriorated situation and a damage-inflicting condition in itself. Although not directly affecting canyon operations, damage to excavations, cave-in of drain lines, and other failures have occurred as a direct result of hard rains. During prolonged heavy rains, water conceivably could enter the building through the expansion joints although no damage or contaminated water runoff is expected.
(Ref. DPSTA-200-10, SUP-11, Sections 5.1.1.4 and 5.4.1.4)

Other, Lightning - The principal adverse effect of lightning is interruption of normal electrical power and the actuation of spurious alarms. No radiological releases have been attributed to lightning.
(Ref. DPSTA-200-10, SUP-11, Sections 5.1.1.4 and 5.4.1.4)

1. E
2. E
3. I
as

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[Y] Fire	[Y] Criticality	[ ] Loss of Site Integrity
[Y] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[Y] Breach of Packaging	[ ] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criticality
[Y] Leakage/Spills	[Y] Other-specify	
[ ] Other Accidents-specify	See Question 6	
[ ] Structural Failure		
[ ] Equipment Failure		
[ ] Material Release		
[ ] Increased Radioactivity Level		
[Y] Other-specify		
Worker Exposure (Internal, External)		

Describe Each Effect Identified Above:

Those events that relate to the adverse conditions contained in section 4 are identified. The remaining events credible for H-Canyon are taken from the Safety Analysis Report (SAR).

Fire - A fire occurring within the H-Canyon process area can lead to a medium energetic event. According to the SAR, there have been 39 fires within the canyon and its ventilation system. Of these, none involved process materials.

Explosion - hydrogen buildup, radiolysis, organic nitrate reaction, inadvertent transfer.
The potential exists for a hydrogen deflagration if hydrogen gas is allowed to accumulate in excess of the lower flammability limit. Also, an organic nitrate reaction could generate sufficient flammable gases that would explode with an ignition source.

Contamination -
Operations or maintenance work in H-Canyon RCAs could result in the spread of contamination to clean areas or to personnel.

Leakage/Spills -corrosion
Nitric acid can, over time, corrode the stainless steel walls of the canyon tanks containing the material in solution. Process leaks permit material to penetrate primary confinements such as vessels, pipes and instruments. Leaks in canyon cells could potentially spread contamination to clean areas through expansion joints, which are located between each section of the canyon.

Worker Exposure (Internal and External) -
The potential exists for increased worker external exposure or internal exposure in the event of a process accident involving radioactive material in solution.

Criticality - inadvertent transfers, radiolysis
The introduction of an incompatible chemical to a fissile material tank could lead to polymerization and/or precipitation and potentially a criticality. Radiolysis destroys acid, which could lead to acid deficient conditions in a fissile material tank, and potentially a criticality.

Material Release - equipment failure, process accidents
The failure of a facility barrier or of safety class equipment could result in the release of fissile material. High energetic events (none identified for H-Canyon) and medium energetic events could damage a facility barrier and result in a release of fissile material.

Breach of Container - hydrogen buildup, corrosion, organic nitric acid reaction, aging
The canyon tank could fail due to a process accident (hydrogen deflagration, organic nitric acid reaction) or due to corrosion over a long period of time.

Question 5: POTENTIAL EFFECTS

e potential Consequences from the effects of long term storage of the HEU solutions will be addressed in the
y assessment form in question 6.

e external or natural phenomena events have or might result from the adverse conditions discussed in Question 4

SITE: Savannan River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 2 Warm Canyon

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[Y] Fire	[Y] Criticality	[ ] Loss of Site Integrity
[Y] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[Y] Breach of Packaging	[ ] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criiticality
[Y] Leakage/Spills	[Y] Other-specify	
[ ] Other Accidents-specify	See Question 6	
[ ] Structural Failure		
[ ] Equipment Failure		
[ ] Material Release		
[ ] Increased Radioactivity Level		
[Y] Other-specify		
Worker Exposure (Internal, External)		

Describe Each Effect Identified Above:

Those events that relate to the adverse conditions contained in section 4 are identified. The remaining events credible for H-Canyon are taken from the Safety Analysis Report (SAR).

Fire - A fire occurring within the H-Canyon process area can lead to a medium energetic event. According to the SAR, there have been 39 fires within the canyon and its ventilation system. Of these, none involved process materials.

Explosion - hydrogen buildup, radiolysis, organic nitrate reaction, inadvertent transfer.
The potential exists for a hydrogen deflagration if hydrogen gas is allowed to accumulate in excess of the lower flammability limit. Also, an organic nitrate reaction could generate sufficient flammable gases that would explode with an ignition source.

Contamination -
Operations or maintenance work in H-Canyon RCAs could result in the spread of contamination to clean areas or to personnel.

Leakage/Spills -corrosion
Nitric acid can, over time, corrode the stainless steel walls of the canyon tanks containing the material in solution. Process leaks permit material to penetrate primary confinements such as vessels, pipes and instruments. Leaks in canyon cells could potentially spread contamination to clean areas through expansion joints, which are located between each section of the canyon.

Worker Exposure (Internal and External) -
The potential exists for increased worker external exposure or internal exposure in the event of a process accident involving radioactive material in solution.

Criticality - inadvertent transfers, radiolysis
The introduction of an incompatible chemical to a fissile material tank could lead to polymerization and/or precipitation and potentially a criticality. Radiolysis destroys acid, which could lead to acid deficient conditions in a fissile material tank, and potentially a criticality.

Material Release - equipment failure, process accidents
The failure of a facility barrier or of safety class equipment could result in the release of fissile material. High energetic events (none identified for H-Canyon) and medium energetic events could damage a facility barrier and result in a release of fissile material.

Breach of Container - hydrogen buildup, corrosion, organic nitric acid reaction, aging
The canyon tank could fail due to a process accident (hydrogen deflagration, organic nitric acid reaction) or due to corrosion over a long period of time.

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 2 Warm Canyon

Question 5: POTENTIAL EFFECTS

Other - The potential Consequences from the effects of long term storage of the HEU solutions will be addressed in the vulnerability assessment form in question 6.

None of the external or natural phenomena events have or might result from the adverse conditions discussed in Question

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 4 Outside Facilities - 211

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[Y] Fire	[Y] Criticality	[ ] Loss of Site Integrity
[Y] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[Y] Breach of Packaging	[ ] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criiticality
[Y] Leakage/Spills	[Y] Other-specify	
[ ] Other Accidents-specify	See Question 6	
[ ] Structural Failure		
[ ] Equipment Failure		
[ ] Material Release		
[ ] Increased Radioactivity Level		
[Y] Other-specify		
Worker Exposure (External, Internal)		

Describe Each Effect Identified Above:

Those events that relate to the adverse conditions contained in section 4 are identified. The remaining events credible for H-Area Outside Facilities are taken from the Safety Analysis Report (SAR).

Fire - Fires have the potential to ignite solvents and other flammable liquids in several of the Outside Facilities systems. Most fires pose a minimal radiological risk to personnel. However, a fire enhances the probability of spreading contamination and causing an internal exposure through the release of airborne activity.

Explosion - hydrogen buildup, radiolysis, organic nitrate reaction, inadvertent transfer
The potential exists for a hydrogen deflagration if hydrogen gas is allowed to accumulate in excess of the lower flammability limit.

Contamination -
Operations or maintenance work in Outside Facilities RCAs could result in the spread of contamination to clean areas or to personnel.

Leakage/Spills -corrosion
Nitric acid can, over time, corrode the stainless steel walls of the canyon tanks containing the material in solution. Process leaks permit material to penetrate primary confinements such as vessels, pipes and instruments. Leaks and spills usually result in material falling to the ground surface of a containment area. In some cases, liquid may flow with an annulus or to an apron, and then to a sump or to a ditch.

Worker Exposure (external, internal) -
The potential exists for increased worker external exposure or internal exposure in the event of a process accident involving radioactive material in solution.

Criticality
A criticality event has been postulated in the SAR for the following scenarios; Freezing, overconcentration, and criticalities in A-Line/EUS sumps.

Material Release - equipment failure, process accidents
The failure of a facility barrier or of safety class equipment could result in the release of fissile material. Events could damage a facility barrier and result in a release of fissile material to the public/environment.

Breach of Container - hydrogen buildup, corrosion, organic nitric acid reaction, aging
Outside Facilities tanks could fail due to a process accident (hydrogen deflagration, organic nitric acid reaction) or due to corrosion over a long period of time.

[illegible] (Building or Location): H Canyon
PARTITIONED AREA: 4 Outside Facilities - 211

Question 6: POTENTIAL EFFECTS

Other - The potential Consequences from the effects of long term storage of the HEU solutions will be addressed in vulnerability assessment form in question 6.

None of the external or natural phenomena events have or might result from the adverse conditions discussed in Sec

1. B
2. B
3. In
as

SITE: Savannah River Site	FACILITY (existing or processing): H-Canyon
	PARTITIONED AREAS: H Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			PUBLIC		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	[illegible]
Explosion (Facility)									

Explanation

Explosion : This event, if it were to occur, could impact the worker, environment, and the public since it has not been considered in the current analysis. An explosion affecting the canyon could be expected to have similar consequences to facility explosion, so there would be consequences to the worker only. There are no initiators identified in the outside facilities which would lead to an explosion in the outside facility storage vessels.

An explosion within the H-Canyon or outside facility partition area would result in a breach of multiple partition areas and defined worker, or environment/public barriers for each of the two facility areas. Sufficient engineering and administrative controls are in place to preclude a vulnerability for this event.

Applicable References

DPSTSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1988

DPSTSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building 211-H Outside Facilities, January 1993

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Contamination (Facility)									

Explanation

Contamination of the facility would be a breach of multiple partition areas and defined barriers (worker and/or environment/public) for each of the Areas (both H-Canyon and Outside Facilities). Sufficient engineering and administrative controls are in place to preclude a vulnerability in this event. No mention in the SAR is made as to the resulting contamination of the public or of the impact of the potential release on the Worker or on the Environment.

Applicable References

DPSTSA-200-10, SUPP-5, Section 5.4.1.1, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1986.

DPSTSA-200-10, SUPP-11, Rev. 1, Section 5.4.1.1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building 211-H Outside Facilities, January 1993.

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public	
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposu
Other Accidents - specify Worker Exposure								

Explanation

Worker Exposure (externally and internally) would be a breach of multiple partition areas and defined partition barrie of the Areas. Sufficient engineering and administrative controls are in place to preclude a vulnerability in the ever

Applicable References

DPSTSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 199

DPSTSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations &
211-H Outside Facilities, January 1993

1. B
2. B
3. Ir
as

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Leakage/Spills (Facility)									

Explanation

A Spill or leakage of material from the H-Canyon or Outside facilities would require a breach of multiple partition areas and defined partition barriers for each of the facility areas. Sufficient engineering and administrative controls are in place to preclude a vulnerability in this event.

Applicable References

DPSTSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1986.

DPSTSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building 211-H Outside Facilities, January 1993

SITE: Savannah River Site

FACILITY (Building or Location): H Canyon

PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

Effect	Worker			Environment			Public		
	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Inj.
Criticality (Material)									

Explanation

Criticalities. No mention in the SAR is made as to the resulting contamination of the public or of the impact of the plan release on the Worker or on the Environment. A breach of a container package would be a breach of multiple partition a and defined partition barriers for each of the Areas. Sufficient engineering and administrative controls are in place t preclude a vulnerability in this event.

Applicable References

DPSTSA-200-10, SUPP-5, Section 5.4.1.1, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, Feb 1986.

DPSTSA-200-10, SUPP-11, Rev. 1, Section 5.4.1.1, Safety Analysis - 200 Area Savannah River Site Separations Are Operations Building 211-H Outside Facilities, January 1993

1.
2.
3.
a

E: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
ial Release (Material)									

anation

aterial release would be a breach of multiple partition areas and defined partition barriers for each of the Areas. cient engineering and administrative controls are in place to preclude a vulnerability in this event.

licable References

TSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1986.

TSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building H Outside Facilities, January 1993

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Breach of Packaging									

Explanation

A breach of a container package would be a breach of multiple partition areas and defined partition barriers for each of the Areas. Sufficient engineering and administrative controls are in place to preclude a vulnerability in this event.

Applicable References

DPSTSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1988.

DPSTSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building 211-H Outside Facilities, January 1993

1. E
2. E
3. I
as

SITE: Savannah River Site	FACILITY (Building or Location): H Canyon
	PARTITIONED AREA: 1 Hot Canyon

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
her - specify (Material) ng Term Storage	Y	Y		Y	Y	Y		Y	

xplanation

he long term storage of HEU/Uranyl Nitrate solutions in outside facilities, as well as the canyon, has been recognized as a ulnerability (potential consequence) for events which may result in the release of radioactive materials to the environment, ncreased exposure to facility workers or exposure to the public. These events could result from the inherent vulnerabilities nd technical uncertainties associated with extended storage, including the potential: (1) evaporation, radiolysis, or changes n solution chemistry that can initiate adverse events, (2) tank cooling coil or heat exchanger failures coupled with detection elay errors, that could result in significant release of radioactivity, and (3) for a number of other events that could result in eleases including spills, leaks, unplanned transfers, and hydrogen generation.

pplicable References

PSTSA-200-10, SUPP-5, Safety Analysis - 200 Area Savannah River Plant H-Canyon Operations, February 1986.

PSTSA-200-10, SUPP-11, Rev. 1, Safety Analysis - 200 Area Savannah River Site Separations Area Operations Building 11-H Outside Facilities, January 1993

Question 7: Site Summary

Site: Savannah River Site

Provide an overall assessment of the site ES&H vulnerabilities.

Important ES&H Concerns

The Uranyly nitrate solutions stored in outside facilities are contained in stainless steel vessels (tanks) which are vented to the recycle vessel vent system. The location and design of the storage vessel provides confinement and shielding. The larger amount of material stored in the three tanks, in the outside facilities, is surrounded by an Annulus (larger outer tank) to contain releases of radioactive liquid. The annulus provide shielding to personnel in the general vacinity. A smaller amount of material (heels) is stored in two smaller tanks which are above a colletion basin (sump) which can be returned back to the vessel or alternate storage location to contain releases of radioactive liquid. There is the potential for some airborne contaimants to the worker and/or release of material to the environment if leaks occur or when sampling of the solutions our conducted over a long and routine period of time.

The outside facilities were designed for temporary storage of materials prior to transferring material to Oak Ridge or processing in the Uranium Solidification Facility, not for the long term storage of the solutions. Both activities have been suspended indefinitely. As a result, administrative controls and personnel ensure criticality safety in tanks containing fissile material solutions, rather than engineered safety controls such as geometrically favorable tanks.

The H-Canyon facility has two tanks which contain uranyl nitrate solutions, recovered from different processing stages of the HM-Process. Both tanks contain material which are in nitric acid solutions, and are contained in stainless steel canyon tanks which are vented to the process vessel vent system, and through an overflow line to the canyon. Canyon tanks contain stainless steel coils which allow cooling or cooling/heating of solutions. Because there is the potential for coil failures (primarily in heated tanks), the cooling water return streams are monitored for activity before either being circulated back to the cooling tower, or released to the environment (Increased risk to the environment, public, worker the longer the material is strored). There is the potential for some airborne contaimants to the worker when sampling of the solutions our conducted over a long and routine period of time

The canyon building is designed to provide confinement and shielding. The tanks are located within the warm canyon, in the H-Canyon facility. Work in the canyon is normally performed remotely using installed cranes. The canyon inner and outer walls are made of concrete which provide shielding to personnel in the center sections of the canyon and gang valve corridors, respectively. Each canyon section has a sloped floor with a collection sump to contain releases of radioactive liquid, which is then transferred to Rerun for processing. There is the potential for some liquid to be released to a clean area (potential to the worker, contamination and exposure) through expansion joints which are installed between canyon sections.

The H-Canyon facility was designed for reprocessing of nuclear materials, not for the storage of solution. As a result, administrative controls and personnel ensure criticality safety in tanks containing fissile material solutions, rather than engineered safety controls such as geometrically favorable tanks.

1. E
2. B
3. Ir
as

Question 7: Site Summary

Site: Savannah River Site

Description of HEU activities.

The activities which pose the highest risks to the worker, in the long term storage of highly enriched uranium (HEU) solutions, is the sampling of the solutions. Sampling of the vessels is done at a minimum of once every two months. The worker can become contaminated/receive exposure if a sampler were to fail.
The long term storage of HEU solution also poses a risk to the public, environment/worker (especially the canyon) with respect to coil failures in the vessesl contaminating cooling water return systems.

Current planned actions.

The planned actions are to continue and enure that sufficient administrative controls and personnel are available to monitor storage vessels to prevent the potential for a criticality in tanks containing fissile material solutions.

Plans are in place to blend down the HEU to LEU. SRS is currently authorized per the SRS Site Integrated Stabilization Management Plan, Rev. 3, dated 3/20/96, to stabilize the uranyl nitrate solutions stored in the H-Canyon facility by the end of FY-2000.

Noteworth program or practices.

Noteworthy practices include the following:

Review of Authorization Basis documents to ensure limits developed to ensure nuclear criticality safety, which limit the amount of fissile material by mass, concentration, or areal density are not compromised.

Compensatory measures in place to reduce the frequency and consequence from long term storage include monitoring of both Canyon and Outside Facilites tanks, containing uranly nitrate solutions, as well as monitoring the activity of the cooling water return systems. Procedures are used for all unit operations including surveillance of canyon and outside facility tanks containing Uranyl Nitrate solutions. They provide operating ranges and limits, as well as instructions for performing activities. A certified training program exists for the qualification of operators working in H-Canyon and Outside Facilitis.

Safety systems such as the canyon ventilation system, nuclear incident monitors, canyon sump level gages, and cooling water activity monitors and diversion valves are in place to minimize the consequences of potential events involving stored radioactive material solutions.

Alarm systems associated with gamma monitors, nuclear incident monitors, and cooling water activity monitors minimize the consequences of potential events involving stored radioactive material solutions by alerting personnel to adverse conditions.

SITE: Savannah River Site	FACILITY (Building or Location) HBL
	FUNCTION: Pu Processing

Question 1: SITE

DOE Headquarters Facility Landlord: EM-60
DOE Headquarters Program Sponsor: EM-60
Facility Age: 10
Design Life: 30

Location of Facility on Site and Distance to Site Boundary

The new HB Line Facility is located on levels 5 and 6 of building 221-H between Sections 2 and 3. The site is approximately 9.7 kilometers from the nearest plant boundary.

Design Mission, Interim Mission, Current Use

HB-Line consists of three separate facilities: the Scrap Recovery Facility, the Neptunium-Oxide Facility, and the Plutonium Oxide Facility. The Scrap Recovery Facility is designed to dissolve local and offsite scrap into a nitrate solution to be transferred to H-Canyon for further processing. It is currently used as the first step to recover Plutonium-238, but may be used to recover Uranium-235, Plutonium-239, and Neptunium-237 as well. The Neptunium Oxide Facility produces neptunium oxide powder by precipitation and calcination from nitrate solutions of neptunium-237. The facility can also be used to precipitate plutonium-239 nitrate solutions. The Plutonium-Oxide Facility produces plutonium-238 oxide by precipitation and calcination from nitrate solutions of plutonium-238. The original design of HB-Line included a Waste Handling Facility to process and package the radiological wastes generated. It has been converted to a multi-purpose facility, primarily an Analytical Lab used to process samples required for HB-Line operations.

For the current campaign, the Scrap Recovery Facility is operated to dissolve existing inventories of plutonium-238 oxides in nitric acid and the Plutonium Oxide Facility is operated to produce plutonium-238 oxide from a purified solution. The purified plutonium oxide is to be packaged and used as heat sources for thermoelectric generators for NASA identified missions.

Operational Status

Operating

Historical Information

The new HB-Line is a reinforced concrete structure, constructed in the early 1980's on top of H-Canyon, consisting of three processing facilities; Phase I Scrap Recovery; Phase II Neptunium Oxide; Phase III Plutonium Oxide. These facilities were designed incorporating the lessons learned from over twenty years of operating the old B-Lines. The process utilizes stainless steel hardware throughout and all process transfers are by vacuum jet, utilizing jacketed piping outside of the gloveboxes. Containment and shielding are provided by gloveboxes, which are exhausted through two stages of independently testable HEPA filters. Process service systems (electrical, air, water, HVAC and instruments & controls) are designed with engineered features (fail-safe, redundancy, multiplicity) to preclude the escalation of postulated abnormalities.

