United States Department of Energy

Savannah River Site

enterprise·srs

Record of Decision
Remedial Alternative Selection for the
B-Area Operable Unit (U)

CERCLIS Number: 48

SRNS-RP-2012-00354

Revision 1

February 2013

Prepared by:
Savannah River Nuclear Solutions, LLC
Savannah River Site
Aiken, SC 29808

Prepared for U.S. Department of Energy under Contract No. DE-AC09-08SR22470

DISCLAIMER

Printed in the United States of America

Prepared for
U.S. Department of Energy
and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

B-Area Operable Unit (U)

CERCLIS Number: 48

SRNS-RP-2012-00354
Revision 1

February 2013

Savannah River Site
Aiken, South Carolina

Prepared by:

Savannah River Nuclear Solutions, LLC
for the
U.S. Department of Energy under Contract DE-AC09-08SR22470
Savannah River Operations Office
Aiken, South Carolina

This page was intentionally left blank.

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

B-Area Operable Unit (BAOU)
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU - 48
Savannah River Site
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989
Aiken, South Carolina
United States Department of Energy

The B-Area Operable Unit (BAOU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/CERCLA unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). This Record of Decision (ROD) addresses the BAOU that is comprised of two subunits, both of which were previously selected for non-time critical removal (NTCR) actions.

The FFA is a legally binding agreement between regulatory agencies (United States Environmental Protection Agency [USEPA] and South Carolina Department of Health and Environmental Control [SCDHEC]) and regulated entities (United States Department of Energy [USDOE]) that establishes the responsibilities and schedules for the comprehensive remediation of SRS. The media associated with this operable unit include soil, construction debris, concrete, and miscellaneous metal components.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the BAOU, which is located at the SRS near Aiken, South Carolina. The remedy was chosen in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the information contained in the Administrative Record File for this site.

The USEPA, SCDHEC and USDOE concur with the selected remedy.

Assessment of the Site

The BAOU consists of two subunits, the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 subunit, and the Building 770-U, Heavy Water Components Test Reactor (HWCTR) subunit. NTCR actions were previously conducted at both BAOU subunits and are documented in a Removal Site Evaluation Report (RSER)/Engineering Evaluation/Cost Analysis (EE/CA) and a Removal Action Report (RAR) for each:

- ECODS B-3 and B-5 (SRNS, 2010a and SRNS, 2011a)
- HWCTR (SRNS, 2010c and SRNS, 2011b)

Hazardous substances had been released into the environment at the ECODS B-3 and B-5 subunit. After the successful completion of the NTCR action, no hazardous substances remain in place at this subunit. In the current state, the ECODS B-3 and B-5 subunit poses no risk to human health and the environment and supports unrestricted land use.

Hazardous and radioactive substances have the potential to be released into the environment at the HWCTR facility. A NTCR action was conducted to remove some contaminated building components and the below-grade portions of the facility were sealed in place with grout material to form a stabilized structure. In the current state the HWCTR facility does not support unrestricted land use because residual contamination remains in place in the below grade portions of the former facility.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

The selected remedy for the ECODS B-3 and B-5 portion of the BAOU is No Further Action. In its current state, this subunit poses no risk to human health and the environment and supports unrestricted land use.

The selected remedy for the former HWCTR facility of the BAOU is Land Use Controls (LUCs) with Groundwater Monitoring. The NTCR action reduced the human health risk by eliminating the human exposure pathway and minimized the potential of contaminants to migrate to groundwater; however, residual hazardous and radioactive substances, although stabilized in place, still remain in the below-grade portions of the former facility. The future land use will remain industrial. This remedy also provides additional assurance regarding the protection of the groundwater by inclusion of a monitoring program.

Under this remedy, LUCs consisting of engineering controls (ECs) and institutional controls (ICs) would be implemented to prevent unrestricted land use. ECs (e.g., physical barriers and signs) and ICs (e.g., excavation permit restrictions and deed restrictions) would be used to restrict access or activities that can be performed. As part of the NTCR action, a concrete cover was installed at the ground surface, access control signs were installed, and surveillance and maintenance activities were initiated. LUCs implemented as part of the NTCR action would be continued as the final remedial action.