Scrap Recovery Facility

The primary purpose of Scrap Recovery is the dissolution of existing inventories of Pu-238 oxides. Scrap Recovery consists of two identical processing lines, with one dedicated to Pu-238 service. The Pu-238 oxide is removed from its unique container inside the glovebox line and accurately measured out for introduction into a geometrically favorable dissolution vessel. The oxide is dissolved in agitated nitric acid at approximately 115 deg C in the presence of a fluoride catalyst, which is complexed with aluminum after complete dissolution. The resultant nitrate solution is vacuum transferred to a geometrically favorable hold tank through two in-line particulate filters. The filtered solution is diluted and transferred by eduction to the appropriate H-Canyon vessel, where further purification takes place.

1. E
2. E
3. I
as

Phase III Plutonium Oxide Facility

E: Savannah River Site	FACILITY (Building or Location) HBL
	FUNCTION: Pu Processing

Question 1: SITE

urified Pu-238 solution is returned from H-Canyon to Phase III for processing to an oxide. The nitrate solution is alence adjusted for proper precipitation upon addition of oxalic acid in a two stage precipitator. The precipitated u-238 is filtered and washed using in-line filter boats. The filter screen containing the oxalate cake is removed from ne filter boat and transferred to the calcining oven in a one-stage operation. The oxalate cake is then calcined using ltra-pure oxygen-16 to reduce neutron emissions from the oxide. The powder is then loaded into a stainless steel hipping container for transfer to another DOE site for further processing.

ist Authorization Basis

. Safety Analysis Reports: DPSTSA 200-10-2A, Rev 1, July 1991
DPSTSA 200-10-2B, Rev 0, May 1986
DPSTSA 200-10-2C, Rev 1, July 1991
DPSTSA 200-10-2C, Add 1, Rev 0, September 1986
Addenda to Safety Analysis Report
DPSTSA-200-10-2A,2B,2C, 2C Add. 1), Addendum 2, Stack Liner Collapse
Unreviewed Safety Question (U) February 4, 1993

. Operational Safety Requirements: WSRC-RP-90-366, Rev 1, December 1992.

. Technical Standards HB-Line, DPSTS-221-HBL, Rev 3, June 1993.

DPSTS-221-HBL-010, Rev 7/1/91	DPSTS-221-HBL-250, Rev 4/10/87
DPSTS-221-HBL-100, Rev 12/91	DPSTS-221-HBL-260, Rev 4/10/87
DPSTS-221-HBL-200, Rev 4/10/87	DPSTS-221-HBL-300, Rev 12/92
DPSTS-221-HBL-210, Rev 4/10/87	DPSTS-221-HBL-310, Rev 7/1/91
DPSTS-221-HBL-220, Rev 4/10/87	DPSTS-221-HBL-320, Rev 7/1/91
DPSTS-221-HBL-230, Rev 4/10/87	DPSTS-221-HBL-400, Rev 6/93
DPSTS-221-HBL-240, Rev 4/10/87	DPSTS-221-HBL-500, Rev 7/1/91

. Nuclear Criticality Safety Supplements: None

. Justification for Continued Operation HB-Line: WSRC-RP-92-981, October 1992.

. Test Authorizations: None

. Nuclear Incident Monitors Technical Standard: DPSTS-NIM-85, Rev 01/86.

)escribe Important or Unique Design Features

he HB-Line facility is a maximum resistance construction (MRC) structure designed to withstand a Design Bases arthquake and Design Basis Tornado. (1) The HB-Line facility structure was designed as an MRC structure, the ighest structural classification at SRS. MRC structures are designed to withstand 48 kPa (1000 lb/ft^2). (2)

IB-Line facility was designed and constructed in the early 1980s in accordance with ERDA Manual, Appendix 6301, General Design Criteria - Plutonium Facilities", applicable Du Pont Engineering Standards, Nuclear Air Cleaning Handbook and National Electric Code. (3)

)escribe Weaknesses in the Design Basis

There are no known weaknesses in the HB Line Facility.

Structural Design

Reinforced concrete

Partitioned Areas of HEU within facility

Scrap Recovery

SITE: Savannah River Site	FACILITY (Building or Location) HBL
	FUNCTION: Pu Processing

Question 1: SITE

Description of Partitioned Areas

For the purposes of this study, the Scrap Recovery Facility partitioned area will be limited to the processing and maintenance areas. Specifically, two glovebox lines, four operating areas, two maintenance areas, and two bagout rooms will form the aggregate.

The ten (10) HEU standards are all stored within cabinets in Operating Area #2 in the Scrap Recovery Facility.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There are no known hazardous materials colocated or comingled with the HEU in the HB Line Facility.

Process Material Transfers

The eight (8) HEU standards and the two (2) EUPU standards are not used by HB Line. They are stored within source cabinets/safes and therefore no material transfers occur.

On-Site Transportation

There have been no on-site transfers of the ten (10) HEU standards.

Staff Levels & Experience

HB Line Staffing Levels

	No. of Employees	Avg. Yrs. HBLine Experience
Supervisory	31	0-5
Technical	30	0-5
Operations	73	0-5
Maintenance	14	0-5
RCO	16	0-5

Applicable References

1. Safety Analysis Reports: DPSTSA 200-10-2A, Rev 1, July 1991
   DPSTSA 200-10-2B, Rev 0, May 1986
   DPSTSA 200-10-2C, Rev 1, July 1991
   DPSTSA 200-10-2C, Add 1, Rev 0, September 1986
   Addenda to Safety Analysis Report
   DPSTSA-200-10-2A,2B,2C, 2C Add. 1), Addendum 2, Stack Liner Collapse
   Unreviewed Safety Question (U) February 4, 1993

2. Operational Safety Requirements: WSRC-RP-90-366, Rev 1, December 1992.

3. Technical Standards HB-Line, DPSTS-221-HBL, Rev 3, June 1993.
   DPSTS-221-HBL-010, Rev 7/1/91
   DPSTS-221-HBL-100, Rev 12/91
   DPSTS-221-HBL-200, Rev 4/10/87
   DPSTS-221-HBL-210, Rev 4/10/87
   DPSTS-221-HBL-220, Rev 4/10/87
   DPSTS-221-HBL-250, Rev 4/10/87
   DPSTS-221-HBL-260, Rev 4/10/87
   DPSTS-221-HBL-300, Rev 12/92
   DPSTS-221-HBL-310, Rev 7/1/91
   DPSTS-221-HBL-320, Rev 7/1/91

DPSTS-221-HBL-230, Rev 4/10/87 DPSTS-221-HBL-400, Rev 6/93
DPSTS-221-HBL-240, Rev 4/10/87 DPSTS-221-HBL-500, Rev 7/1/91

Nuclear Criticality Safety Supplements: None

Justification for Continued Operation HB-Line: WSRC-RP-92-981, October 1992.

Test Authorizations: None

Nuclear Incident Monitors Technical Standard: DPSTS-NIM-85, Rev 01/86.

SITE: Savannah River Site

FACILITY (Building or Location): HBL

PARTITIONED AREA: Scrap Recovery

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[ ] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[Y] Double Contingency Not Applied (specify)	[ ] Material Limts
[ ] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[ ] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[Y] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[ ] Authorization Basis
[ ] Hood	[ ] Trenches		[Y] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[Y] Lessons-Learned
[Y] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[ ] Alarm System			[Y] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[ ] Emergency Response
[ ] Other-specify			[ ] Other-specify
[ ] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): HBL
	PARTITIONED AREA: Scrap Recovery

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Workers handling standards will be attired in one degree of protective clothing or another, depending on where within the facility the work is taking place. PCs provide an obvious barrier between the worker and the material.

However, since the HEU standards in HB Line are not used, workers are not exposed to the material.

The standards included in the Scrap Recovery partition contain only gram quantities.

The packaging of the standards, the containers in which the standards are placed, provide an additional barrier between the worker and the material. Additionally, administrative controls are in place that require donning respiratory protection if any of the packaging was required to be opened.

Public/Environment Barrier Narrative:

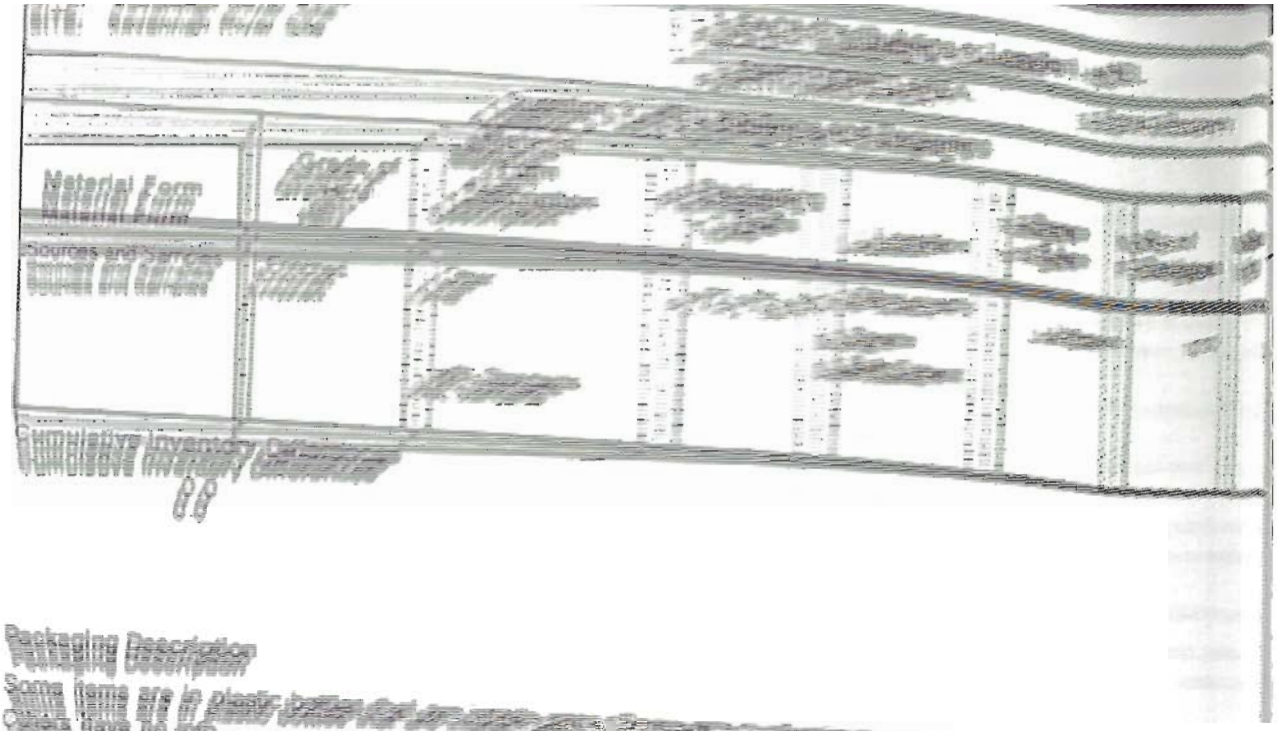
In addtion to the packaging barrier for the worker, the facility itself serves as an additional barrier to the public. The site boundary also serves as a barrier to unauthorized public access.

Criticality Barrier Narrative:

The total U-235 mass within the HB Line Facility is only gram quantities. There is no criticality concern, irregardless of configuration.

Administrative Barrier Narrative:

Waste handling and the use of standards are performed by operators in accordance with approved procedures. Use of procedures to govern these operations ensures that activities are performed safely and within the operating envelope approved for the facility.



Packaging Description

Material at Risk Description

1.
2.
3.

06/199

Savannah River Site	FACILITY (Building or Location): HBL
	PARTITIONED AREA: Scrap Recovery

Question 4: POTENTIAL CAUSES

Facility	Material	External
Process Material Transfer	[Y] Aging	[ ] Fire
Inadvertent Transfers	[Y] Container Seal Degradation	[ ] Explosion
Aging/Degradation	[ ] Pressurization	[ ] Earthquakes
Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
Change in Mission	[ ] Radioactivity	[ ] Winds
Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
Combustible Loading	[ ] Oxidation	[ ] Ash Loading
Inadequate Seals	[ ] Flammability	[ ] Aircraft Crash
Water Sources	[ ] Toxicity	[ ] Vehicle Accident
Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
Administrative Control	[ ] Other - Specify	[ ] Other-specify
Human Error		
Chemical Reactions		
Contamination		
Inadequacy of Design Basis		
Design Deficiency		
Flooding		
Fire		
Other SAR Accidents		
Other-specify		

cribe Each Potential Cause Identified Above:

g of the material packaging is unknown. Over time, the packaging may degrade resulting in the loss of seal integrity.

SITE: Savannah River Site	FACILITY (Building or Location) HBL
	PARTITIONED AREA: Scrap Recovery

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other HBL Standards	P2, , P0, , B0,	Other-specify Source Safe/Cabinet	Unknown	10	0

Cumulative Inventory Differences

0.0

Packaging Description

Some items are in plastic bottles that are inside cans. Some are in aluminum cans. Others have no info.

Material at Risk Description

U-235 standards, two with Pu-239 included. Some are sealed in plastic bottles, some packaging unknown.

1. E
2. E
3. I
a

TE: Savannah River Site	FACILITY (Building or Location): HBL
	PARTITIONED AREA: Scrap Recovery

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[Y] Aging	[ ] Fire
[ ] Inadvertent Transfers	[Y] Container Seal Degradation	[ ] Explosion
[ ] Aging/Degradation	[ ] Pressurization	[ ] Earthquakes
[ ] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[ ] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[ ] Aircraft Crash
[ ] Water Sources	[ ] Toxicity	[ ] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[ ] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[ ] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

Aging of the material packaging is unknown. Over time, the packaging may degrade resulting in the loss of seal integrity.

SITE: Savannah River Site

FACILITY (Building or Location): HBL

PARTITIONED AREA: Scrap Recovery

Question 5: POTENTIAL EFFECTS

Facility	Material	External
☐ Fire	☐ Criticality	☐ Loss of Site Integrity
☐ Explosion	☐ Material Release	☐ Loss of Building Integrity
☐ Contamination	☐ Breach of Packaging	☐ Release of Materials
☐ Criticality	☐ Fire	☐ Radiation and Releases from Criticality
☐ Leakage/Spills	☐ Other-specify	
☐ Other Accidents-specify		
☐ Structural Failure		
☐ Equipment Failure		
☐ Material Release		
☐ Increased Radioactivity Level		
☐ Other-specify		

Describe Each Effect Identified Above:

Breach of material packaging of any of the standards could occur. However, the standards are located in a locked source s a remote, seldom used location within the Facility and are rarely handled. Addtionally, the standards are surveyed by Radiological Control before any of them are handled which is an addtional safeguard against personnel contamination or exp

1.
2.
3.

SITE: Savannah River Site	FACILITY (Building or Location): HBL
	PARTITIONED AREA: Scrap Recovery

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
reach of Packaging									

Explanation

A vulnerability does not exist for HB Line due to the small quantities of material contained in the standards and the fact that all of the standards are located in a locked source safe in a remote, seldom used location within the Facility. Addtionally, the standards are surveyed by Radiological Control before any of them are handled which is an addtional safeguard against personnel contamination or exposure. Therefore, there are no potential consequences.

Applicable References

Question 7: Site Summary

River Site

assessment of the site ES&H vulnerabilities.

oncerns

ł concerns.

U activities.

risk activities.

ctions.

standards currently located in HB Line will be shipped to the 235-F Facility in the near future. The s to use two of the standards for start-up activities. Upon completion of the start-up activities, all ds will be evaluated for permanent disposal.

m or practices.

; had no use for the HEU standards, they have all been placed in a source safe along with other ards that are not currently being used. This source safe is located in an area of the Facility that is ce the room in which the source safe is located is rarely entered by workers, and the source safe ost never accessed by workers, the Facility has assured that radiation exposure due to the HEU n kept as low as reasonably achievable.

SITE: Savannah River Site	FACILITY (Building or Location) 321-M
	FUNCTION:

Question 1: SITE

DOE Headquarters Facility Landlord: DP-20
DOE Headquarters Program Sponsor: DP-20 **Design Life:** 0
Facility Age: 39

Location of Facility on Site and Distance to Site Boundary

M-Area is located at the northern edge of the Savannah River Site approximately 0.4 miles from the site boundry. Maps of the M-Area facilities can be found in OSR3-158, Site Maps.

Design Mission, Interim Mission, Current Use

Building 321-M is a facility in cold shutdown, which in the past provided fuel assemblies for the nuclear production reactors onsite.

Operational Status

Not operating

Historical Information

There have been no Occurance Reports, Unreviewed Reviewed Safety Questions, Defense Nuclear Facilities Safety concerns, or regulatory concerns since the facility entered the shutdown mode.

List Authorization Basis

•Justification for Continued Operation (Applicable to all M Area Nuclear Facilities, DPSTSA-300-3A Addendum 1, Rev. Date September 1994.
•Operational Safety Requirements for Building 321-M, DPW-86-101, December 1988.
•Technical Standards (Applicable to 300 Area), WSRC-TN-21, July 31, 1991.
•Nuclear Criticality Safety Supplements 300 Area, WSRC-21-SUP, September 1988 through March 1995.
•300 Area Safety Analysis Report, DPSTSA-300-3A, June 1987.
•M Area Facilities Justification for Continued Operation (JCO) (U), RRD-94-0076, June 9, 1994.

Describe Important or Unique Design Features

Building 321-M is a rectangular steel frame structure with a roof consisting of precast concrete panels covered by insulation board, a vinly membrane and protective tiles. The steel frame is covered with a 0.4-inch-thick asbestos cement board cladding system. The building is constructed on a grade-level concrete pad and covers about 1.2 acres of floor space. The high-bay area over the extrusion press is 28 feet high, and the remainder of the building is 14 feet high. Building 321-M is a class II, friable construction, facility according to specification 3580 (contained in DuPont Site Specification 7096).

The Building 321-M Contamination Area (Charge Preparation, Casting, Machining rooms) is ventilated by a once-through HVAC system. The HVAC supply fans and nine exhaust fans are designed to maintain the Contamination Area at a slightly negative pressure with respect to the remainder of the Building 321-M. Each exhaust fan ventilates a specific piece of equipment or room. The exhaust ducts are constructed of galvanized sheet steel. Each exhaust is single or double stage HEPA filtered. The exhaust fans, a portion of the ductwork, and most HEPA filter housings are located on the building roof. Each exhaust is sampled to monitor radionuclide emmisions.

Describe Weaknesses in the Design Basis

Weakness in Design Basis: The facility and equipment is not designed to withstand a fire, tornado, or straight winds. There is no installed fire suppression system.

Structural Design

Steel frame

Partitioned Areas of HEU within facility

SITE: Savannah River Site	FACILITY (Building or Location) 321-M
	FUNCTION:
Question 1: SITE	

Description of Partitioned Areas

Building 321-M

Amount & Location of Hazardous Material Collocated or Commingled with HEU

Asbestos within building wall sections.

Process Material Transfers

There are no material transfers involved in the shutdown mode of this facility.

On-Site Transportation

There is no onsite transportation involved in the shutdown mode of this facility.

Staff Levels & Experience

Minimal staffing of building Custodian and Lay-up crew.

Applicable References

SITE: Savannah River Site	FACILITY (Building or Location): 321-M
	PARTITIONED AREA: 321-M

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]

- [ ] Gloveboxes
- [ ] Transfer System
- [Y] Duct
- [ ] Filter
- [ ] Vault
- [Y] Room
- [ ] Hot Cell/Canyon
- [ ] Hood
- [ ] Piping
- [ ] Shielding
- [Y] Distance
- [Y] Respiratory Protection
- [Y] Protective Clothing
- [ ] Remote Handling
- [ ] Confinement System
- [ ] Burial Ground
- [ ] Tanks
- [ ] Alarm System
- [ ] Temporary Barriers
- [ ] Other-specify

- [ ] None

Public/Environmental Barrier [2]

- [Y] Facility/Building Boundary
- [Y] HVAC/Confinement
- [ ] Liquid Containment/Dike
- [ ] Bay, Cells, Magazines
- [ ] Canyons
- [ ] Pads
- [Y] Site Boundary
- [ ] Trenches
- [ ] Storage Vault
- [ ] Alarm System
- [ ] Fire Suppression
- [ ] Other - Specify

Criticality [1,2]

- [Y] Double Contingency Applied
- [ ] Double Contingency Not Applied (specify)

(e.g., Mass
Absorbers
Geometry
Interaction
Concentration
Moderation
Enrichment
Reflection
Volume)

Administrative Barrier [3]

- [Y] Procedure: Operation, Maint.
- [Y] Material Limts
- [Y] Monitoring
- [ ] Configuration Control
- [Y] Quality Assurance
- [Y] Conduct of Operations
- [Y] Authorization Basis
- [ ] Training
- [ ] Organization
- [ ] Lessons-Learned
- [ ] Testing
- [ ] Trending
- [ ] Records
- [ ] Standards
- [ ] External Regulation
- [Y] Surveillance
- [ ] Personnel Reliablity Assurance Program
- [ ] Worker/Access Occupancy Limits
- [Y] Emgergency Response
- [ ] Other-specify

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 321-M
	PARTITIONED AREA: 321-M

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

•Room-Separate areas normally unoccupied.

•Duct-Holdup U-Al is within ductwork in regulated area. This provides some separation from surveillance personnel.

•Distance-Building 321-M is normally unoccupied providing a distance barrier between the area worker and HEU.

•Respiratory protection and protective clothing-Personal Protective Equipment (PPE) routinely worn by workers.

Public/Environment Barrier Narrative:

- Facility is located 0.4 miles from the site boundry.
- Building and HEPA-filtered exhausts provide containment.

Criticality Barrier Narrative:

Calculation N-CLC-M-00019 shows that the expected frequency for criticality due to the holdup material in Building 321-M is incredible (i.e., 2.2 E-10/yr)

Administrative Barrier Narrative:

Operating procedures specify the number of fissile items that may be placed in each physical location.

Authorization Basis documents provide the facility design basis, operational requirements, and authorized bounds of operation important to safety.

Conduct of operations procedures have been imnplemented at SRS through WSRC Procedure Manual 2S, Conduct of Operations. The manual contains a very detailed and commprehensive organization including diagrams, duties, and responsibilities.

The WSRC quality assurance program is implemented as described in the WSRC Quality Assurance Manual (WSRC 1Q). Actitivies affecting quality, safety, and/or reliability of operations, products, and services are performed in accordance with documented and approved procedures.

The facility is walked down daily to check for changes that could compromise HEU locations or configuration. Radiological surveys are routinely performed. Exhaust effluents are monitored for radiological emissions.

TE: Savannah River Site	FACILITY (Building or Location) 321-M
	PARTITIONED AREA: 300-M

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
oldup	Enriched	Other -specify U-Al Alloy	, W1,	Process Area	10 yrs.	19	0.00

umulative Inventory Differences

0.0

ackaging Description

oldup material in Building 321-M located within the ductwork and therefore is not ackaged.

aterial at Risk Description

EU material contained within ductwork and equipment.

09/05/[illegible]

SITE: Savannah River Site	FACILITY (Building or Location) 321-M
	PARTITIONED AREA: 300-M

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other -specify U-Al Alloy	, , , , , C1, , C0,	Process Area	5-10 years	0	0

Cumulative Inventory Differences

0.0

Packaging Description

Hepa filter standards in cordboard boxes.
Pre filter standards stored in plastic bags.
Crucible standards stored inside portable crucible cart.
No. 10 can standards stored in storage rack.
(All coverings serve as contamination barriers)

Material at Risk Description

HEU material contained in:

Hepa filter standards

Pre filter standards.

Crucible standards cart.

No. 10 can standards.

[illegible]	Savannah River Site
	Facility
[ ]	Change in [illegible]

SITE: Savannah River Site	FACILITY (Building or Location): 321-M
	PARTITIONED AREA: 321-M

Question 5: POTENTIAL EFFECTS

Facility	Material	External
[ ] Fire	[ ] Criticality	[ ] Loss of Site Integrity
[ ] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[Y] Contamination	[ ] Breach of Packaging	[Y] Release of Materials
[ ] Criticality	[ ] Fire	[ ] Radiation and Releases from Criticality
[ ] Leakage/Spills	[ ] Other-specify	
[ ] Other Accidents-specify		
[Y] Structural Failure		
[ ] Equipment Failure		
[Y] Material Release		
[ ] Increased Radioactivity Level		
[ ] Other-specify		

Describe Each Effect Identified Above:

A facility fire, tornado or straight winds could cause release of material from exhaust ducts on the Building 321-M roof.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	FUNCTION: 105-K ASSEMBLY

Question 1: SITE

DOE Headquarters Facility Landlord:
DOE Headquarters Program Sponsor:
Facility Age: 42 Design Life: 0

Location of Facility on Site and Distance to Site Boundary

The K-Reactor is located approximately 8.8 kilometers from the western site boundary (ref. WSRC-SA-10003, Savannah River Site Production Reactor Safety Analysis Report, K Production Reactor). Maps of the site and the Assembly Area can be found in this Reference and in OSR3-158, Site Maps.

Design Mission, Interim Mission, Current Use

The original designed mission of the Assembly Area was to receive, assemble, inspect, and stage new fuel assemblies, unirradiated targets, and reactor components in a critically safe configuration prior to use in the reactor. The current mission is to provide a staging area for the site inventory of unirradiated enriched uranium material in a manner that provides asset and criticality protection. This material is to be staged in the K-Reactor Asembly Area until plans are made for a permanent storage location (i.e. Oak Ridge).

Operational Status

Other- specify Cold Standby

Historical Information

Reactor Incident (RI) Reports and Occurrence Reports were examined in WSRC-TR-93-55, REV. 3, Basis for Interim Operation (BIO) for the K-Reactor Assembly Area, to determine the abnormal occurrences related to the storage of reactor fuel. The reports cover the period 1957 through 1993 for the five production reactors at SRS. Of over 7000 reports, seven were concerned with unirradiated fuel storage, The Assembly Area, or the Final Storage Area.

Five of the reports were a result of personnel error, the sixth was due to procedure error, and the seventh involved a roof leak. The proposed compensatory measures involved instructing personnel to improve their attention to following strict procedures, correcting procedures, fixing the leaking roof, and instituting a roof surveillance program.

List Authorization Basis

1) K Production Reactor Safety Analysis Report, WSRC-SA-10003, REV. 4, November 8, 1992

2) K Production Reactor Technical Specifications, WSRC-TS-10003, REV. 23, December 12, 1995

08r

3) **Basis for** Interim Operation for the K-Reactor Assembly Area, WSRC-TR-93-55, June 1995

Describe Important or Unique Design Features

The Assembly area is a single-story structure with a basement under a portion of structure. The roof height of the Assembly Area is 40 feet except for the Final Storage Area which is 34 feet high. The Assembly Area (except for the Final Storage Area) is a Class III structure designed to Uniform Building Code-1946 and its supplements. The roof of the Assembly Area consists of 2-inch concrete slabs on steel joists, and the exterior walls consist of corrugated asbestos on steel girts. The Final Storge Area, Slug Vault, and Presentation Room are all Seismic Category I structures with reinforced concrete roofs, walls, foundations, and monorail systems capable of resisting forces due to Design Basis Earthquake and were originally designed to withstand blast resistant to 1000 psf.

There are several unique design features of 105-K Assembly which are described in the following paragraphs.

The slug vault serves as a staging area for DOT-6M shipping containers. It is a seismically qualified area that was designed to survive a blast of at least 1000 psf.

The Final Storage Area is used to stage unirradiated Mark 22 fuel assemblies on monorail-mounted hangers. The monorails are mounted on the ceiling in rows which are separated to prevent crititcality. Also, the hangers provide additional protection from criticality by their size which prevents assemblies from getting too close to each other. The final Storage Area is a vault like room of steel-reinforced concrete with heavy metal doors that are locked to prevent unauthorized access. No water lines are located in the room, and other moderating materials are minimized procedurally. Floor drains located in front of the entrance doors drain to the -20 foot elevation basement and help prevent water from entering Final Storage Area. This area is seismically qualified and designed to resist a blast of at least 1000 psf.

The Presentation Room is used to stage DOT-6M shipping containers of ingots moved from M-Area. This area is seismically qualified and designed to resist a blast of at least 1000 psf.

A Nuclear Incident Monitor (NIM) system is installed to provide a visual and audible alarm in the event of a nuclear criticality.

The Borated Concrete Storage Racks are used for storage of unirradiated enriched auranium material in a manner which prevents criticality.

Though the portion of the K-Reactor Assembly Area where the borated concrete storage racks reside is not a Seismic Category I structure, the concrete walls along the backs of the storage racks provide some protection during high wind and seismic events. Concrete walls behind the storage racks are 18-inch thick reinforced concrete and are approximately the same height as the storage racks.

The security cages on the front of the borated concrete storage racks protect the fuel from unauthorized removal and provide some protection against fuel being ejected from the racks during high wind and seismic events.

The Assembly Area is ventilated by a once-through/ recirculating ventilation system. It is pressurized with respect to the Process Room, Receiving Bay, and the outdoors. Air handling systems draw in outdoor air and return air, and filter the mixed air before it is heated or cooled, as required. The fans in the air handling system then deliver the conditioned supply air to the various rooms through a network of ducts.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	FUNCTION: 105-K ASSEMBLY
Question 1: SITE	

Describe Weaknesses in the Design Basis

There were no safety-related deficiencies or noncompliances identified in WSRC-TR-500, Basis for Interim Operation (BIO) For the K-Reactor Assembly Area.

Structural Design

Steel frame

Partitioned Areas of HEU within facility

Final Storage
Borated Racks
Floor Storage

Description of Partitioned Areas

The Final Storage Area is located in the northwestern portion of 105-K Assembly Area and is used to stage unirradiated Mark 22 fuel assemblies on monorail-mounted hangers. The monorails are mounted on the ceiling in rows which are separated to prevent crititcality. The Final Storage Area is a vault like room of steel-reinforced concrete with heavy metal doors that are locked to prevent unauthorized access. This area is seismically qualified and designed to resist a blast of at least 1000 psf.

The borated racks are located on the south end of the Assembly Area. There are four distinct racks, each constructed of stacks of concrete slabs 8" thick, 5.5' wide, by 13.5' long. The slabs are constructed of a concrete and boron glass frit mixture poured around nine PVC or polystyrene tubes. The tubes in the slabs have a 5 inch inside diameter to accommodate and entire fuel assembly or ingots and are spaced on 7-inch centers. Nine of the concrete slabs are stacked together to form one "stack", providing 81 storage locations. A rack contains either four or six stacks placed together. There are concrete walls along the backs of the storage racks which provide some protection during high wind and seismic events. Concrete walls behind the storage racks are 18-inch thick reinforced concrete and are approximately the same height as the storage racks. The security cages on the front of the borated concrete storage racks protect the fuel from unauthorized removal and provide some protection against fuel being ejected from the racks during high wind and seismic events.

The Floor Storage partitioned Area represents the balance of the Assembly Area where fissile material may be handled or stored, excluding the borated racks and Final Storage. Floor Storage includes the Slug Vault, Receiving Bay, Presentation Point, and the Process and Handling Zones.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

Except for asbestos in the Assembly Area walls, there are no known hazardous chemicals/materials used, stored, or

Savanna

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Borated Racks

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Protective clothing and respiratory protection are employed in operations involving potential surface contamination and airborne contamination.

A Nuclear Incident Alarm (NIM) system is installed to provide a visual and audible alarm in the event of a nuclear criticality.

Aluminum cladding on fuel tubes prevents personnel exposure to radioactive contamination.

The reinforced concrete walls of Final Storage reduce personnel radiation exposure.

Tritium contaminated Mark 22 assemblies are contained in aluminum storage cans to prevent personnel exposure to radioactive contamination.

Ingot cans prevent personnel exposure to radioactive contamination.

The concrete matrix used in construction of the borated racks help reduce personnel radiation exposure.

Access to the borated racks by unauthorized personnel is prevented by the use of locked and alarmed steel cage doors.

Public/Environment Barrier Narrative:

The distance to the site boundary ensures that the public is not exposed to any significant risk form normal operations, abnormal events, or postulated accidents

Criticality Barrier Narrative:

EPD-CTG-95-0085, Nuclear Criticality Safety Evaluation: Double Contingency Analysis for K-Reactor Assembly shows that K-Assembly complies with the double contingency principle as specified in DOE Order 5480.24.

Fuel assemblies, tubes, and ingots are critically safe due to spacing and absence/restriction of moderators. The borated racks also contain sufficient amounts of boron, a neutron poison, to prevent criticality.

Administrative Barrier Narrative:

The boron content of the racks is measured at prescribed frequencies to protect against inadvertant crititcality.

Surveillances are performed at prescribed frequencies to ensure that floor drains remain open.

Operating procedures specify the number of ingots, fuel tubes and assemblies which can be placed into each storage rack position.

Authorization Basis documents provide the facility design basis, operational requirements, and authorized bounds of operation important to safety.

Conduct of operations procedures have been implemented at SRS through WSRC Procedure Manual 2S, Conduct of Operations. The manual contains a very detailed and comprehensive organization including diagrams, duties, and responsibilities.

The WSRC quality assurance program is implemented as described in the WSRC Quality Assurance Manual (WSRC 1Q). Actitivies affecting quality, safety, and/or reliability of operations, products, and services are performed in accordance with documented and approved procedures. Personnel who perform quality verification activities are qualified/certified as appropriate. Qualification/certification programs include documentation of capability through either written tests and/or physical demonstrations of skill and continued maintenance of the individual's proficiency based upon retraining or continued satisfactory performance.

A Configuration Control Program, as described in Procedure Manual 7E, Configuration Management Manual, and the WSRC 1E Manual, is established to identify and document the technical baseline of safety related structure, systems, components, and computer software as well as to ensure that changes to the technical baseline are properly developed, assessed, approved, issued, and implemented.

WSRC Manuals 6Q and 6Q7 provide emergency response plans for the site and reactor areas.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]

- [ ] Gloveboxes
- [ ] Transfer System
- [ ] Duct
- [ ] Filter
- [Y] Vault
- [ ] Room
- [ ] Hot Cell/Canyon
- [ ] Hood
- [ ] Piping
- [Y] Shielding
- [ ] Distance
- [Y] Respiratory Protection
- [Y] Protective Clothing
- [ ] Remote Handling
- [ ] Confinement System
- [ ] Burial Ground
- [ ] Tanks
- [Y] Alarm System
- [Y] Temporary Barriers
- [Y] Other-specify

aluminum cladding, plastic bags

- [ ] N None

Public/Environmental Barrier [2]

- [ ] Facility/Building Boundary
- [ ] HVAC/Confinement
- [ ] Liquid Containment/Dike
- [ ] Bay, Cells, Magazines
- [ ] Canyons
- [ ] Pads
- [Y] Site Boundary
- [ ] Trenches
- [ ] Storage Vault
- [ ] Alarm System
- [ ] Fire Suppression
- [ ] Other - Specify

Criticality [1,2]

- [Y] Double Contingency Applied
- [ ] Double Contingency Not Applied (specify)

(e.g., Mass
Absorbers
Geometry
Interaction
Concentration
Moderation
Enrichment
Reflection
Volume)

Administrative Barrier [3]

- [Y] Procedure: Operation, Maint.
- [ ] Material Limts
- [ ] Monitoring
- [Y] Configuration Control
- [Y] Quality Assurance
- [Y] Conduct of Operations
- [Y] Authorization Basis
- [ ] Training
- [ ] Organization
- [ ] Lessons-Learned
- [ ] Testing
- [ ] Trending
- [ ] Records
- [ ] Standards
- [ ] External Regulation
- [Y] Surveillance
- [ ] Personnel Reliability Assurance Program
- [Y] Worker/Access Occupancy Limits
- [Y] Emergency Response
- [ ] Other-specify

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Protective clothing and respiratory protection are employed in operations involving potential surface contamination and airborne contamination.

A Nuclear Incident Alarm (NIM) system is installed to provide a visual and audible alarm in the event of a nuclear criticality.

Aluminum cladding on fuel tubes prevents personnel exposure to radioactive contamination.

The reinforced concrete walls of Final Storage reduce personnel radiation exposure.

Tritium contaminated Mark 22 assemblies are sealed in plastic bags to prevent personnel exposure to radioactive contamination.

Public/Environment Barrier Narrative:

The distance to the site boundary ensures that the public is not exposed to any significant risk form normal operations, abnormal events, or postulated accidents

Criticality Barrier Narrative:

EPD-CTG-95-0085, Nuclear Criticality Safety Evaluation: Double Contingency Analysis for K-Reactor Assembly shows that K-Assembly complies with the double contingency principle as specified in DOE Order 5480.24.

Fuel assemblies stored in Final Storage are critically safe due to spacing and absence/restriction of moderators.

Administrative Barrier Narrative:

Authorization Basis documents provide the facility design basis, operational requriements, and authorized bounds of operation important to safety.

Occupancy limits have been established for Final Storage so as to limit the amount of moderators present in the area.

Surveillances are performed at prescribed frequencies to ensure that floor drains remain open.

Conduct of operations procedures have been implemented at SRS through WSRC Procedure Manual 2S, Conduct of Operations. The manual contains a very detailed and comprehensive organization including diagrams, duties, and responsibilities.

The WSRC quality assurance program is implemented as described in the WSRC Quality Assurance Manual (WSRC 1Q). Actitivies affecting quality, safety, and/or reliability of operations, products, and services are performed in accordance with documented and approved procedures. Personnel who perform quality verification activities are qualified/certified as appropriate. Qualification/certification programs include documentation of capability through either written tests and/or physical demonstrations of skill and continued maintenance of the individual's proficiency based upon retraining or continued satisfactory performance.

A Configuration Control Program, as described in Procedure Manual 7E, Configuration Management Manual, and the WSRC 1E Manual, is established to identify and document the technical baseline of safety related structure, systems, components, and computer software as well as to ensure that changes to the technical baseline are properly developed, assessed, approved, issued, and implemented.

WSRC Manuals 6Q and 6Q7 provide emergency response plans for the site and reactor areas.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[ ] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[ ] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[ ] Material Limits
[ ] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[ ] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[Y] Vault	[ ] Canyons		[Y] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[Y] Alarm System			[Y] Worker/Access Occupancy Limits
[Y] Temporary Barriers			[Y] Emergency Response
[Y] Other-specify			[ ] Other-specify
aluminum cladding, plastic bags			
[ ] N None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

Savanna

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Floor Storage

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[ ] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[ ] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[Y] Material Limits
[ ] Duct	[ ] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[ ] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[ ] Distance	[ ] Fire Suppression		[ ] Testing
[Y] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[Y] Protective Clothing			[ ] Records
[ ] Remote Handling			[ ] Standards
[ ] Confinement System			[ ] External Regulation
[ ] Burial Ground			[Y] Surveillance
[ ] Tanks			[ ] Personnel Reliability Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Respon
[ ] Other-specify			[ ] Other-specify
DOT-6M, DOT 17C			
[N] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site

Describe each barrie

Worker Barrier Narr

Portable docking and re

A Nuclear Incident Alarm

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Borated Racks

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Other	, C0,,,	Other-specify borated racks	1 - 2 yrs.	396	0

Cumulative Inventory Differences

0.0

Packaging Description

Dross skimmings are packaged in a tin-plated #3 fooddpack can which serves as a contamination barrier.

Material at Risk Description

Dross skimmings arecast ingots of uranium-aluminum alloy generated by the 321-M casting process.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Borated Racks

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Unirradiated de-inventory ingots		Other-specify borated racks	1 - 3 years	5718	0.00

Cumulative Inventory Differences

0.0

Packaging Description

De-inventory ingots are packaged in tin-plated #3 foodpack cans.

Material at Risk Description

De-inventory ingots are solid uranium-aluminum alloy ingots approximately 4" diameter by 10" long that were produced by a casting process.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Borated Racks

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Other fuel tubes and assemblies	. . aluminum can,	Other-specify borated racks	5-7 yrs.	978	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Some of the Mark 22 fuel assemblies are housed in aluminum cans to prevent the spread of tritium contamination.