The selected remedial action will achieve the following LUC objectives:

- Maintain the integrity of ECs which provide an exposure barrier (including in-situ grouting and concrete cover);
- Maintain the integrity of the groundwater monitoring well system;
- Restrict or prohibit groundwater use as determined to be necessary based on monitoring results;
- Restrict access by posting and maintaining warning signs and enforcing SRS security procedures;
- Prohibit the development and use of property for any use other than industrial; no residential use, school use, child care facilities or recreational use shall be allowed.

This remedy was selected because it meets the remedial action objectives (RAOs), provides overall protection of human health and the environment, complies with Applicable or Relevant

and Appropriate Requirements (ARARs), and is cost-effective. The remedy provides a high level of long term protection to the radioactive and hazardous constituents that remain in place.

The RCRA permit will be revised to reflect selection of the final remedy using the procedures under 40 CFR Part 270, and SCHWMR R.61-79.264.101; 270.

Statutory Determinations

Regulatory decisions were made on both of the BAOU subunits as documented in the Action Memoranda for each of the NTCR actions. Following successful completion of the NTCR action at the ECODs B-3 and B-5 subunit, no residual hazardous substances remain that pose a threat to human health and the environment, and the selected remedy is No Further Action. After successful completion of the NTCR action at HWCTR, residual hazardous and radioactive substances still remain in the below grade portions of the facility that pose a potential threat to human health and the environment. Therefore, Land Use Controls with Groundwater Monitoring has been selected as the final remedy for the HWCTR subunit. As part of the selected remedy, the future land use of the former HWCTR facility will be industrial.

In accordance with Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(c), a statutory review will be conducted within 5 years of initiation of the remedial action, and every 5 years thereafter, to ensure that the remedy continues to be protective of human health and the environment.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action (unless justified by a waiver), and is cost-effective. The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy because it does not reduce the toxicity, mobility, or volume of material comprising principal threats through treatment.

In the long term, if the property, or any portion thereof, is ever transferred from USDOE, the U.S. Government and/or USDOE will take those actions necessary pursuant to Section 120(h)(1) of CERCLA. Those actions will include in any contract, deed, or other transfer document, notice of the type and quantity of any hazardous substances that were known to have been stored (for

more than one year), released, or disposed of on the property. The notice will also include the time at which the storage, release, or disposal took place to the extent such information is available.

In addition, if the property, or any portion thereof, is ever transferred by deed, the U.S. Government will also satisfy the requirements of CERCLA 120(h)(3). The requirements include: a description of the remedial action taken, a covenant, and an access clause. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

LUCs will be implemented through the following:

- The contract, deed, or other transfer document shall also include restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the LUCs will be done through an amended ROD with USEPA and SCDHEC review and approval.
- In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the OU will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

In the event of a property lease or interagency agreement, the equivalent restrictions will be implemented as required by CERCLA Section 120(h).

The selected remedy for the BAOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control Assurance Plan (LUCAP) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Control Implementation Plan (LUCIP) incorporated by reference into this ROD will provide details and

specific measures required to implement and maintain the LUCs selected as part of this remedy. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved by the USEPA and SCDHEC as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

Data Certification Checklist

This ROD provides the following information:

- Constituents of concern (COCs) and their respective concentrations (Section V);
- Baseline risk represented by the COCs (Section VII);
- Cleanup levels established for the COCs and the basis for the levels (Section VIII);
- Current and reasonably anticipated future land and groundwater use assumptions used in the Baseline Risk Assessment (BRA) and ROD (Section VI);
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section VI);
- Estimated capital, operation and maintenance, and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected (Section IX);
- Key decision factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria) (Section X); and
- How source materials constituting principal threats are addressed (Section VII, Section XI).