Material at Risk Description

Mark 22 fuel tubes and assemblies with external aluminum cladding which prevents the spread of HEU contamination.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Final Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reador fuel	Enriched	Unirradiated assemblies	, B2,	Other-specify Final Storage	5 - 7 yrs.	874	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Some of the Mark 22 assemblies are tritium contaminated and are sealed in plastic bags.

Material at Risk Description

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Floor Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Other de-inventory ingots	, C0, , B0, , X2, ,	Other-specify process floor	1 - 3 yrs.	120	0.0

Cumulative Inventory Differences

0.0

Packaging Description

De-inventory ingots are sealed in #3 tin-plated food cans. Two canned ingots are placed in a plastic sleeve with stainless steel sponges (for shock absorption) and packaged inside the 2R inner containers of the DOT 6M shipping containers.

Material at Risk Description

De-inventory ingots are solid uranium-aluminum alloy ingots approximately 4" diameter by 10" long that were produced by a casting process.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Floor Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Other floorsweepings	, B0, C0, X2, DOT-	Other-specify Assembly process floor	1 - 3 yrs.	362	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Floorsweepings are sealed in #3 tin-plated food cans. Two canned floorsweepings are placed in a plastic sleeve with stainless steel sponges (for shock absorption) and packaged inside the 2R inner containers in the DOT 6M shipping containers.

Material at Risk Description

Floorsweepings are uranium-aluminum particles contaminated with trash swept from the casting furnace enclosures in Building 321-M

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Floor Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Other dross skimmings	, C0, , , , 6M/2R i	Other-specify Assembly process floor	1 -3 yrs.	116	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Dross skimmings are sealed in #3 tin-plated food cans. Two canned skimmings are placed in a plastic sleeve with stainless steel sponges (for shock absorption) and packaged inside the 2R inner containers in the DOT 6M shipping containers.

Material at Risk Description

Dross skimmings are cast ingots of uranium-aluminum alloy generated from the 321-M casting process

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Floor Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Process residues	Enriched	Filters	, DOT 17C,	Other-specify Assembly process floor	1 - 3 yrs.	95	0.00

Cumulative Inventory Differences

0.0

Packaging Description

The filters are wrapped in plastic and packaged in DOT 17C 55 gallon drums.

Material at Risk Description

Used pre-filters and HEPA filters containing U-Al alloy particles.

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	PARTITIONED AREA: Floor Storage

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Sources and Samples	Enriched	Other disk standards	, F1, , X2, , DOT	Other-specify process floor	1 yr.	12	000

Cumulative Inventory Differences

0.0

Packaging Description

Disk standards are individually wrapped in aluminum foil and packaged in a DOT 17C shipping container using empty #3 foodpack cans as an overpack

Material at Risk Description

Disk standards are uranium-alloy disks used as shuffler calibration standards. Approximate dimensions are 6" diameter by 1" thickness.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Borated Racks

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[ ] Aging	[ ] Fire
[ ] Inadvertent Transfers	[Y] Container Seal Degradation	[ ] Explosion
[Y] Aging/Degradation	[ ] Pressurization	[Y] Earthquakes
[ ] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[Y] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[Y] Aircraft Crash
[Y] Water Sources	[ ] Toxicity	[Y] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[Y] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[Y] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

FACILITY:

Equipment failure results in crane or hoist to fall on racks.
Water sources sustain damage to pipe or valve causing moderator to leak out.
Human error results in results in fuel being placed in unsafe configuration.

EXTERNAL:

Earthquake reconfigures material into unsafe configuration.
Straight winds/tornadoes cause structural damage which reconfigures material into unsafe array.
Aircraft crash causes material to be dislodged and results in an unsafe configuration
Vehicle accident involving forktruck results in material being in unsafe configuration.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[ ] Aging	[Y] Fire
[ ] Inadvertent Transfers	[Y] Container Seal Degradation	[ ] Explosion
[ ] Aging/Degradation	[ ] Pressurization	[ ] Earthquakes
[ ] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[ ] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[Y] Aircraft Crash
[Y] Water Sources	[ ] Toxicity	[ ] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[Y] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[Y] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

FACILITY:

Water sources sustain damage to pipe or valve causing release of moderator.

Human error results in results in fuel being placed in unsafe configuration.

Fire results in fuel being placed in unsafe configuration

EXTERNAL:

Aircraft crash causes material to be dislodged and results in an unsafe configuration.

Fire causes material to be dislodged and results in an unsafe configuration.

ITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Floor Storage

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[ ] Aging	[ ] Fire
[ ] Inadvertent Transfers	[ ] Container Seal Degradation	[ ] Explosion
[ ] Aging/Degradation	[ ] Pressurization	[Y] Earthquakes
[Y] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[Y] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[ ] Floods
[ ] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[Y] Aircraft Crash
[Y] Water Sources	[ ] Toxicity	[Y] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[ ] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[ ] Adjacent Facility Accident
[ ] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[Y] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[Y] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

FACILITY:

Equipment failure results in crane or hoist to fall on drums.
Water sources sustain damage to pipe or valve causing release of moderator.
Human error results in results in fuel being placed in unsafe configuration.
Fire results in results in fuel being placed in unsafe configuration.

EXTERNAL:

Earthquake reconfigures material into unsafe configuration.
Straight winds/tornadoes cause structural damage which reconfigures material into unsafe array.
Aircraft crash causes material to be dislodged and results in an unsafe configuration
Vehicle accident involving forktruck results in material being in unsafe configuration.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Borated Racks

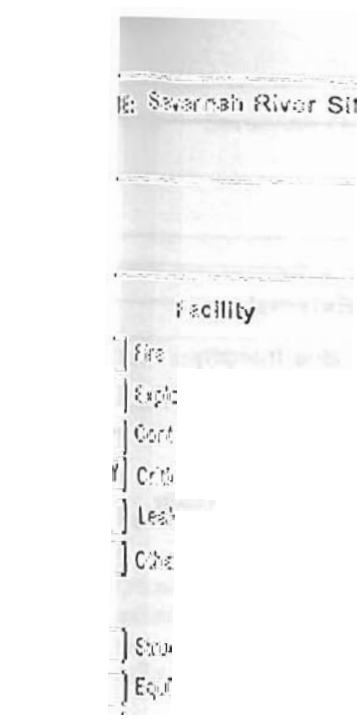
Question 5: POTENTIAL EFFECTS

Facility	Material	External
[ ] Fire	[ ] Criticality	[ ] Loss of Site Integrity
[ ] Explosion	[Y] Material Release	[ ] Loss of Building Integrity
[ ] Contamination	[Y] Breach of Packaging	[Y] Release of Materials
[Y] Criticality	[ ] Fire	[Y] Radiation and Releases from Criiticality
[ ] Leakage/Spills	[ ] Other-specify	
[ ] Other Accidents-specify		
[ ] Structural Failure		
[ ] Equipment Failure		
[ ] Material Release		
[ ] Increased Radioactivity Level		
[ ] Other-specify		

Describe Each Effect Identified Above:

A criticality event could occur from any of the causes listed in Question 4 due to the fissile material arrays being disturbed and moderated.

The integrity of the packaging (aluminum cans housing tritium contaminated assemblies and tin-plated steel foodpack cans housing ingots and skimmings) could be compromised from the causes listed in Question 4.



IE: Savannah River Sit

Facility

Fire

Explo

Cont

Criti

Leak

Othe

Stru

Equi

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Other - specify (Facility) N/A									

Explanation

Numerous process accident scenarios, natural phenomena events, and criticality were analyzed in the K-Assembly BIO. Criticality is the only event having potential for release of significant contamination or radiation. This BIO shows that criticality is considered not credible due to its calculated frequency of less than one event per 1.0E6 years and that the consequence of all postulated process accident scenarios and natural phenomena events would have negligible impact on the facility worker, environment, or the public.

Applicable References

Basis for Interim Operation (BIO) for the K-Reactor Assembly Area, WSRC-TR-93-500, Rev. 3, June 1995

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Floor Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Other - specify (Facility) N/A									

Explanation

Numerous process accident scenarios, natural phenomena events, and criticality were analyzed in the K-Assembly BIO. Criticality is the only event having potential for release of significant contamination or radiation. This BIO shows that criticality is considered not credible due to its calculated frequency of less than one event per 1.0E6 years and that the consequence of all postulated process accident scenarios and natural phenomena events would have negligible impact on the facility worker, environment, or the public.

Applicable References

Basis for Interim Operation (BIO) for the K-Reactor Assembly Area, WSRC-TR-93-500, Rev. 3, June 1995

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Final Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Other - specify (Facility) N/A									

Explanation

Numerous process accident scenarios, natural phenomena events, and criticality were analyzed in the K-Assembly BIO. Criticality is the only event having potential for release of significant contamination or radiation. This BIO shows that criticality is considered not credible due to its calculated frequency of less than one event per 1.0E6 years and that the consequence of all postulated process accident scenarios and natural phenomena events would have negligible impact on the facility worker, environment, or the public.

Applicable References

Basis for Interim Operation (BIO) for the K-Reactor Assembly Area, WSRC-TR-93-500, Rev. 3, June 1995

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: Floor Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Other - specify (Facility) N/A									

Explanation

Numerous process accident scenarios, natural phenomena events, and criticality were analyzed in the K-Assembly BIO. Criticality is the only event having potential for release of significant contamination or radiation. This BIO shows that criticality is considered not credible due to its calculated frequency of less than one event per 1.0E6 years and that the consequence of all postulated process accident scenarios and natural phenomena events would have negligible impact on the facility worker, environment, or the public.

Applicable References

Basis for Interim Operation (BIO) for the K-Reactor Assembly Area, WSRC-TR-93-500, Rev. 3, June 1995

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	FUNCTION: Disassembly Basin

Question 1: SITE

DOE Headquarters Facility Landlord:
DOE Headquarters Program Sponsor:
Facility Age: 42 Design Life: 0

Location of Facility on Site and Distance to Site Boundary

The K-Reactor Disassembly Basin is located approximately 5.5 miles from the western site boundary (ref. WSRC-10003, Savannah River Site Production Reactor Safety analysis Report, K Production Reactor). Maps of the site and the Disassembly Basin can be found in this reference and in OSR3-158, Site Maps.

Design Mission, Interim Mission, Current Use

The Disassembly Basin is used to store and handle irradiated components (i.e., fuel and target assemblies, control rods, source rods, reactor internals, etc.) after reactor operation and to prepare the irradiated components for shipment to the Separation Facilities or or the burial grounds.

Operational Status

In use

Historical Information

There have been 242 abnormal occurrences in the SRS production reactors which are relevant to K-Reactor in Cold Standby and the L and P Reactor Disassembly Basins. Of the occurrences, nineteen events involved fuel or target assemblies being dropped to the basin floor, twenty-one events involved the violation of assembly storage and handling or criticality rules, ten events involved the operational disassembly errors, twenty seven events involved releases of contaminated Disassembly Basin water, twenty-six events involved improper shipment of fuel and target material, ten events involved pH above or below the operating limits, twenty-three events involved Disassembly Basin level above or below the operating limits, seventeen events involved personnel contamination in the Disassembly Basin, two events involved fires, and eighty-seven events involved miscellaneous process difficulties. The compensatory measures for these occurrences were to improve programs such as Conduct of Operations, to improve training, to improve attention to procedures, to correct procedures, and to repair defective equipment.

List Authorization Basis

K Production Reactor Technical Specifications, WSRC-TS-10003, Rev.23, December 12, 1995

Basis for Interim Operation (BIO) for the K-Reactor in Cold Standby, WSRC-TR-94-207, Rev.0, February 1995

K Production Reactor Safety Analysis Report, WSRC-SA-10003, Rev.4, November 8, 1992

Describe Important or Unique Design Features

The K-Reactor Disassembly Basin is a large concrete basin containing 3,400,000 gallons of water, varying in depth from 17 to 50 feet. Concrete walls divide the basin into seven sections to permit isolating a portion of the basin in case maintenance requires draining surrounding water. The basin walls and floor are below ground level and constructed of steel-reinforced concrete. The concrete walls and floor range in thickness from 2.5 to 7 feet. The basin was originally designed and constructed for a 0.1g earthquake statically applied to the dead and live loads.

The K-Reactor Disassembly Basin consists of interconnected, water-filled (except dry cave) basins in which irradiated assemblies are stored, disassembled, prepared for shipping, and shipped for chemical processing or disposal. The basins are arranged into three major sections: the machine basin (MB), the vertical tube storage (VTS), and the transfer area. The MB is further divided into the machine area, dry cave, emergency disassembly, and the horizontal bundle and bucket storage (HBBS) area. The VTS includes the deposit and exit (D&E) canal as well as the VTS area. The walls between the individual sections have narrow vertical openings that permit the transfer of material from one

sin to another. Portable stop logs (stackable carbon steel sections with rubber edges) can be used to block these enings when necessary. Two pneumatically sealed isolation gates are also used to isolate the VTS basin from the B. The Disassembly Area also includes equipment for cleaning and cooling the water for handling the casks in hich the irradiated material is shipped.

he Building 105-K Disassembly Basin ventilation system is powered primarily by a 90,000 cfm fan which supplies tered outside air into a common discharge duct in the area. This duct discharges air into the disassembly main ea and various perimeter office and equipment rooms. The Disassembly Basin is exhausted in three locations - via n exhaust fan on the roof, a gravity backdraft damper located at the shipping dock, and an exhaust fan in the dry ave area. This latter exhaust is HEPA filtered.

The ventilation system is used only as needed for personal comfort. Operation of the system is not required due to he very low potential for airborne release and due to administrative controls in place to govern the movement and storage of nuclear material. Although there has been no historical problem with controlling airborne activity, the area is monitored with Kanne chambers and Constant Air Monitors.

Describe Weaknesses in the Design Basis

Inadequate seismic design - During earthquakes, the Disassembly Basin may develop cracks in the walls or floors or leak through the expansion joints, causing release of contaminated water into an uncontrolled area and exposure of workers to unshielded irradiated material.

Inadequate structure - A shipping cask (70-ton) drop event from a high elevation could cause sufficient structural damage to the basin floor, causing release of contaminated water into an uncontrolled area and exposure of workers to unshielded irradiated material.

The Disassembly Basins were not designed for long term storage of aluminum clad fuel and a potential exists for cladding corrosion, release of radionuclides, and criticality. However, cladding corrosion has been minimized by eliminating galvanic couples where possible, removing basin sludge, reducing basin water conductivity, and improving basin water chemistry surveillance.

Structural Design

Reinforced concrete

Partitioned Areas of HEU within facility

basin

Description of Partitioned Areas

The disassembly basin is the only identified partitioned area in 100-K Area, excluding the Assembly Area. The description may be found in the "Design Features" section of Question 1.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There are no radioactive chemical hazards present in the K-Reactor Disassembly Basin.

Process Material Transfers

Fuel assemblies are moved on hangers using the overhead monorail system from the VTS to the MB, where they

SITE: Savannah River Site	FACILITY (Building or Location) 100K
	FUNCTION: Disassembly Basin

Question 1: SITE

are stored temporarily to await disassembly. Administrative limits allow for a maximum of four fuel assemblies to be placed on this rail. An assembly is taken from the rail to the VDM where its inner target is removed. The resulting outer sub-assembly is then transferred to the cutting saw where two cuts are made to liberate the fuel from the outer target. The fuel and outer target is separated at the HDM. The Mark 22, 16B, and 42 fuel that is extracted is transferred to the bundling station where it is placed with a maximum of three other fuel segments to make a bundle. After processing into bundles, the segments are transferred to the HBBS for storage prior to shipping. A motor operated carriage is used on the overhead monorail system to transport fuel into or out of the HBBS.

On-Site Transportation

Fuel bundles are placed in shipping casks in the transfer bay and loaded onto rail cars for delivery to the Separations Area.

Staff Levels & Experience

Applicable References

: Savannah River Site

FACILITY (Building or Location): 100K

PARTITIONED AREA: basin

stion 2: What barriers are used to protect the workers, the public and environment from HEU?

each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[ ] Material Limts
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[Y] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[ ] Records
[Y] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[Y] Emergency Response
[ ] Other-specify aluminum cladding			[ ] Other-specify
[N] None			

1. Barriers between HEU and worker.
2. Barriers between HEU and public/environment.
3. Includes management controls. Temporary administrative requirements are included in Question 6 as compensatory measures.

SITE: Savannah River Site	FACILITY (Building or Location): 100K
	PARTITIONED AREA: basin

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Aluminum cladding on the fuel contains the HEU and other radioactive materials.

Remote handling is accomplished via crane and monorail systems which allow materials to be transported while remaining underwater.

Shielding from irradiated materials and distance is maintained due to the materials being submerged several feet below the surface of the water.

Two alarm systems, the health monitoring system and nuclear incident monitors, are activated by high gamma radiation in the event that radioactive material is raised out of the basin water.

Public/Environment Barrier Narrative:

The distance to the site boundary minimizes the public exposure to any significant risk from normal operations, abnormal events, or postulated accidents.

Criticality Barrier Narrative:

Administrative limits are used to limit the number of assemblies that can be stored on hangers on the monorail prior to disassembly in the Machine Basin.

Tubular fuel stored in horizontal storage racks utilize spacers to prevent the insertion of too many fuel bundles in a storage rack slot. The racks are connected at the tops in an inverted "V" arrangement to prevent fuel from being placed between the racks.

Fuel blocking system is used to prevent a fuel tube bundle from accidentally falling into a slot.

Shipping casks used for Mark 16B, 22 and 42 fuel are equipped with cadmium separator plates which provide neutron absorption capabilities.

Administrative Barrier Narrative:

Authorization Basis documents provide the facility design basis, operational requirements, and authorized bounds of operation important to safety.

Administrative limits are placed on the number of assemblies which can be stored or processed to ensure that a criticality cannot occur.

Basin water levels are controlled with periodic checks/calibration of the level instrumentation.

Basin water temperature is monitored with periodic checks/calibration of temperature instrumentation.

Periodic verification of cadmium plates configuration in 70-ton shipping casks.

Periodic verification of neutron absorption in cadmium plates on the 70-ton shipping casks.

Conduct of operations procedures have been implemented at SRS through Procedure Manual 2S, Conduct of Operations. The manual contains a very detailed and comprehensive organization including diagrams, duties, and responsibilities.

The WSRC quality assurance program is implemented as described in the WSRC Quality Assurance Manual (WSRC 1Q). Activities affecting quality, safety, and/or reliability of operations, products, and services are performed in accordance with documented and approved procedures. Personnel who perform quality verification activities are qualified/certified as appropriate. Qualification/certification programs include documentation of capability through either written tests and/or physical demonstrations of skill and continued maintenance of the individual's proficiency based upon retraining or continued satisfactory performance.

A Configuration Control Program, as described in Procedure Manual 7E, Configuration Management Manual, and the WSRC 1E Manual, is established to identify and document the technical baseline of safety related structure, systems, components, and conputer software as well as to ensure that changes to the technical baseline are properly developed, assessed, approved, issued, and implemented.

WSRC Manuals 6Q and 6Q7 provide emergency response plans for the site and reactor areas.

Savannah River Site

FACILITY (Building or Location) 100K

PARTITIONED AREA: basin

Question 3: HEU Holdings and Packaging

erial Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
d fuel	Enriched	Other irradiated assemblies		Other-specify basin	4 - 7 yrs.	937	0.00

ulative Inventory Differences

0.0

kaging Description

ated fuel is stored and processed underwater in the Disassembly Basin. There is ackaging of the fuel other than placing bundles in a cask prior to shipment to the erations area.

erial at Risk Description

irradiated fuel stored in the K-Reactor Disassembly Basin includes:

rk 22 assemblies (Item #1) in Vertical Tube Storage

rk 22 assemblies (Items # 8, 9, 10 plus plus 36 additional assemblies from the 105-P assembly Basin (Item #9)).

Mark 16B assembly (Item #7) in Horizontal Storage.

e: Item numbers are referenced from the 1993 SNF VA.

SITE: Savannah River Site	FACILITY (Building or Location) 100L
	FUNCTION: DISASSEMBLY BASIN

Question 1: SITE

DOE Headquarters Facility Landlord:

DOE Headquarters Program Sponsor:

Facility Age: 42 Design Life: 0

Location of Facility on Site and Distance to Site Boundary

The L-Reactor is located approximately 5.5 miles from the southern and western site boundaries (ref. WSRC-TR-94-207, Basis for Interim Operation for the K-Reactor in Cold Standby (Disassembly Basin only)). Maps of the site and the Disassembly Basin can be found in this reference and in OSR3-158, Site Maps.

Design Mission, Interim Mission, Current Use

The Disassembly Basin is used to store and handle irradiated components (i.e., fuel and target assemblies, control rods, source rods, reactor internals, etc.) after reactor operation and to prepare the irradiated components for shipment to the Separation facilities or the burial grounds.

Operational Status

In use

Historical Information

There have been 242 abnormal occurrences in the SRS production reactors which are relevant to K-Reactor in Cold Standby and the L and P Reactor Disassembly Basins. Of the occurrences, nineteen events involved fuel or target assemblies being dropped to the basin floor, twenty-one events involved the violation of assembly storage and handling or criticality rules, ten events involved the operational disassembly errors, twenty seven events involved releases of contaminated Disassembly Basin water, twenty-six events involved improper shipment of fuel and target material, ten events involved pH above or below the operating limits, twenty-three events involved Disassembly Basin level above or below the operating limits, seventeen events involved personnel contamination in the Disassembly Basin, two events involved fires, and eighty-seven events involved miscellaneous process difficulties. The compensatory measures for these occurrences were to improve programs such as Conduct of Operations, to improve training, to improve attention to procedures, to correct procedures, and to repair defective equipment.

List Authorization Basis

L Reactor Facility Technical Specifications, WSRC-TS-10002, Rev.5, November 1, 1995

Basis for Interim Operation (BIO) for the K-Reactor in Cold Standby (Disassembly Basin only), WSRC-TR-94-207, Rev.0, February 1995

Describe Important or Unique Design Features

The L-Reactor Disassembly Basin is a large concrete basin containing 3,400,000 gallons of water, varying in depth from 17 to 50 feet. Concrete walls divide the basin into seven sections to permit isolating a portion of the basin in case maintenance requires draining surrounding water. The basin walls and floor are below ground level and constructed of steel-reinforced concrete. The concrete walls and floor range in thickness from 2.5 to 7 feet. The basin was originally designed and constructed for a 0.1g earthquake statically applied to the dead and live loads.

The L-Reactor Disassembly Basin consists of interconnected, water-filled (except dry cave) basins in which irradiated assemblies are stored, disassembled, prepared for shipping, and shipped for chemical processing or disposal. The basins are arranged into three major sections: the machine basin (MB), the vertical tube storage (VTS), and the transfer area. The MB is further divided into the machine area, dry cave, emergency disassembly, and the horizontal bundle and bucket storage (HBBS) area. The VTS includes the deposit and exit (D&E) canal as well as the VTS area. The walls between the individual sections have narrow vertical openings that permit the transfer of material from one basin to another. Portable stop logs (stackable carbon steel sections with rubber edges) can be used to block these

E. Sasannah F

NCTION.

SITE

...ntings when r
NS. The CH
which the ir

The Buildin
filtered out
area and v
gravity ba
HDPA filte

The vent
the sy
storage
a month

Cassiff
Inadeq
lack th
entire

Inadequate
damage to
trunk field

The
ch
ali
ba

openings when necessary. Two pneumatically sealed isolation gates are also used to isolate the VTS basin from the MB. The Disassembly Area also includes equipment for cleaning and cooling the water for handling the casks in which the irradiated material is shipped.

The Building 105-L Disassembly Basin ventilation system is powered primarily by a 90,000 cfm fan which supplies filtered outside air into a common discharge duct in the area. This duct discharges air into the disassembly main area and various perimeter office and equipment rooms. The Disassembly Basin is exhausted in two locations - via a gravity backdraft damper located at the shipping dock and an exhaust fan in the dry cave area. This latter exhaust is HEPA filtered.

The ventilation system is used only as needed for personal comfort. Operation of the system is not required due to the very low potential for airborne release and due to administrative controls in place to govern the movement and storage of nuclear material. Although there has been no historical problem with controlling airborne activity, the area is monitored with Kanne chambers and Constant Air Monitors. used only as needed for personal comfort

Describe Weaknesses in the Design Basis

Inadequate seismic design - During earthquakes, the Disassembly Basin may develop cracks in the walls or floors or leak through the expansion joints, causing release of contaminated water into an uncontrolled area and exposure of workers to unshielded irradiated material.

Inadequate structure - A shipping cask (70-ton) drop event from a high elevation could cause sufficient structural damage to the basin floor, causing release of contaminated water into an uncontrolled area and exposure of workers to unshielded irradiated material.

The Disassembly Basins were not designed for long term storage of aluminum clad fuel and a potential exists for cladding corrosion, release of radionuclides, and criticality. However, cladding corrosion has been minimized by eliminating galvanic couples where possible, removing basin sludge, reducing basin water conductivity, and improving basin water chemistry surveillance.

Structural Design

Reinforced concrete

Partitioned Areas of HEU within facility

basin

Description of Partitioned Areas

The Disassembly Basin is the only identified partitioned area of 100-L Area. Its description is given in the "Design Features" section of Question 1.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There are no radioactive chemical hazards present in the L-Reactor Disassembly Basin.

Process Material Transfers

Fuel assemblies are moved on hangers using the overhead monorail system from the VTS to the MB, where they are stored temporarily prior to disassembly. Administrative limits allow for a maximum of four fuel assemblies to be placed on this rail. An assembly is taken from the rail to the VDM where its inner target is removed. The resulting

outer sub-assembly is then transferred to the cutting saw where two cuts are made to liberate the fuel from the outer target. The fuel and outer target is separated at the HDM. The Mark 22, 16B, and 42 fuel that is extracted is transferred to the bundling station where it is placed with a maximum of three other fuel segments to make a bundle. After processing into bundles, the segments are transferred to the HBBS for storage prior to shipping. A motor operated carriage is used on the overhead monorail system to transport fuel into or out of the HBBS.

On-Site Transportation

Fuel bundles are placed in shipping casks in the transfer bay and loaded onto rail cars for delivery to the Separations Area.

Staff Levels & Experience

Applicable References

SITE: Savannah River Site

FACILITY (Building or Location): 100L

PARTITIONED AREA: basin

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Use below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]	Public/Environmental Barrier [2]	Criticality [1,2]	Administrative Barrier [3]
[ ] Gloveboxes	[Y] Facility/Building Boundary	[Y] Double Contingency Applied	[Y] Procedure: Operation, Maint.
[ ] Transfer System	[Y] HVAC/Confinement	[ ] Double Contingency Not Applied (specify)	[ ] Material Limts
[ ] Duct	[Y] Liquid Containment/Dike	(e.g., Mass Absorbers Geometry Interaction Concentration Moderation Enrichment Reflection Volume)	[Y] Monitoring
[ ] Filter	[ ] Bay, Cells, Magazines		[Y] Configuration Control
[ ] Vault	[ ] Canyons		[Y] Quality Assurance
[ ] Room	[ ] Pads		[Y] Conduct of Operations
[ ] Hot Cell/Canyon	[Y] Site Boundary		[Y] Authorization Basis
[ ] Hood	[ ] Trenches		[ ] Training
[ ] Piping	[ ] Storage Vault		[ ] Organization
[Y] Shielding	[ ] Alarm System		[ ] Lessons-Learned
[Y] Distance	[ ] Fire Suppression		[ ] Testing
[ ] Respiratory Protection	[ ] Other - Specify		[ ] Trending
[ ] Protective Clothing			[ ] Records
[Y] Remote Handling			[ ] Standards
[Y] Confinement System			[ ] External Regulation
[ ] Burial Ground			[ ] Surveillance
[ ] Tanks			[ ] Personnel Reliablity Assurance Program
[Y] Alarm System			[ ] Worker/Access Occupancy Limits
[ ] Temporary Barriers			[ ] Emgergency Response
[ ] Other-specify			[ ] Other-specify
inium cladding			
[ ] None			

iers between HEU and worker.
iers between HEU and public/environment.
ides management controls. Temporary administrative requirements are included in Question 6
mpensatory measures.

SITE: Savannah River Site

FACILITY (Building or Location) 100L

PARTITIONED AREA: basin

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Reactor fuel	Enriched	Other irradiated assemblies		Other-specify Disassembly Basin	4 - 7 yrs.	560	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Irradiated fuel is stored and processed underwater in the Disassembly Basin. There is no packaging of the fuel other than placing bundles in a cask prior to shipment to the Operations Area.

Material at Risk Description

The irradiated fuel stored in the L-Reactor Disassembly Basin includes 560 Mark 16B assemblies (Items # 1, 12, 13, 14, 15, 16 plus 22 additional assemblies from 105-P Disassembly Basin (Item # 8)) in Horizontal Storage.

The item numbers are referenced from the 1993 SNF VA.

SITE: Savannan River Site

FACILITY (Building or Location) 100P

FUNCTION: 100P Disassembly Basin

Question 1: SITE

DOE Headquarters Facility Landlord:

DOE Headquarters Program Sponsor:

Design Life: 0

Facility Age: 0

Location of Facility on Site and Distance to Site Boundary

The P-Reactor is located 4.5 miles from the eastern site boundry (ref. WSRC-TR-94-207, Basis for Interim Operation for the K-Reactor in Cold Standby (Disassembly Basin only). Maps of the site and the Disassembly Basin can be found in this reference and in OSR3-158, Site Maps.

Design Mission, Interim Mission, Current Use

The Disassembly Basin is used to store and handle irradiated components (i.e., fuel and target assemblies, control rods, source rods, reactor internals, etc.) after reactor operation and to prepare the irradiated components for shipment to the Separation facilities or to the burial grounds.

Operational Status

In use

Historical Information

There have been 242 abnormal occurrences in the SRS production reactors which are relevant to K-Reactor in Cold Standby and the L and P Reactor Disassembly Basins. Of the occurrences, nineteen events involved fuel or target assemblies being dropped to the basin floor, twenty-one events involved the violation of assembly storage and handling or criticality rules, ten events involved operational disassembly errors, twenty seven events involved releases of contaminated Disassembly Basin water, twenty-six events involved improper shipment of fuel and target material, ten events involved pH above or below the operating limits, twenty-three events involved Disassembly Basin level above or below the operating limits, seventeen events involved personnel contamination in the Disassembly Basin, two events involved fires, and eighty-seven events involved miscellaneous process difficulties. The compensatory measures for these occurrences were to improve programs such as Conduct of Operations, to improve training, to improve attention to procedures, to correct procedures, and to repair defective equipment.

List Authorization Basis

100-P Reactor Facility Technical Specifications, WSRC-TS-10001, Rev.3, November 1, 1995

Basis for Interim Operation (BIO) for the K-Reactor in Cold Standby (Disassembly Basin only), WSRC-TR-94-20, Rev.0. February 1995

Describe Important or Unique Design Features

The 100-P Reactor Disassembly Basin is a large concrete basin containing 4,800,000 gallons of water, varying in depth from 17 to 50 feet. Concrete walls divide the basin into seven sections to permit isolating a portion of the basin in case maintenance requires draining surrounding water. The basin walls and floor range in thickness from 2.5 to 7 feet. The basin was originally designed and constructed for a 0.1g earthquake statically applied to the dead and live loads.

The P-Reactor Disassembly Basin consists of interconnected, water-filled (except the dry cave) basins in which irradiated assemblies are stored, disassembled, prepared for shipping, and shipped for chemical processing or disposal. The basins are arranged into three major sections: the machine basin (MB), the vertical tube storage (VTS), and the transfer area. The MB is further divided into the machine area, dry cave, emergency disassembly and the horizontal bundle and bucket storage (HBBS) area. The VTS includes the deposit and exit (D&E) canal as well as the VTS area. The walls between the individual sections have narrow vertical openings that permit the transfer of material from one basin to another. Portable stop logs (stackable carbon steel sections with rubber edges) can be used to

block these openings when necessary. Two pnumatically sealed isolation gates are also used to isolate the VTS basin from the MB. The Disassembly Area also includes equipment for cleaning and cooling the water for handling the casks in which the irradiated material is shipped.

The Building 105-P Disassembly Basin ventilation system is powered primarily by a 90,000 cfm fan which supplies filtered outside air into a common discharge duct in the area. This duct discharges air into the disassembly main area and various perimeter offices and equipment rooms. The Disassembly Basin is exhausted in two locations - via a gravity backdraft damper located at the shipping dock and an exhaust fan in the dry cave area. This latter exhaust is HEPA filtered.

However, this system is not used. Operation of the system is not required due to the very low potential for airborne release and due to administrative controls in place to govern the movement and storage of nuclear material. Although there has been no historical problem with controlling airborne activity, the area is monitored with Kanne chambers and Constant Air Monitors.

Describe Weaknesses in the Design Basis

Inadequate seismic design - During earthquakes, the Disassembly Basin may develop cracks in the walls or floors or leak through the expansion joints, causing release of contaminated water into the an uncontrolled area and exposure of workers to unshielded irradiated material.

Inadequate structure - A shipping cask (70-ton) drop event from a high elevation could cause sufficient structural damage to the basin floor, causing release of contaminated water into an uncontrolled area and exposure of workers to unshielded irradiated material.

The Disassembly Basins were not designed for long term storage of aluminum clad fuel and a potential exists for cladding erosion, release of radionuclides, and criticality. However, cladding corrosion has been minimized by eliminating galvanic couples where possible, removing basin sludge, reducing basin water conductivity, and improved basin water chemistry surveillance.

Structural Design

Reinforced concrete

Partitioned Areas of HEU within facility

Basin

Description of Partitioned Areas

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There are no radioactive chemical hazards persent in the P-Reactor Disassembly Basin.

Process Material Transfers

Fuel assemblies are moved on hangers using the overhead monorail system from the VTS to the MB, where they stored temporarily to await disassembly. Administrative limits allow for a maximum of four fuel assemblies to be placed on this rail. An assembly is taken from the rail to the VDM where its inner target is removed. The resulting outer sub-assembly is then transferred to the cutting saw where two cuts are made to liberate

the fuel from the outer target. The fuel and outer target is separated at the HDM. The Mark 22, 16B, and 42 fuel that is extracted is transferred to the bundling station where it is placed with a maximum of three other fuel segments to make a bundle. After processing into bundles, the segments are transferred to the HBBS for storage prior to shipping. A motor operated carriage is used on the overhead monorail system to transport fuel into or out of the HBBS.

On-Site Transportation

Fuel bundles are placed in shipping casks in the transfer bay and onto rail cars for delivery to the Separations Area.

Staff Levels & Experience

Applicable References

SITE: Savannah River Site

FACILITY (Building or Location):

PARTITIONED AREA: Basin

Question 2: What barriers are used to protect the workers, the public and environment from HEU?

For each partitioned area identified in Question 1, list the facility barriers used to protect the worker and the public/environment. Refer below for identifying barriers. Multiple barriers usually employed should be noted.

BARRIER TYPES

Worker Barrier [1]

- [ ] Gloveboxes
- [ ] Transfer System
- [ ] Duct
- [ ] Filter
- [ ] Vault
- [ ] Room
- [ ] Hot Cell/Canyon
- [ ] Hood
- [ ] Piping
- [ ] Shielding
- [ ] Distance
- [ ] Respiratory Protection
- [ ] Protective Clothing
- [ ] Remote Handling
- [ ] Confinement System
- [ ] Burial Ground
- [ ] Tanks
- [ ] Alarm System
- [ ] Temporary Barriers
- [ ] Other-specify
- [ ] Aluminum cladding
- [ ] None

Public/Environmental Barrier [2]

- [Y] Facility/Building Boundary
- [Y] HVAC/Confinement
- [Y] Liquid Containment/Dike
- [ ] Bay, Cells, Magazines
- [ ] Canyons
- [ ] Pads
- [Y] Site Boundary
- [ ] Trenches
- [ ] Storage Vault
- [ ] Alarm System
- [ ] Fire Suppression
- [ ] Other - Specify

Criticality [1,2]

- [Y] Double Contingency Applied
- [ ] Double Contingency Not Applied (specify)

(e.g., Mass
Absorbers
Geometry
Interaction
Concentration
Moderation
Enrichment
Reflection
Volume)

Administrative Barrier [3]

- [ ] Procedure: Operation, Maint.
- [ ] Material Limits
- [Y] Monitoring
- [Y] Configuration Control
- [Y] Quality Assurance
- [Y] Conduct of Operations
- [Y] Authorization Basis
- [ ] Training
- [ ] Organization
- [ ] Lessons-Learned
- [ ] Testing
- [ ] Trending
- [ ] Records
- [ ] Standards
- [ ] External Regulation
- [ ] Surveillance
- [ ] Personnel Reliablity Assurance Program
- [ ] Worker/Access Occupancy Limits
- [Y] Emergency Response
- [ ] Other-specify

s between HEU and worker.
s between HEU and public/environment.
s management controls. Temporary administrative requirements are included in Question 6
pensatory measures.

SITE: Savannan River Site	FACILITY (Building or Location):
	PARTITIONED AREA: Basin

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Aluminum cladding on the fuel contains the HEU and other radioactive materials.

Remote handling is accomplished via crane and monorail systems which allow materials to be transported while remaining underwater.

Shielding from irradiated materials and distance is maintained due to the materials being submerged several feet below the surface of the water.

Two alarm systems, the health monitoring system and nuclear incident monitors, are activated by high gamma radiation in the event that radioactive material is raised out of the basin water.

Public/Environment Barrier Narrative:

The distance to the site boundry minimizes the public exposure to any significant risk from normal operations, abnormal events, or postulated accidents.

Criticality Barrier Narrative:

Administrative limits are used to limit the number of assemblies that can be stored on hangers on the monorail prior to disassembly in the Machine Basin.

Tubular fuel stored in horizontal stotage racks utilize spacers to prevent the insertion of too many fuel bundles in a storage rack slot. The racks are connected at the tops in an inverted "V" arrangement to prevent fuel from being placed between the racks.

A fuel blocking system is used to prevent a fuel tube bundle from accidentally falling into a slot.

Shipping casks used for Mark 16B, 22 and 42 fuel are equiped with cadmium separator plates which provide neutron absorption capabilities.

Administrative Barrier Narrative:

Authorization Basis documents provide the facility design basis, operational requirements, and authorized bounds of operation important to safety.

Administrative limits are placed on the number of assemblies which can be stored or processed to ensure that a criticality cannot accur.

Basin water levels are controlled with periodic checks/calibration of the level instrumentation.

Basin water temperature is monitored with periodic checks/calibration of temperature instrumentation.

Periodic verification of cadmium plates configuration in 70-ton shipping casks.

Periodic verification of neutron absorption in cadmium plates on the 70-ton shipping casks.

Conduct of Operations procedures have been implemented at SRS through Procedure Manual 2S, Conduct of Operations. The manual contains a very detailed and comprehensive organization including diagrams, duties, and responsiblilities.

The WSRC Quality Assurance program is implimented as described in the WSRC Quality Assurance Manual (WSRC 1Q). Activities affecting quality, safety, and/or reliability of operations, products, and services are performed in accordance with documented and approved procedures. Personnel who perform quality verification activities are qualified/certified as appropriate. Qualification/certification programs include documentation of capability through either written tests and/or physical demonstrations of skill and continued maintenance of the individuals proficiency based upon retraining or continued satisfactory performance.

A Configuration Control Program, as described in Procedure Manual 7E, Configuration Management Manual, and the WRSC 1E Manual, is established to identify and document the technical baseline of safety related structure, systems, components, and computer software as well as to ensure that changes to the technical baseline are properly developed, assessed, approved, issued, and implimented.

WSRC Manuals 6Q and 6Q7 provide emergency response plans for the site and reactor areas.

Question 3: HEU Holdings and Packaging

Material Form	Grade of HEU	Material Form Description	Packaging Types	Location	Range of Age	No. of Packages	Mass (kg)
Spent Fuel	Enriched	Other Irradiated Assemblies		Other-specify	4-7 yrs.	390	0.00

Cumulative Inventory Differences

0.0

Packaging Description

Irradiated fuel is stored and processed underwater in the Disassembly Basin. There is no repackaging of the fuel other than placing bundles in a cask prior to shipment to the Separations Area.