2/21/13
Date

Karen Guevara
Assistant Manager for Infrastructure and Environmental Stewardship
U. S. Department of Energy
Savannah River Operations Office

3/14/13
Date

Franklin E. Hill
Director
Superfund Division
U. S. Environmental Protection Agency - Region 4

3/25/13
Date

Daphne G. Neel
Bureau Chief
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control

This page was intentionally left blank.

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

B-Area Operable Unit

CERCLIS Number: 48

SRNS-RP-2012-00354
Rev. 1

February 2013

Savannah River Site
Aiken, South Carolina

Prepared By:

Savannah River Nuclear Solutions, LLC
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

This page was intentionally left blank.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
ARRA	American Recovery and Reinvestment Act
BAOU	B-Area Operable Unit
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulation
CM	contaminant migration
COC	constituent of concern
CSM	conceptual site model
+D	plus daughters
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethylene
EC	engineering control
ECODS	Early Construction and Operational Disposal Site
ESD	explanation of significant difference
FFA	Federal Facility Agreement
ft, ft^2, ft^3	feet, square feet, cubic feet
GPR	ground penetrating radar
HH	human health
HHRA	human health risk assessment
HSWA	Hazardous and Solid Waste Amendments
HWCTR	Heavy Water Components Test Reactor
IC	institutional control
IOU	integrator operable unit
kg	kilogram
km, km^2	kilometer, square kilometer
LLC	Limited Liability Company
LUC	Land Use Controls
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
m, m^2, m^3	meter, square meter, cubic meter
mi, mi^2	mile, square mile
MCL	maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NPL	National Priorities List
NTCR	non-time critical removal

LIST OF ABBREVIATIONS AND ACRONYMS

O&M	operations and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
PTSM	principal threat source material
RAO	remedial action objective
RAR	Removal Action Report
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goal
RI	Remedial Investigation
ROD	Record of Decision
RSER/EE/CA	Removal Site Evaluation/Engineering Evaluation/Cost Analysis
SARA	Superfund Amendments Reauthorization Act
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SE	site evaluation
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TAL	Target Analyte List
TCL	Target Compound List
TSD	treatment, storage or disposal
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WSRC	Westinghouse Savannah River Company (before October 2005)
WSRC	Washington Savannah River Company, LLC (after October 2005)
yd, yd^3	yard, cubic yard

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

Unit Name, Location, and Brief Description

B-Area Operable Unit (BAOU)
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 48
Savannah River Site
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989
Aiken, South Carolina
United States Department of Energy (USDOE)

Savannah River Site (SRS) occupies approximately 803 km^2 (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina.

The USDOE owns SRS, which historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the CERCLA, are currently present in the environment at SRS.

The Federal Facility Agreement (FFA) (FFA, 1993) for SRS lists the B-Area Operable Unit (BAOU) as a Resource Conservation and Recovery Act Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) unit requiring further evaluation.

The BAOU was evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to determine the actual or potential impact to human health (HH) and the environment of releases of hazardous substances to the environment.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational and Compliance History

The primary mission of SRS has been to produce tritium, plutonium, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on September 30, 2003. Module VIII of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RCRA facility investigation (RFI) program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 United States Code Section 9620, USDOE has negotiated a FFA (FFA, 1993) with United States Environmental Protection Agency (USEPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA - Region 4 and the SCDHEC.

Operable Unit Operational and Compliance History

The BAOU is located in the northwest quadrant of the SRS in Aiken County, South Carolina (Figure 1). The BAOU consists of the following subunits:

- Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5
- Heavy Water Components Test Reactor (HWCTR), Building 770-U

Funding through the American Recovery and Reinvestment Act (ARRA) of 2009 supported acceleration of the original milestone dates for these subunits, and the USDOE has performed a non-time critical removal (NTCR) action at each in order to achieve the accelerated schedule commitments.