Material at Risk Description

The irradiated fuel stored in the P-Reactor Disassembly Basin consists of:

330 Mark 16B assemblies (Items # 7 & 8, minus 22 assemblies from Item # 8 which were shipped to the 105-L Disassembly Basin) in Horizontal Storage.

350 Mark 22 assemblies (Item # 9 minus 36 assemblies which were shipped to the 105-K Disassembly Basin) in Horizontal Storage.

Note: The Item numbers are referenced from the 1993 SNF VA.

SITE: Savannah River Site	FACILITY (Building or Location) RBOF
	FUNCTION: Pool Storage

Question 1: SITE

DOE Headquarters Facility Landlord:
DOE Headquarters Program Sponsor:
Facility Age: 0 **Design Life:** 0

Location of Facility on Site and Distance to Site Boundary
The RBOF facility is located in H-Area and is designated as 244-H.

Design Mission, Interim Mission, Current Use
The design mission and current use of RBOF is the receipt and storage of Spent Nuclear Fuels (SNF). Most of this material is designated as HEU.

Operational Status
Operating

Historical Information
There have been no incidents to date outside of the safety envelope of the authorization basis. All incidents have proven inconsequential. Information concerning significant events is provided below (ref. WSRC-TR-94-0287, Rev. 1.):

June 21, 1984. A fuel assembly was incorrectly cut at the fuel plates instead just the inert end. The stop plate for the submerged bandsaw was found loose.

October 17, 1985. A flexible hose in the filter-deionizer system ruptured, discharging about 20,000 gallons of water into the decontamination cell of the Resin Regeneration Facility (RRF). While most of the water drained to the waste cell, some flowed under the door to the paved area outside.

March 25, 1987. A Nuclear Incident Monitor (NIM) alarm was activated by a momentary high radiation field from a DR-3 fuel assembly inadvertently raised to the water surface.

November 5, 1992. A routine inventory assessment revealed a stored fuel bundle in violation of the applicable Nuclear Safety Data Sheet (NSDS).

October 10, 1994. While unloading DR-3 fuel (Denmark) from a Pegase cask, problems were encountered with the concentric tubular fuel assemblies including the grasping of the tops of assemblies. These fuel assemblies were undesirably recessed deeply into the cask basket. Separation of the identification band from the assemblies and separation of the fuel assemblies into individual tubes had occurred. These difficulties directly resulted in one tube from one assembly becoming free from the fuel handling tools and settling to the floor of the cask basin.

October 17, 1994. Violation of Technical Standard Fuel Spacing Requirements. While performing a criticality survey of fissile material in RBOF, in response to a complex wide concern for nuclear criticality safety, engineers discovered inadequate control of nuclear safety control space between 3 fuel bundles in Row JJ, as required by NSDS #124. The fuel has been stored in the same location, and had not been moved, for 24 years. No fuel movement was in progress at the time of discovery.

December 1, 1994. During verification of input parameters that were used to prepare the proposed RBOF Technical Safety Requirements (TSR), it was discovered that 16 of the fuel bundles, which were located in the basin, did not have the required 7 feet of water above the fuel. The TSRs were being written to ensure that the requirements of WSRC-TR-94-0287, "Basis for Interim Operation (BIO) for the Receiving Basin for Offsite Fuels (RBOF) and the Resin Regeneration Facility (RRF)," are maintained. The previous BIO revision required a minimum of 7 feet of water be maintained above the fuel at all times to protect workers during a criticality accident.

Assumptions were made during the development of the BIO and TSR without being confirmed. Although the BIO had been approved and the TSR was being written, neither document had been implemented as the Authorization Basis for RBOF. DOE approval of the BIO was contingent upon the revision and approval of the TSR and lower tier implementing procedures. Therefore, WSRC and DOE-SR concur that the RBOF SAR was the Authorization Basis for RBOF at the time of this event. After further investigation, it was determined that Technical Standard DPSTS-244-H-0.06 prohibits the lifting of fuel within ten feet of the water surface without the use of a special procedure and prior approval from Operation and Engineering personnel. This limit is designed to minimize the chronic radiation exposure of personnel working in the basin area.

List Authorization Basis

The authorization basis for the facility is provided by the Basis for Interim Operation (BIO), WSRC-TR-94-0287, and the Technical Safety Requirements (TSR) document, S-TSR-H-0002.

Describe Important or Unique Design Features

The Process Hazards Analysis (PHA) for the RBOF/RRF facilities credits the following structures, systems, components, and operator actions for preventing and mitigating some of the postulated accident scenarios.

Fuel Basins and Canal System - Fuel handling, storage basins and associated transfer canals serve as primary containment for radioactive contaminants contained in the basin water. The concrete basin floors are 3 feet thick and concrete walls are 3 to 6.5 feet thick. The floors are lined with stainless steel and the walls are coated with a phenolic protective coating.

Shielding - The facility design provides shielding at various locations to protect personnel from direct gamma radiation. Reinforced concrete walls that surround the Waste Cell, Decontamination Cell and the Resin Regeneration Cell protect personnel from radiation emanating from these locations. Personnel within the RBOF control room are shielded from radiation emanating from the basins by a concrete shield wall that permits operation of the facility even in the event of a significant release of radioactivity within the basin area.

Offsite Casks - Offsite casks are required to be qualified in accordance with 10CFR71 for normal operation and postulated accident conditions. This standard provides acceptable leakage values and radiation levels which have been confirmed under test conditions for each cask. These values have been credited in determining bounding source terms for accident scenarios.

Chemical Pads Drainage Piping - An airborne release involving the maximum allowable inventories of all identified chemical, except ethylene glycol, will result in facility worker concentrations exceeding Emergency Response Planning Guidelines (ERPG-2) values. To prevent exceeding the ERPG-2 values for facility workers, the accident analysis credits the drainage piping from Chemical Pads No. 1 to the waste tank (EP-38) for prevention of accumulation of the spilled chemical.

Nuclear Incident Monitors - The NIMs are the credited means of alerting the RBOF worker to a nuclear incident whether the alarm is caused by direct radiation or fission product gases. A brief discussion of the use of NIMs in RBOF is provided in Section D.4 of DPSTS-NIM-85. However, this document assumes that there is at least 10 feet of water over the highest fuel assemblies. Since the depth of water over the fuel is less than 10 feet in some cases, the NIM may alarm from either direct radiation from the criticality event, as well as, fission product gases released from the fuel and basin water surface.

Describe Weaknesses in the Design Basis

Although some weaknesses exist in the design basis and current configuration of the facility, such as seismic design,

fire protection system, ventilation and atmosphere control, no credit has been taken in the authorization basis.

Structural Design

Partitioned Areas of HEU within facility

Fuel Storage

Description of Partitioned Areas

All areas within RBOF are considered one partitioned area.

The RBOF facility consists of six main sections separated by partition walls and shielding walls as required. The process areas are summarized below:

Carport and Unloading Area - Casks containing spent fuel elements are delivered to the Carport on the north side of the RBOF facility by truck or rail car. The transporation vehicle is spotted inside the RBOF facility within the working limits of the 100-ton overhead crane used to lift and transfer casks. Casks can be temporarily staged on the parking pads located north and south of the 244-H Building.

Cask Wash Pit - Casks are lowered into the cask wash pit to remove any dirt that may have been acquired in transit. The cask wash pit is equipped with the facilities to perform decontamination of the cask, venting of the cask to equalize internal pressure and water addition for radionuclide sampling.

Cask Basin - Washed casks are transferred to the cask basin where the casks are opened underwater. Personnel work from the traveling bridge to remove fuel from the cask. As appropriate to the particular fuel elements, the loaded fuel basket within the cask may be removed in its entirety or a specified number of fuel elements may be transferred to a fuel transfer bucket. The fuel is then transported from the cask basin area to its storage location through a canal system by means of the traveling bridge or the monorail system.

Main Storage Basin #1 - The underwater storage basin provides the means to store various fuel types in relatively close proximity while maintaining nuclear safety. The storage basin contains three basic rack types: The main storage racks provide storage for intact fuel assemblies and bundled fuel elements; bucket storage racks store fuel contained in reactor-slug buckets; and tube storage racks which store failed, cut or otherwise exposed fuels. Nuclear safety is maintained through compliance with the spacing limits detailed in the NSDS available for each fuel type stored in RBOF.

Storage Basin #2 - This basin was originally a second cask basin that has been converted to a storage basin by the addition of storage racks. The hole originally used to hold a shipping cask has been covered to prevent the inadvertent dropping of fuel assemblies into the opening. Fuel is stored in a manner similar to that described for Storage Basin #1.

Transfer Canals - Fuel elements are transferred between basins though a system of canals connecting each basin using either the traveling bridge or the monorail system.

Repackaging Basin - This basin provides fuel repackaging capability by mechanical means. Fuel elements destined

Question 1: SITE

to SRS reprocessing facilities or offsite shipment are loaded into bundles, packaged and stored until needed. Preparation of bundles occasionally requires the underwater cutting of inert ends from the fuel assemblies. Fuel may be stored in this basin as long as the requirements of the applicable NSDS are maintained.

Disassembly Basin - This basin provides fuel disassembly capability by mechanical means. Underwater equipment for weighing is also available in the basin.

Inspection Basin - The inspection basin provides the necessary space and equipment for the examination and measurement of fuel.

Control Room - Controls for operation of all pumps, valves and other equipment for purifying and disposing of basin water are located in this room. A one-foot thick concrete shielding wall is located between this room and the basin area providing protection from radiation exposure to operations personnel.

Decontamination Cell - The quality of the basin water is maintained by circulating contaminated basin water through the filter-deionizer recycle loop system. The decontamination recycle loop filter uses tubular type "Porostone" filter elements to remove contaminants greater than 1 micron in size. The deionizer contains mixed exchange resins that effectively removes both radioactive and non-radioactive ions from the basin water.

Waste Cell - The waste cell contains two tanks designated as EP-37 and EP-38. Waste tank EP-37 is a 1000-gallon capacity floor drain collection tank which drains to EP-38. Waste tank EP-38 is a 6400-gallon capacity tank used to collect and neutralize liquid waste from the RBOF and RRF buildings. Depending on the radioactive content and type of waste in the tank, it is transferred to either the H-Canyon Outside Facilities or the waste tank farm.

Amount & Location of Hazardous Material Collocated or Commingled with HEU

There is no hazardous materials collocated or comingled with the HEU.

Process Material Transfers

Process material transfers within the facility are made utilizing the traveling bridge or monorail system.

On-Site Transportation

On-site transportation can be provided using either truck or rail car. Interface with the facility is provided in the Carport and Unloading Area as discussed above.

Staff Levels & Experience

Staffing of the RBOF facility is provided 24-hours per day using 5 rotating shifts. A shift is comprised of 7 operators, 2 shift supervisors and a support engineer. Maintenance and Rad Con personnel are available as needed. The estimated average RBOF experience level of operations personnel is estimated to be 3 years.

Applicable References

WSRC-TR-94-0287, Rev. 1, "Basis for Interim Operation (BIO) for the Receiving Basin for Offsite Fuels (RBOF) and the Resin Regeneration Facility (RRF) (U)", March, 1995.

S-TSR-H-0002, "Receiving Basin for Offsite Fuels Facility and Resin Regeneration Facility (U)", Technical Safety Requirements dated March, 1995.

WSRC-TR-94-054, Rev. 0, "Hazards Assessment Document for Receiving Basin for Offsite Fuels (244-H) and Resin Regeneration Facility (245-H) (RBOF/RRF) (U)", July, 1994.

S-CLC-H-00146, Rev. 3, "Preliminary Hazards Analysis for the Receiving Basin for Offsite Fuels and the Resin Regeneration Facility", March, 1995.

WSRC Administrative Manual RD-1, Procedure RDP 2.23, Rev. 2, "Receiving Basin for Offsite Fuels Facility and

SITE: Savannah River Site	FACILITY (Building or Location)	RBOF
	FUNCTION:	Pool Storage
Question 1: SITE		

Resin Regeneration Facility (U)", Process Requirements approved April 30, 1996.

Gover
Trans
Filter
Burial Gro
Tanks

SITE: Savannah River Site	FACILITY (Building or Location): RBOF
	PARTITIONED AREA: Fuel Storage

Question 2: BARRIER TYPES

Describe each barrier identified above and its intended protective functions.

Worker Barrier Narrative:

Shielding and distance is provided primarily by the water in the RBOF basin. Water level is carefully controlled and monitored.

Protective clothing is provided to limit the contamination risk that is associated with RBOF activities.

An alarm system consisting of NIMs and gamma monitors provide an audible warning of high radiation fields that could result from a criticality or some other type of handling accident.

Public/Environment Barrier Narrative:

The site boundary is the only barrier that is taken credit for in the authorization basis.

Criticality Barrier Narrative:

All fuel elements are placed in aluminum bundles that limits the number of fuel elements that can be stored in any single location. The bundles are also relied on to provide configuration control of the individual fuel assemblies.

The rack system provides a physical divider for the fuel bundles. The storage racks provide a means for controlling spacing between individual bundles and controls the alignment of the bundle with respect to adjacent bundles.

Double contingency assures that no single error or malfunction can cause a criticality.

Administrative Barrier Narrative:

These barriers are defined in Procedure Manual RD-1, "Excess Facilities and Reactor Fuel Storage Program Division Administrative Manual", procedure RDP 2.23, "Receiving Basin for Offsite Fuels Facility and Resin Regeneration Facility".

Environmental Risk Sta

Ex

Exist

0.0

Hazardous Waste Description

(HD) material is in t
(BOF.

terial at Risk Descr

le classified inventor

ere has been no m
essment that has
en considered to be
ected under the Un
complete
mendous
ination
SP test) for
as after the
ults of th
mendous
legislatur
brought the
byield s

Facil

Fire

Explos

Contac

Critic

Leak

Other

Struc

Equi

Mat

In

O

External

SITE: Savannan River Site

FACILITY (Building or Location): RBOF

PARTITIONED AREA: Fuel Storage

Question 4: POTENTIAL CAUSES

Facility	Material	External
[ ] Process Material Transfer	[ ] Aging	[Y] Fire
[ ] Inadvertent Transfers	[ ] Container Seal Degradation	[ ] Explosion
[ ] Aging/Degradation	[ ] Pressurization	[Y] Earthquakes
[ ] Equipment Failure	[ ] Pyrophoricity	[ ] Subsidence
[ ] Change in Mission	[ ] Radioactivity	[Y] Winds
[ ] Other Collocated Hazards	[ ] Chemical Reactivity	[Y] Floods
[Y] Corrosion/Embrittlement	[ ] Radiolysis	[ ] Extreme Temperature
[ ] Inadequate Configuration Knowledge	[ ] Volumetric Expansion	[ ] Snow
[ ] Combustible Loading	[ ] Oxidation	[ ] Ash Loading
[ ] Inadequate Seals	[ ] Flammability	[Y] Aircraft Crash
[ ] Water Sources	[ ] Toxicity	[Y] Vehicle Accident
[ ] Inadequate Drains	[ ] Hydroloysis	[Y] Onsite Transporation
[ ] Preventive Maintenance Failure	[ ] Crystallization	[Y] Adjacent Facility Accident
[Y] Administrative Control	[ ] Other - Specify	[ ] Other-specify
[Y] Human Error		
[ ] Chemical Reactions		
[ ] Contamination		
[ ] Inadequacy of Design Basis		
[ ] Design Deficiency		
[ ] Flooding		
[ ] Fire		
[ ] Other SAR Accidents		
[ ] Other-specify		

Describe Each Potential Cause Identified Above:

Corrosion/Embrittlement:

Corrosion is a recognized mechanism by which aluminum cladding could be compromised or the uranium aluminum alloy could release fission products to the basin water. In the case of RBOF, basin water quality is maintained so that aluminum corrosion is reduced to a minimal amount and any risk associated with corrosion induced releases essentially eliminated.

Administrative Controls and Human Error:

The breakdown in administrative controls and/or human error could result in the failure of these barriers to provide adequate protection by placing the facility outside the envelop of the RBOF authorization basis. This possibility is recognized and accounted for in the BIO and PHA.

External Causes:

The possibility of causes affecting RBOF is recognized and accounted for in the BIO and PHA.

Savannah River Site

FACILITY (Building or Location): RBOF

PARTITIONED AREA: Fuel Storage

Question 5: POTENTIAL EFFECTS

Facility	Material	External
Fire	[Y] Criticality	[ ] Loss of Site Integrity
Explosion	[ ] Material Release	[ ] Loss of Building Integrity
Contamination	[ ] Breach of Packaging	[ ] Release of Materials
Criticality	[ ] Fire	[ ] Radiation and Releases from Criiticality
Leakage/Spills	[ ] Other-specify	
Other Accidents-specify		
Structural Failure		
Equipment Failure		
Material Release		
Increased Radioactivity Level		
Other-specify		

Describe Each Effect Identified Above:

Contamination:

Failure of any fuel could result in the release of fission products into the basin water and as a result in the contamination of the RBOF facility. This potential is controlled by the operation of the deionizer system, use of protective clothing by operations personnel and by routine surveillance by Radiation Control personnel.

Leakage/Spills:

The potential of basin water leakage or spills is a potential effect of most failure modes. This potential is controlled by the use of building structures that would confine leakage to the RBOF facility.

Criticality:

The potential for a criticality can increase with through human error or the violation of administrative controls. Analysis has shown that the basin water would provide adequate shielding to protect facility workers and the public.

Savannah River Site

FACILITY (Building or Location): RBOF

PARTITIONED AREA: Fuel Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Spills (Facility)									

ation

rative control procedures, basin water quality control and support from Radiation Control personnel prevent a spill of ater from being a vulnerability. This is the result of the basin water's radio isotope concentration being maintained tablished procedural guidelines.

ible References

SITE: Savannah River Site	FACILITY (Building or Location): RBOF
	PARTITIONED AREA: Fuel Storage

Question 6: POTENTIAL CONSEQUENCES

	Worker			Environment			Public		
Effect	Contamination	Exposure	Injury	Ground	Water	Air	Contamination	Exposure	Injury
Criticality (Facility)									

Explanation

The use of fuel bundles, storage racks and administrative controls reduce the probability of a criticality occurring. In the event that such an event were to occur, adequate shielding is available to protect the facility works, the public and the environment.

Applicable References

Question 7: Site Summary

Savannah River Site

Overall assessment of the site ES&H vulnerabilities.

ES&H Concerns

Vulnerabilities were identified during the November 1993 SNF Vulnerability Assessment and corrective actions have been completed or are in progress. A summary of these findings with the corresponding corrective actions is provided below:

Training in conduct of operation needs to emphasize the extended storage role of the fuel storage

Personnel are trained to the current Conduct of Operations procedures and manuals as part of their job qualification. Additional training will be conducted to emphasize the extended storage role for the fuel storage basins through the training enhancement efforts. Additional training specifically designed to address the concerns associated with extended storage of SNF in RBOF was developed and was presented to all RBOF operations staff in 1995. This action is complete.

The roof over the cask basins and the transite walls of the RBOF facility provide inadequate tornado protection.

A structural assessment for the design basis hazard for the facility will be completed as part of the safety analysis report upgrade (see Item 17). Facility modification to bring RBOF up to Performance Category 3 (PC-3) standards is in progress and are scheduled for completion 8/96. Once modification work is finished, this action will be complete.

Since the initial design, there has been no deterministic seismic evaluation of the facility. A seismic event could damage masonry walls above the pool, the sole significant makeup water line penetrating the facility could be damaged and unanchored chemical storage tanks/piping adjacent to the facility, adversely affecting RBOF.

A structural assessment for the design basis hazard for the facility will be completed as part of the safety analysis report upgrade. The analysis will include the basins, the above grade walls, roof and storage racks. In the interim, the existing safety analysis bounds radiological releases from all credible scenarios because it is extremely conservative. The new SAR is scheduled for completion 8/96. Once issued, this action will be complete.

2. Lack of basin water leakage detection system.

Evaluation of the beneficial methods of leak detection has been done including a review of the level monitoring system utilized at the West Valley facility in New York. No significant benefits from implementation of this system were identified. Overall H-Area ground water effects are monitored and reported in accordance with RCRA requirements. Basin water makeup rates are monitored and trended. This action is closed.

3. Lack of up-to-date and approved safety analysis.

Question 7: Site Summary

rnah River Site

Describe your site's most important ES&H concern regarding the storage of Reactor Irradiated erials?

of additional fuel since the time of the RINM Vulnerability Assessment has not altered the response provided.

s review, no new vulnerabilities have been identified as a result of the receipt of additional SNF material

on of HEU activities.
e no high risk activities.

canned actions.
HEU standards currently located in HB Line will be shipped to the 235-F Facility in the near future. The acility plans to use two of the standards for start-up activities. Upon completion of the start-up activities, all e standards will be sent to Low Level Waste.

ect program or practices.
-B Line has had no use for the HEU standards, they have all been placed in a source safe along with other ed standards that are not currently being used. This source safe is located in an area of the Facility that is service. Since the room in which the source safe is located is rarely entered by workers, and the source safe self and almost never accessed by workers, the Facility has assured that radiation exposure due to the HEU ds has been kept as low as reasonably achievable.

APPENDIX C

VULNERABILITY ASSESSMENT FORMS

Savannah River Site	FACILITY (Building or Location) 235F
	VULNERABILITY NO. SRS/235-F/SAT/001

VULNERABILITY ASSESSMENT FORM

ch and contamination release.

n/suppression system using HALON is provided in the vaults to extinguish any fires while not affecting the material ty

ntation of a Conduct of Operations program in 235-F teaches personnel to be inquisitive and be alert for unusual signs of adverse reactions.

ersonnel on vault related activities provides them with a knowledge base of the materials and conditions within the

are used for all vault activities and provide appropriate safety instructions which alert the worker to potential adverse Procedures typically call for contamination surveys of items to be handled prior to work being performed.

ned from other facilities and across the Complex are utilized in alerting workers to potential stored material hazards plicable are implemented into procedures.

ssible Consequences

ility could result in a release as discussed in the 235-F SAR (DPSTSA-200-10, SUP-15). The SAR contains an e dose associated with a release due to container rupture as a result of pressurization. The estimate is based on quantity of material allowed in a shipping container becoming airborne as a result of a catastrophic container stopping distribution of the material studied is described in the SAR.) The SAR estimates the frequency of this be 0.24/year with associated consequences of 14 REM exposure to the operator . The maximum dose to an vaults estimated to be 1.2 x 10-4 REM.

is based on a maximum amount of Plutonium oxide being released and dispersed in one of the vaults. A exists for the worker. Release of Uranium material is not specifically described in the current SAR. For the purpose ssment, it is assumed that Uranium can be released from the facility and can reach the ground outside the facility. is assumed that there is no vulnerability to the water, air, or public.

meframe in which consequences of vulnerability might occur.

Plans to mitigate or minimize potential vulnerability.

ability was previously recongized by SRS in the IMNM EIS and by the DNFSB. Plans are in place to either repackage the HEU. SRS is currently authorized per the SRS Site Integrated Stabilization Management Plan, Rev. 3, dated stabilize the HEU material stored in the 235-F vaults by the end of FY-2002.

SITE: Savannah River Site	FACILITY (Building or Location) 235F
	VULNERABILITY NO. SRS/235-F/SAT/001

VULNERABILITY ASSESSMENT FORM

Block 9: Database Information

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR (g)
U-235	Powder	Uranium Oxide	1980.0000
U-234			20.0000
Pu-239			1.0000

Collocated Chemicals and Release Parameters

Chemical/Release Products

Name	Mass (g)

Release Path Parameters

Chemical Form and Release Products	DR	ARF	RF	LPF
	1.000000	0.002000	0.300000	0.000001
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000

Exposure Parameters

Chemical Form and Release Products	V(meter)^3	ΔT(min)*/t(min)	X/ Q(CW)	X/ Q(P)
	50.00000	1.00000	0.040000	0.00002
	0.00000	0.00000	0.000000	0.00000
	0.00000	0.00000	0.000000	0.00000
	0.00000	0.00000	0.000000	0.00000
	0.00000	0.00000	0.000000	0.00000
	0.00000	0.00000	0.000000	0.00000
	0.00000	0.00000	0.000000	0.00000

;h River Site	FACILITY (Building or Location) 235F
	VULNERABILITY NO. SRS/235-F/SAT/001

VULNERABILITY ASSESSMENT FORM

ments and references for parameter selection.

Grouping #186. HEU/Zr alloy; Pu contaminated;

e of the worst case material - Material

d.

kage in vault while handling

kaging

gh frequency
sequences to worker; No public or env.

WPE Category
MP

Team Member

Team Leader

Date 8-7-96

Date 8/8/96

07/30/96

SITE: Savannah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/001
VULNERABILITY ASSESSMENT FORM	

Block 1: Title of Vulnerability

Material Release due to DBA

Block 2: Executive Summary

Design Basis Accident breaches containment resulting in a release of material. The DBE could also potentially resul criticality in the wet processing area of the facility. This is discussed in SRS/247-F/SAT/002.

Savannah River Site

FACILITY (Building or Location) 247F

VULNERABILITY NO. SRS/247-F/SAT/001

VULNERABILITY ASSESSMENT FORM

Vulnerability Description/Information	
al and material form	Holdup Materials in pipes, tanks, duc
al at risk (give approximate mass (kg) composition of material which may ticipate in the release - which is not ntify the inventory of material given location).	
aging type and number of packages	0
ity and other barrier	Gloveboxes, ducts, filters, distance, PCs, tanks, alarms, HVAC, double contingency, emergency response, etc.
ation or weakness	The facility structure can be damaged by less than a DBA.

Potential Causes and Effects of Barrier Failure

fires, aging/degredation, earthquakes, winds

contamination, structural failure, material release, and loss of building integrity

Compensatory Measures

that remains is considered to be tightly adhered based on the degree of cleaning and flushing performed when the shutdown. If this is in fact true, it will be less likely to be released during a DBA.

Possible Consequences

sequences include increased exposure and injury to the worker, releases to the environment, and public contamination and

Timeframe in which consequences of vulnerability might occur.

erability is directly linked to the frequency of a design basis earthquake of 1.5E-05/yr. Therefore, may not occur during lifetime.

Plans to mitigate or minimize potential vulnerability.

viously recognized this vulnerability of release of material due to a DBA. Therefore, SRS developed a D&D plan 2-00005, Rev. 0, dated 9/14/94) for eventual removal of existing uranium facilities and associated contaminated support PPL. Meanwhile, the facility is pursuing formal deactivation in 1996. Facility personnel continue a surveillance and ence program to ensure that the facility barriers are not compromised. This will continue until D&D is accomplished.

'96

07/30/96

SITE: Savannah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/001

VULNERABILITY ASSESSMENT FORM

Block 9: Database Information

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR (g)
U-235	Powder	Uranium Oxide	33660.0000
U-234			340.0000

Collocated Chemicals and Release Parameters

Chemical/Release Products

Name	Mass (g)

Release Path Parameters

Chemical Form and Release Products	DR	ARF	RF	LPF
	1.000000	0.001000	0.300000	1.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000

Exposure Parameters

Chemical Form and Release Products	V(meter)^3	ΔT(min)*/t(min)	X/ Q(CW)	X/ Q(P)
	50.00000	1.00000	0.040000	0.000030
	0.00000	0.00000	0.000000	0.000000
	0.00000	0.00000	0.000000	0.000000
	0.00000	0.00000	0.000000	0.000000
	0.00000	0.00000	0.000000	0.000000
	0.00000	0.00000	0.000000	0.000000
	0.00000	0.00000	0.000000	0.000000

...nnah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/001

VULNERABILITY ASSESSMENT FORM

...mments and references for parameter selection.

...gh tightly adhered material in process equipment and HVAC ductwork. DBE/DBT collapes building and releases all

...ndition

NPH frequency

...nsequences to worker and environment

: W P E Cat.

M * M FC

Team Member

Date 8-7-96

Team Leader

Date 8/8/96

07/30/96

SITE: Savannah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/002
VULNERABILITY ASSESSMENT FORM	

Block 1: Title of Vulnerability

Criticality due to a DBA

Block 2: Executive Summary

Design Basis Accident can possibly rearrange tanks and equipment on the wet side of the old process resulting in

If tanks on the wet side of the process area were rearranged, a criticality cannot be ruled out. The SAR analyzed t for this criticality and estimated that it was possible because it could not predict how tanks might rearrange themse earthquake. (It is noted that the SAR analysis was looking at tanks with significantly more material than is present Currently a study is underway to support deactivation. The study preliminarily indicates that a criticality is not cred the present quantities and locations of all of the holdup.

Savannah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/002

VULNERABILITY ASSESSMENT FORM

erability Description/Information	
and material form	Holdup Materials in pipes, tanks, duc
at risk (give approximate mass (kg) position of material which may ute in the release - which is not arily the inventory of material en location).	
ging type and number of packages	0
and other barrier	Gloveboxes, ducts, filters, distance, PCs, tanks, alarms, HVAC, double contingency, emergency response, etc.
ion or weakness	Criticality caused by a DBA

a criticality.

he potential
lves in an
today.)
ible given

ential Causes and Effects of Barrier Failure

rquakes or winds

mination, criticality, and radiation and releases from criticality

pensatory Measures

study, preliminarily indicating that a criticality is not credible, is nearing completion. Approval is expected in July,

sible Consequences

ts include increased exposure and injury to the worker and public exposure.

Timeframe in which consequences of vulnerability might occur.

ality is directly linked to the frequency of a design basis earthquake of 1.5E-05/yr. Therefore, may not occur during
me.

ns to mitigate or minimize potential vulnerability.

ady recognized the low probability of DBA caused criticality in 247-F. A study, Nuclear Criticality Safety Evaluation:
Removal (U), showing that criticality is incredible in 247-F is being developed and is expected to be issued in July.

SITE: Savannah River Site	FACILITY (Building or Location) 247F
	VULNERABILITY NO. SRS/247-F/SAT/002

VULNERABILITY ASSESSMENT FORM

Block 9: Database Information

Radionuclide Source Parameters

Isotope	Physical Form	Chemical Form	MAR
		ÕÓ@Åðî	

Collocated Chemicals and Release Parameters

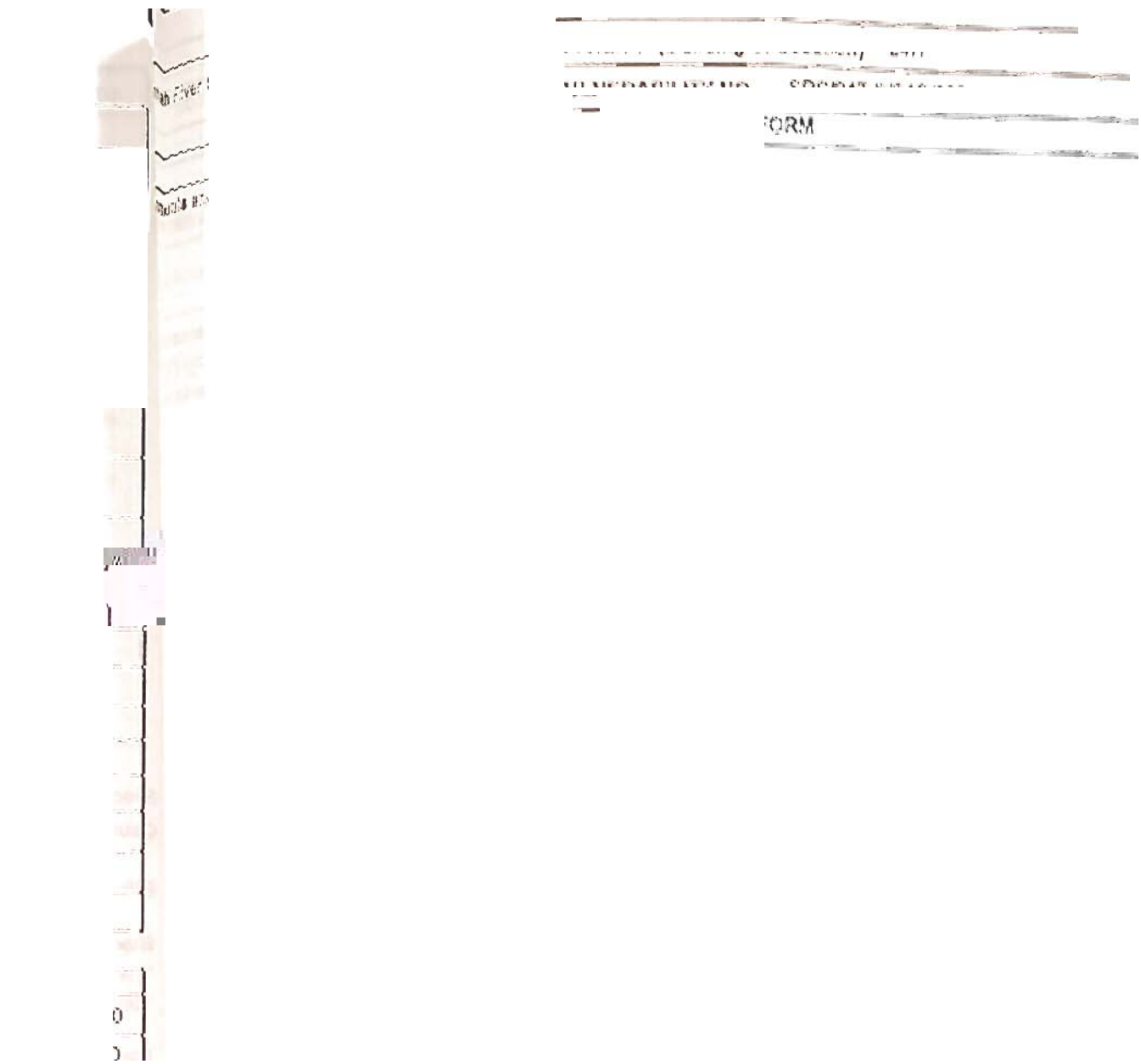
Chemical/Release Products	
Name	Mass (g)

Release Path Parameters

Chemical Form and Release Products	DR	ARF	RF	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	

Exposure Parameters

Chemical Form and Release Products	V(meter)^3	ΔT(min)*/t(min)	X/ Q(CW)	X/
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	
	0.00000	0.00000	0.000000	0



SITE: Savannah River Site	FACILITY (Building or Location) H Canyon
	VULNERABILITY NO. SRS/H CANYON/SAT/001

VULNERABILITY ASSESSMENT FORM

Block 1: Title of Vulnerability

Long Term Storage of Uranyl Nitrate Solutions in the Outside Facilities (211-H) tanks and H-Canyon tanks, unsuitable fo extended storage.

Block 2: Executive Summary

The Uranyl Nitrate solutions in outside facilities, as well as the canyons, are unsuitable for extended storage because o potential for events which may result in the release of radioactive materials to the environment, increased exposure to f workers or exposure to the public. These events could result from the inherent vulnerabilities and technical uncertainties associated with extended storage, including the potential: 1) evaporation, radiolysis, or changes in solution chemistry th initiate adverse events, 2) tank cooling coil or heat exchanger failures coupled with detection delay errors, that could res significant releases of radioactivity, and 3) for a number of other events that could result in the releases including spills leaks, unplanned transfers, and hydrogen generation.

Savannah River Site	FACILITY (Building or Location) H Canyon
	VULNERABILITY NO. SRS/H CANYON/BAT/001
	VULNERABILITY ASSESSMENT FORM

erability Description/Information	
and material form	Solutions Nitric acid
...ck (give approximate mass (kg)) ...position of material which may ...e in the release - which is not ...ly the inventory of material ...location).	
...type and number of packages	...T3, T3 Ann 0
...other barrier	Canyon, filter, duct, HVAC, Site boundary, monitoring, surveillance, tanks, liquid containment
	Long Term Storage of HEU solutions.

...ntial Causes and Effects of Barrier Failure

...vertent transfer, aging/degregation, equipment failure, change of mis...
...olysis and hydrolysis

...xplosion, contamination, leakage/spills, worker exposure, criticality,

...sed for all unit operations including surveillance of canyon
...rovide operating ranges and limits, as well as instruction...

...cuments (OSR, Technical Standards) provide limits
...centration, or areal density. Surveillance procedur...

...canyon operations provides a knowle...

...reminds personnel to be inquisitive and to b... ...pons.

1-H Facilities authorization basis defines a safety ...

Lessons learned from other facilities are used to inform personnel of potential adverse conditions or events, and when a are implemented into procedures.

Both Canyon and Outside Facilites tanks are continuously monitored, and important parameters are recorded on rounds several times a shift to ensure conditions are within the prescribed limits of the safety envelope.

Safety systems such as the canyon ventilation system, nuclear incident monitors, canyon sump level gages, and coolin activity monitors and diversion valves are in place to minimize the consequences of potential events involving stored ra material solutions.

Alarm systems associated with gamma monitors, nuclear incident monitors, and cooling water activity monitors minimize consequences of potential events involving stored radioactive material solutions by alerting personnel to adverse condit

Block 6: Possible Consequences

Consequences include increased radiation exposure and contamination to the worker, release to the environment and pu exposure.

Block 7: Timeframe in which consequences of vulnerability might occur.

5 years to facility end-of-life

Block 8: Plans to mitigate or minimize potential vulnerability.

This vulnerability was previously recognized by SRS in the IMNM EIS and by the DNFSB. Plans are in place to blend do HEU to LEU. SRS is currently authorized per the SRS Site Integrated Stabilization Management Plan, Rev. 3, dated 3/ stabilize the uranyl nitrate solutions stored in the H-Canyon facility by the end of FY-2000.

FACILITY (Building ...)

VULNERABILITY NO. SRS/H CANYON/SAT/001

VULNERABILITY ASSESSMENT FORM

Radionuclide Source Parameters

...al Form	Chemical F...	MAR (g)
Solution	Uranyl Nitrate	1287000.0000
		13000.0000

Collocated Chemi...

Releas...

...roducts	OR		
	1.000000		0.001000
			0.000000

SITE: Savannan River Site	FACILITY (Building or Location) H Canyon
	VULNERABILITY NO. SRS/H CANYON/SAT/001

VULNERABILITY ASSESSMENT FORM

Block 10: Comments and references for parameter selection.

Scenario:

1) Spill or release of material inside canyon. Send no workers inside to cleanup. No consequences.

2) Collocated worker can be affected but only after HVAC system and sand filters.

3) Material packaging

4) Results Low likelihood
Low consequences to worker and environment

Likelihood W P E Category
L L * L MP

Brett A Clinton
Signature, Team Member

8/6/96
Date

Signature, Team Leader

3/3/96
Date

VULNERABILITY ASSESSMENT FORM

of Vulnerability

p material from exhaust ducts and equipment in Building 321-M.

utive Summary

nado, or straight winds could cause release of holdup material from exhaust ducts and equipment in Building

SITE: Savannah River Site	FACILITY (Building or Location) 321-M
	VULNERABILITY NO. SRS/321-M/SAT/001
VULNERABILITY ASSESSMENT FORM	

Block 3: Vulnerability Description/Information

Material and material form	Other -specify
Material at risk (give approximate mass (kg) and composition of material which may participate in the release - which is not necessarily the inventory of material at a given location).	
Packaging type and number of packages	0
Facility and other barrier	Facility and barriers include building structure, equipment enclosures, interior and exterior exhaust ducts.
Condition or weakness	The facility and equipment is not designed to withstand a fire, tornado, or straight winds. Some exhaust ducts and HEPA filter housings are located on the facility roof. There is no installed fire suppression system.

Block 4: Potential Causes and Effects of Barrier Failure

A facility fire, tornado or straight winds could cause release of holdup material from exhaust ducts and equipment in Building 321-M.

Block 5: Compensatory Measures

The quantity of material available for release has been minimized during Building 321-M De-Inventory campaign and by removing used prefilters and HEPA filters from ducts when building operations were terminated. Only limited quantities of combustible materials are permitted in the facility. Fire alarm systems are maintained operable. Routine custodial and radiological surveillances are maintained.