ECODS B-3 and B-5 History

Construction activities at the SRS were initiated in 1951, with the majority of production facilities and related support facilities completed by 1955. During that period, an abundance of construction waste was generated which required disposal. Aerial photographs of SRS were utilized to search for potential environmental hazards related to historical waste disposal practices. Historical photographs revealed that, prior to SRS construction, land around B Area was used as farm land. However, in aerial photographs taken after SRS construction began, several anomalies (i.e., disturbed soil) were observed within B Area. These anomalies were subsequently identified as land burial tracts where construction waste had been placed. Upon identification, these areas were denoted as ECODS and were added to Appendix G.1 (Areas To Be Investigated) of the FFA.

ECODS B-3 and B-5 were two of the twenty-five ECODS identified at SRS that were used to dispose of waste material associated with the construction of SRS facilities. ECODS B-3 and B-5 were associated with the construction of B Area and are located between B Area and the Sanitary Landfill (Figure 2). Construction waste was buried in shallow, elongated trenches, and several trenches were also used as burn pits for combustible waste disposal.

ECODS B-3 and B-5 were sampled in 2001 and 2002 under the Site Evaluation (SE) program to determine the nature and extent of contamination in soils from construction waste. The analytical results for the soil media that are documented in the SE Reports (WSRC, 2002 and WSRC, 2003) demonstrated that these ECODS contained metals, organic chemicals, pesticides, polychlorinated biphenyls (PCBs), and minor amounts of other contaminants, predominantly in the subsurface soils. Based on evaluations of other ECODS at SRS, friable asbestos was also thought to be present at ECODS B-3 and B-5. Therefore, ECODS B-3 and B-5 were subsequently transferred to Appendix C (RCRA/CERCLA Units) of the FFA for further evaluation.

Funding through the ARRA of 2009 supported acceleration of the original FFA milestone dates for this operable unit. In order to achieve the accelerated schedule, the USDOE performed a NTCR action at the ECODS B-3 and B-5 OU.

The *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 Operable Unit (OU) (U)* (SRNS, 2010a) identified the objectives of the removal action, evaluated the alternatives that addressed the potential threats from release of contaminants to the environment, and provided a vehicle for public comment per the National Oil and Hazardous Substances Contingency Plan (NCP), 40 Code of Federal Regulations 300.415.

Arsenic and pesticides (alpha-chlordane, gamma-chlordane, DDD [dichlorodiphenyldichloroethane], DDE [dichlorodiphenyldichloroethylene], DDT [dichlorodiphenyltrichloroethane], heptachlor and heptachlor epoxide) were identified as human health refined constituents of concern (RCOCs) in the surface soils at ECODS B-3 and B-5. RCOCs are those constituents that have been determined to require a removal action. In addition, the potential for exposure to asbestos that may have been buried was also identified as a problem that required a removal action response.

An evaluation for source materials that could potentially migrate to groundwater or are highly toxic, (i.e., identified as principal threat source material [PTSM]) was conducted.

No ecological risk, contaminant migration (CM) or PTSM RCOCs were identified for ECODS B-3 or B-5. The preferred removal action for the ECODS B-3 and B-5 OU was "Removal and Offsite Disposal" as documented in the RSER/EE/CA (SRNS, 2010a).

The Revision 1 RSER/EE/CA was submitted to the USEPA and SCDHEC on March 3, 2010. The RSER/EE/CA was made available for public review and comment from March 16, 2010 to April 14, 2010. The USDOE submitted the Action Memorandum and Responsiveness Summary (for comments received during the RSER/EE/CA public comment period) to the regulators on April 28, 2010, and they were issued to the public on May 6, 2010.

The removal action for this area included the excavation of approximately 5,620 m^3 (7,350 yd^3) from ECODS B-3 and 918 m^3 (1,200 yd^3) from ECODS B-5 of construction debris and impacted soil to a depth of 3.7 m (12 feet [ft]). The excavations extended to a minimum of 0.6 m (2 ft) beyond the waste (both horizontally and vertically) in each area. Primarily cafeteria waste was identified in the excavated media at both ECODS. All excavated material was transported to the Three Rivers Landfill, which is approved for off-site disposal of CERCLA waste.

Upon completion of the excavation activities, confirmation sampling of the remaining soil in each trench was conducted per the *Sampling and Analysis Plan for Removal Confirmation at ECODS B-3 and B-5 (U)* (SRNS, 2010b). The confirmation sampling results indicated satisfactory completion of the removal action, and the affected area was subsequently backfilled (to a depth of approximately 3.7 m [12 ft]) with clean fill material, contoured, graded, and stabilized for establishment of vegetative cover. The filled/contoured/graded area was then seeded for vegetative stabilization. An evaluation of the analytical results of the clean fill material indicated that it met the requirements for an unrestricted (residential) land use scenario.

The *Removal Action Report (RAR) for the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 Operable Unit (OU) (U)* (SRNS, 2011a) documents the USDOE performance of the NTCR action. The RAR concluded that implementation of

the selected alternative met the objectives of the removal action and was protective of human health and the environment in the short- and long-terms. Currently there are no surficial exposure issues at ECODS B-3 and B-5 and the potential for exposure to asbestos in the subsurface has been eliminated by virtue of the removal action. Furthermore, the NTCR action met residential cleanup goals and will not require any land use restrictions. SCDHEC approved the RAR document on June 8, 2011, and the USEPA approved it on June 16, 2011.

HWCTR Site History

The HWCTR facility is located on approximately 8,094 m^2 (2 acres [ac]) in the northwest quadrant of the SRS (Figure 1) in an area formally known as U Area. This area is now part of B Area (Figure 2), which is composed primarily of administrative, protective force operations, laboratory, and warehouse facilities. The HWCTR facility is located approximately 4.8 km (3 mi) from the nearest SRS property boundary and about 4.5 km (2.5 mi) from any major nuclear materials production facilities on the site.

The HWCTR was a pressurized heavy water reactor designed to test candidate fuel designs for heavy water power reactors. The test reactor was not a defense-related facility like the five production reactors at the SRS. The HWCTR facility operated from March 1962 until December 1964 when operations were terminated and the facility was placed in a standby condition, including the removal of fuel and heavy water. The radiation levels in most accessible areas of the HWCTR containment building were low (i.e., less than 1 millirem per hour) and the residual radioactivity and contamination from operation and maintenance of the reactor and its associated components remained inside the containment building. In 2009, the total amount of radioactivity (activated metal and concrete) estimated in the facility was approximately 2,100 curies. More than 99 percent of the radioactivity in the HWCTR was associated with activated metal in the internal structure of the reactor vessel and associated steam generators. In addition, the facility also contained hazardous substances such as lead, asbestos, and PCBs associated with the existing equipment or previous operations (e.g., lights, piping, paints, etc.).

The USDOE determined that a NTCR action was warranted to decommission the HWCTR to address the potential threat of contaminant releases which could impact both human health and the environment. The purpose of the removal action was to protect future industrial workers from exposure to radionuclides and hazardous constituents in the reactor vessel, steam generators and associated equipment in the HWCTR facility and to prevent potential migration of radionuclides and hazardous constituents from the HWCTR so they would not contribute contamination to the groundwater above maximum contaminant levels (MCLs).

The *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the Heavy Water Components Test Reactor (HWCTR) (770-U) (U)* (SRNS, 2010c) selected the NTCR action for HWCTR to be "In Situ Decommissioning with Reactor Vessel and Steam Generator Removal." The USEPA and SCDHEC received the Revision 1 RSER/EE/CA on February 5, 2010, and it was made available for public review and comment from February 8, 2010, to March 10, 2010. The USDOE submitted the Action Memorandum and Responsiveness Summary (for comments received during the RSER/EE/CA public comment period) to the regulators on March 18, 2010, and they were issued to the public on March 31, 2010.