Block 6: Possible Consequences

Calculation G-CLC-M-00001, Rev. 0 shows that:

1) Contamination to the facility worker, collocated worker and the onsite environment due to a facility fire, tornado or straight winds could exceed 1,000 dpm/100 sq. cm. within 100 meters of Building 321-M. (i.e., HEU VA "Medium" severity class).

2) The radiological dose to the facility worker could exceed 2 rem CEDE (i.e., HEU VA "Low" severity class).

3) Other potential consequences to workers, collocated workers, the public, and the offsite environment would not exceed the HEU VA "Low" severity class criteria threshold.

Block 7: Timeframe in which consequences of vulnerability might occur.

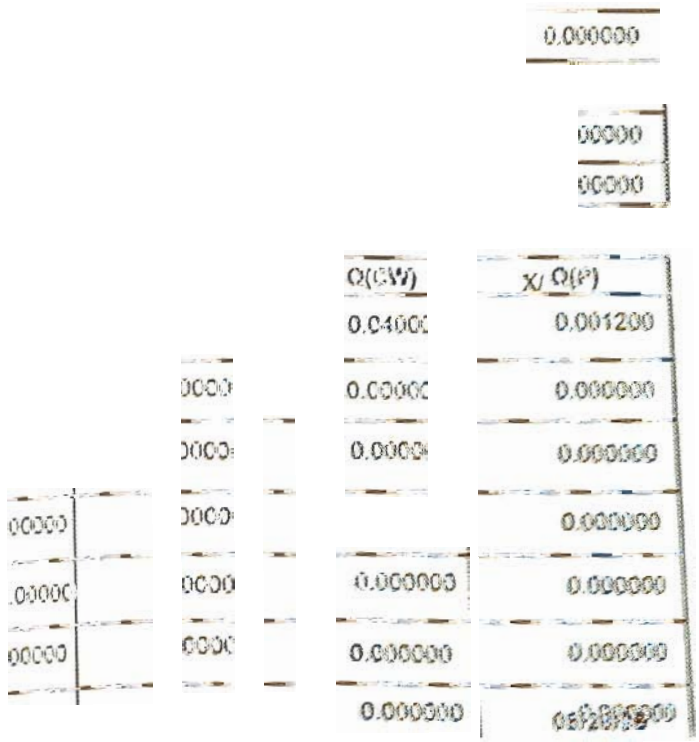
0-5 years

Block 8: Plans to mitigate or minimize potential vulnerability.

SRS previously recognized that a design basis accident could release HEU materials from Building 321-M.

It is planned to decontaminate and/or remove the equipment and exhaust ducts. Funding is not currently available to implement these plans.

321-M
21-M/SAT/001


0.000000
Q(SW)
X/ Q(F)
0.04000
0.001200
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000

SITE: Savannah River Site	FACILITY (Building or Location) 321-M
	VULNERABILITY NO. SRS/321-M/SAT/001

VULNERABILITY ASSESSMENT FORM

Block 10: Comments and references for parameter selection.

- "Collocated Worker" and "Public" inhalation dose calculated by equation 1 per DOE HEU VAP, page 28.

- "Collocated Worker" and "Public" inhalation intake calculated by equation 3 per DOE HEU VAP, page 28.

- "Collocated Worker" and "Public" gamma shine dose calculated by equation 2 per DOE HEU VAP, page 28.

- Environmental contamination calculated by equation 8 per DOE HEU VAP, page 28.

SCENARIO:

- Even though tightly adhered material in ductwork, approximately 200g released during building collapse in high wind condition.

2) High winds can occur frequently; thus high likelihood.

3) Facility condition.

4) Results High likelihood (not NPH)
Low consequences to worker and environment.
No public

Likelihood W P E Category
Likelihood W P E Category

Signature, Team Member — Date 8/22/96

Signature, Team Leader — Date 8/22/96

Site Assessment Team Members

Ames Laboratory

Stephanie Chesney, Team Coleader
Thomas E. Wessels, Team Coleader
Bruce W. Hokel

Argonne National Laboratory-East

Steven Ludwig, Team Coleader
Thomas W. Barkalow, Team Coleader
John D. B. Lambert, Team Coleader

Argonne National Laboratory-West

James P. Geringer, Team Coleader
Robert C. Singleterry, Team Coleader
Kenneth P. Amar
Lawrence L. Burke
Fred L. DiLorenzo
Roger D. Haga
Shelly J. Havlovick
Chad L. Pope
Michael J. Shannon
Tom P. Zahn

Bettis Atomic Power Laboratory

John C. Todd, Team Leader

Brookhaven National Laboratory

Peter W. Kelley, Team Coleader
Robert C. McNair, Team Coleader

Hanford Site/ Pacific Northwest National Laboratory

Angel B. Joy, Team Coleader
David C. Lini, Team Coleader
W. Dean Bartlett
Greg M. Clark
Scott W. Gority
Wiley V. Witherspoon, III

Idaho National Engineering Laboratory

William D. Jensen, Team Coleader
Craig S. Olson, Team Coleader
Phillip A. Anderson
Fred J. Balkovetz
Richard F. Bonney
Ronald P. Bopp
Darris J. Bright
Roy L. Campbell
Connie J. Cerchione
Stephen L. Denison
Bryce L. Denning
Jerald L. Edson
Donald D. Garbe, Jr.
K. C. Gerard
Mari A. Graham
Rodney L. Hand
Jeffrey L. Hansen
Lawrnel Harrison
Joseph P. Henscheid
Cindie L. Jensen
Nels C. Jensen
Deborah A. Johnson
John E. Johnson, Jr.
Stephen P. Johnson
Norman P. Klug
Karen A. Kublak
Allyn W. Kyes
Ernest L. Laible
Charles M. Landgraver
Laurence G. Lee
Kerry L. Martin
Ron T. Metcalf
E. V. Mobley
Michael E. Nitzel
Richard G. Oesterling
David L. Olsen
Paula A. Ostby
John W. Peterson
Ken C. Philips
Richard G. Rahl
Ronald L. Ramer
John W. Rice, Jr.
Dennis B. Schanz
Edmond J. Schuebert
Julie A. Sellars
Paul J. Sentieri
Richard Struthers
Charles E. Stuart, III
Joseph T. Taylor
Mary Alice Thom
Alden N. Tschaeche
Jan L. Ulrich
Kenneth B. Woods
Helmut A. Worle

Knolls Atomic Power Laboratory

John C. Todd, Team Leader

Lawrence Livermore National Laboratory

Salma El-Safwany, Team Coleader
Brent H. Ives, Team Coleader
Yun Chang
Patricia C. Crawford
Richard B. Evarts
James M. Mecozzi
William W. Short
Melvin (Mel) N. Tate

Los Alamos National Laboratory

James A. Phoenix, Team Coleader
Billy D. Baker, Team Coleader
Paul S. Dunn, Team Coleader
Philip K. Tubesing, Team Coleader
George Biggs
Ken Bower
Roger W. Brewer
Ken Chidester
Tonya Collins
Kenneth C. Feller
Candace Frostenson
Larry Haynes
Suzanne Y. Helfinstine
Sue Jones
Gerald C. Langner
Vicki Longmire
Phyllis Martell
Audrey Martinez
Victor Allen Martinez
Walter W. Maybee
Don Parsons
Rene Sanchez
Ray Tell
Douglas E. Volkman

Mound Plant

Stephen P. Holliday, Team Coleader
Douglas G. Draper, Team Coleader
Thomas A. Grice
Eric T. Kirk

Nevada Test Site

David L. Wheeler, Team Leader
Jeffrey M. Haeberlin
Richard L. Waters

New Brunswick Laboratory

Jon W. Neuhoff, Team Coleader
D. Eric Dallmann, Team Coleader
Corliss A. Johnson
Robert A. Mason
Francis P. Orlowicz
Margaret R. Redman
John T. Sickels
H. Dennis Troutman

Oak Ridge K-25 Site

Narsalah Karne, Team Coleader
David C. Lannom, Team Coleader
Tony C. Chung
Michael A. Harrison
Mae M. Jacks
Kevin D. Kimball
Russell A. Rickard
Kenneth I. Roy
James N. Underwood

Oak Ridge Y-12 Plant

Robert C. McBroom, Team Coleader
David L. Wall, Team Coleader
Robert M. Davis, Team Coleader
John E. Powell, Team Coleader
Tom R. Christman
Shirley O. Cox
Reed B. Durham
Guen T. Eagle
William S. Gordon
Robert S. Hamby
R. Joe Hunt
Jon A. Kreykes
Sam F. Lariviere
Kim R. Leach
Phillip B. Leonetti
Ken R. Martin, Jr.
Ron R. Milsaps
Jesse M. Moore
Rodney L. Patton
Ronnie E. Phillips
Mike J. Pierce
Keith A. Pilcher
Chris H. Robinson
Marshall R. Seavers
Ed A. Tyl
Gene E. Walker

Oak Ridge National Laboratory

D. Ken Rhyne, Team Coleader
L. Tommy Gordon, Team Coleader
J. David Baity
Linda L. Gilpin
C. Richard Hammond
Jerry B. Hunt
David L. Kirby
C. Greg Palko
Davis A. Reed
Mahender K. Singhal
Jonathan P. Snapp
Bruce D. Warnick

Pantex Plant

Harry R. Griffith, Team Coleader
Elmer H. Mann, Team Coleader
Pamela S. Allison
Ronald L. Benson
Norman F. Foster
William J. Harris
David T. Hooten
Stanley G. Keadle
Michael G. Knight
Larry F. Kuga
David C. Nester
Ronna A. Rice
Richard C. Stone
Priscilla J. Thompson

Portsmouth Gaseous Diffusion Plant

Russell J. Vranicar, Team Coleader
Gary J. Gibson, Team Coleader
Ralph J. D'Antoni, Jr.
Gregory Kelmeckis
Matthew J. Miller
Robert L. Rodino, Jr.
Alfred E. Stuart
Anthony L. Takacs

Rocky Flats Environmental Technology Site

David J. Nickless, Team Coleader
Lewis L. Richey, Team Coleader
Robert J. Ahlstrand
Steven L. Browdy
Scott H. Davies
Thomas P. Denny
Michael O. Erickson
Rick Reynolds
Warren E. Seyfert
Larry E. Wilson
John R. Winkel

Sandia National Laboratories

Jeffrey N. Irwin, Team Coleader
John L. Sichler, Team Coleader
Donald J. Bragg
Philip J. Cooper
Jeffrey A. Mahn
Richard Schetnan
Theodore N. Simmons
Carrie Wood

Savannah River Site

Roger Rollins, Team Coleader
Richard L. Geddes, Team Coleader
James C. Ayers
Albert Barone
Stephen R. Beck-Montgomery
Bradley D. Clark
Brett A. Clinton
William C. Dennis
Doug N. Fleiss
Phillip J. Keuhlen
Faye Key
Donald L. McWhorter
Audrey B. Osteen
Lamar Willard Reynolds, Jr.
Frederick C. Rhode
Walter L. Sansot
Howard E. Shook
Deanna Stimac
Bruce L. Tomlin
Charles E. Varner
Timothy E. Worth

Working Group Assessment Team Members

Idaho National Engineering Laboratory/ Argonne National Laboratory–West

Pranab K. Guha, U.S. DOE, Office of Environment, Safety and Health, Team Leader
William J. Woody, Jr., Link Technologies, Deputy Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Barbara K. Kneece, Parallax, Inc.
Billy L. Lee, Jr., Battelle, Oak Ridge Operations
Bryce L. Rich, SCIENTECH, Inc.
Subir K. Sen, U.S. DOE, Office of Environment, Safety and Health
Ray A. Sprankle, Applied Analysis Corporation
James E. Vath, Lockheed Martin Energy Systems

Los Alamos National Laboratory/ Sandia National Laboratories, New Mexico

Rowland E. Felt, U.S. DOE, Office of Environment, Safety and Health, Team Leader
Richard E. Day, U.S. DOE, Office of Environment, Safety and Health
Walter K. Duerksen, Lockheed Martin Energy Systems
Roger N. Henry, Lockheed Martin Idaho Technologies Company
William M. Hogle, Independent Consultant
Bryce L. Rich, SCIENTECH, Inc.
Colleen A. Yelle, SCIENTECH, Inc.

Oak Ridge K-25 Site/ Oak Ridge National Laboratory

Frank Y. Chen, U.S. DOE, Office of Environment, Safety and Health, Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
Harold M. Burton, SCIENTECH, Inc.
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Jeffrey L. Kotsch, SCIENTECH, Inc.
David S. Mowrer, HSB Professional Loss Control
W. Wilson Pitt, Jr., Texas A&M University
Evelyn M. Rothleder, U.S. DOE, Office of Environment, Safety and Health
Bryce L. Still, SCIENTECH, Inc.

Oak Ridge Y-12 Plant

William C. Rask, U.S. DOE, Rocky Flats Field Office, Team Leader
Louis C. Bogar, Independent Consultant, Deputy Team Leader
Myrtle L. Hyder, Westinghouse Savannah River Company, Deputy Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
Wayne L. Andrews, Defense Nuclear Facilities Safety Board, Observer
William G. Boyce, U.S. DOE, Office of Environmental Management
Robert T. Brock, U.S. DOE, Savannah River Operations Office
Fred N. Carlson, F.N. Carlson & Associates, Inc.
Michael J. Cates, Lockheed Martin Idaho Technologies Company
Melton H. Chew, M.H. Chew and Associates, Inc.
Nicholas J. Flouras, Westinghouse Savannah River Company
Daniel J. Guzy, U.S. DOE, Office of Environment, Safety and Health
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
William G. Lussie, Lockheed Martin Idaho Technologies Company
Shean P. Monahan, Los Alamos National Laboratory
Jon B. Nielsen, Los Alamos National Laboratory
David J. Odland, Sonalysts, Inc.
Douglas A. Outlaw, Science Applications International Corporation
Benjamin G. Owens, Mason & Hanger
Janice L. Ulrich, Lockheed Martin Idaho Technologies Company
Ralph W. West, Jr., Defense Nuclear Facilities Safety Board, Observer
Glenn A. Whan, Independent Consultant
Mark H. Williams, U.S. DOE, Office of Environment, Safety and Health, Advisor

Pantex Plant

Michael K. Hooper, U.S. DOE, Oakland Operations Office, Team Leader
Brent H. Ives, Lawrence Livermore National Laboratory, Deputy Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
Raymond Bass, Texas A&M University, Observer
Sushil K. Bhatnagar, U.S. DOE, Office of Environment, Safety and Health
Eugene L. Bird, Lockheed Martin Energy Systems
David A. Chaney, U.S. DOE, Office of Defense Programs, Observer
Ralph D. Crowe, Westinghouse Hanford Company
Hans J. Dahlke, Lockheed Martin Idaho Technologies Company
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Henry A. Harper, Jr., Argonne National Laboratory West
Darrell A. Huff, U.S. DOE, Office of Environment, Safety and Health
John L. Jones, Westinghouse Savannah River Company
Joe E. Kersh, U.S. DOE, Office of Defense Programs
John M. Selby, M.H. Chew and Associates, Inc.
Anthony L. Takacs, U.S. DOE, Portsmouth Site Office
Gerald P. Van Gelder, Halliburton NUS
Deidra D. Yearwood, Los Alamos National Laboratory

Portsmouth Gaseous Diffusion Plant

Fred E. Witmer, U.S. DOE, Office of Defense Programs, Team Leader
Tracy S. Rudisill, Westinghouse Savannah River Company, Deputy Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
Billy D. Baker, Los Alamos National Laboratory
Connie J. Cerchione, Lockheed Martin Idaho Technologies Company
Mary Anne Chillingworth, SCIENTECH, Inc.
Stephen D. Cook, Lockheed Martin Energy Systems
James A. Crum, U.S. DOE, Portsmouth Site Office, Observer
Leo Derderian, U.S. DOE, Office of Environment, Safety and Health
Ann L. Doherty, Pacific Northwest National Laboratory
Randy L. Eastman, Lockheed Martin Idaho Technologies Company
Ronald W. Glass, Lockheed Martin Energy Systems
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Duncan L. Hammon, Los Alamos National Laboratory
Robert V. Hernon, U.S. DOE, Rocky Flats Field Office
Gregory K. Miller, Lockheed Martin Idaho Technologies Company
John C. Orrison, U.S. DOE, Portsmouth Site Office, Observer
Donald K. Parsons, Los Alamos National Laboratory
Betty K. Revsin-Watson, Radiological Solutions, Inc.

Rocky Flats Environmental Technology Site

Thomas J. Hull, U.S. DOE, Office of Environment, Safety and Health, Team Leader
Robert L. Wright, Mason & Hanger, Deputy Team Leader
Sarbes Acharya, U.S. DOE, Office of Environment, Safety and Health, Advisor
George W. Becker, Westinghouse Savannah River Company
N. Danny Chien, Lockheed Martin Idaho Technologies Company
Frank A. Felix II, Mason & Hanger
George R. Goebel, Parallax, Inc.
Vincent W. Gorman, Lockheed Martin Idaho Technologies Company
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Gary F. Hagan, Lockheed Martin Energy Systems
Michael E. Hodges, Westinghouse Savannah River Company
Gregory E. Kelmeckis, Lockheed Martin Energy Systems
Julie Sellars, Lockheed Martin Idaho Technologies Company
Ray A. Sprankle, Applied Analysis Corporation
J. Todd Taylor, Lockheed Martin Idaho Technologies Company
Richard J. Traub, Pacific Northwest National Laboratory

Savannah River Site

Jon MacLaren, U.S. DOE, Office of Defense Programs, Team Leader
Patrick A. Ward, SCIENTECH, Inc., Deputy Team Leader
Barry C. Collyer, Mason & Hanger
Leo G. Faust, M.H. Chew and Associates, Inc.
Milton Haas, U.S. DOE, Office of Environment, Safety and Health, Advisor
Cindie L. Jensen, Lockheed Martin Idaho Technologies Company
Nels C. Jensen, Lockheed Martin Idaho Technologies Company
Alan M. Krichinsky, Oak Ridge National Laboratory
Robert J. Lewis, Defense Nuclear Facilities Safety Board, Observer
Daryl A. Lopez, Lockheed Martin Idaho Technologies Company
Matthew J. Miller, Lockheed Martin Energy Systems
Michael E. Nitzel, Lockheed Martin Idaho Technologies Company
Ronald D. Shaffer, Parallax, Inc.
Richard G. Taylor, Lockheed Martin Energy Systems
Lance E. Traver, SCIENTECH, Inc.
Mark H. Williams, U.S. DOE, Office of Environment, Safety and Health, Advisor

Sites with Small HEU Holdings*

Pranab K. Guha, U.S. DOE, Office of Environment, Safety and Health, Team Leader
Carl F. Obenchain, Global Technologies, Inc., Deputy Team Leader
Frank Y. Chen, U.S. DOE, Office of Environment, Safety and Health
Harold M. Burton, SCIENTECH, Inc.
Robert E. Canaan, ANRCP, University of Texas
Walter K. Duerksen, Lockheed Martin Energy Systems
William M. Hogle, Independent Consultant
Nels C. Jensen, Lockheed Martin Idaho Technologies Company
Vishwa M. Kapila, U.S. DOE, Office of Environment, Safety and Health
Ashok K. Kapoor, U.S. DOE, Office of Environmental Management
Jeffrey L. Kotsch, SCIENTECH, Inc.
Calvin K. Lai, U.S. DOE, Office of Environment, Safety and Health
Billy L. Lee, Battelle, Oak Ridge Operations
P. K. Niyogi, U.S. DOE, Office of Environment, Safety and Health
W. Wilson Pitt, Jr., Texas A&M University
Bryce L. Rich, SCIENTECH, Inc.
Ray A. Sprankle, Applied Analysis Corporation
James E. Vath, Lockheed Martin Energy Systems
Patrick A. Ward, SCIENTECH, Inc.

* Sites with Small HEU Holdings: Lawrence Livermore National Laboratory, New Brunswick Laboratory, Argonne National Laboratory-East, Hanford Site, Pacific Northwest National Laboratory, Brookhaven National Laboratory, Nevada Test Site, Mound Plant, Ames Laboratory, Bettis Atomic Power Laboratory, Knolls Atomic Power Laboratory