The *Removal Action Report (RAR) for the Heavy Water Components Test Reactor (770-U) (U)* (SRNS, 2011b) describes the details of the NTCR action. Under this selected removal action, the reactor vessel, steam generators, steel containment dome, and all above-grade components of the facility, with the exception of the transfer coffin refueling machine, were removed and disposed of at appropriate disposal facilities. The majority of the waste generated (approximately 465 m^3 [16,430 ft^3]) was low level radioactive waste that was dispositioned to the E-Area Low-Level Waste Facility (Slit Trench Disposal Units) and included pump cooling motors, piping and conduit, the polar crane, trolley, crane bridge, reactor shield ring, equipment cabinets, the reactor vessel top drive platform, and the containment dome. The reactor vessel (approximately 57 m^3 [2,000 ft^3]), steam generators (approximately 51 m^3 [1,800 ft^3]) and PCB Bulk Product Waste (approximately 390 m^3 [13,770 ft^3]) were also dispositioned to the E-Area slit

trench disposal units as low level CERCLA waste. Mixed waste in the form of oil (approximately 50 gallons), lead shielding and brass valves (approximately 57 m^3 [2,000 ft^3]), were staged at the Mixed Waste Storage Facility (645-1N) at SRS until final disposition at a permanent treatment, storage or disposal (TSD) facility. In addition, approximately 40 ft^3 of universal waste (a category of waste materials designated as hazardous waste, but containing materials that are very common, e.g., fluorescent lights) was brought to the Construction Shop Building (725-1N) at SRS until final disposition at a permanent TSD facility. Nonhazardous solid waste was disposed of at the C&D Landfill (approximately 64 m^3 [92,270 ft^3]) and Three Rivers Landfill (approximately 18 m^3 [650 ft^3]). Following removal of these components, the transfer coffin refueling machine was placed in the reactor vessel void space and the below-grade portions of the facility were sealed in place with a grout material to form a stabilized structure. The area was then covered with concrete at the ground surface to prevent infiltration and eliminate direct exposure to contaminants left in place for future industrial workers.

In addition, four groundwater monitoring wells were installed at HWCTR in 2009 to confirm that there was no impact to groundwater from historical releases and to provide a future monitoring network if needed (i.e., if potential sources were not stabilized or removed). The 2009-2010 sampling results acknowledged that there was no historical impact to groundwater from HWCTR operations or a former underground storage tank location.

The RAR concluded that implementation of the selected alternative met the objectives of the removal action and was protective of human health and the environment in the short- and long-terms. Removal of the reactor vessel and steam generators provided the additional benefit of reducing the residual activity at the HWCTR by approximately 99 percent and consolidating the highly radioactive materials in a facility designed and operated for their long-term management. Furthermore, grouting below grade and covering portions of the facility at-grade removed pathways for industrial worker exposure to remaining contaminants while requiring minimal surveillance and maintenance costs and reducing any future risk of contaminant migration to groundwater.

SCDHEC approved the RAR document on January 31, 2012, and the USEPA approved it on January 23, 2012. A site model of the HWCTR facility after implementation of the NTCR action is provided in Figure 3.

Signs were installed, ongoing surveillance and maintenance activities were initiated, and land use controls (LUCs) were implemented as part of the removal action. The area subject to these activities is shown on Figure 4.

The HWCTR facility is in an area designated for industrial use and is primarily used as an administrative area. Future industrial land use will be controlled in accordance with the SRS Land Use Control Assurance Plan (LUCAP) (WSRC, 2011a). Because residual contamination remains at HWCTR, LUCs will be part of the final remedy to ensure protection against unrestricted uses (e.g., residential). All of the residual contamination is limited to the below-grade portions of the facility that were sealed in place with grout material to form the stabilized structure; there is no evidence that contaminants have migrated in the past or will migrate in the future from the facility to the surrounding soil or groundwater media.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA (42 United States Code Sections 9613 and 9617). These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternative for addressing the BAOU soils and groundwater. The Administrative Record File must be established at or near the facility at issue.

The SRS FFA Community Involvement Plan (WSRC, 2011b) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-

79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the B-Area Operable Unit (U)* (SRNS, 2012), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the BAOU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the following locations:

US Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina – Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

The RCRA Administrative Record File for SCDHEC is available for review by the public at the following locations:

The South Carolina Department of
Health and Environmental Control
Bureau of Land and Waste Management
8911 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

The South Carolina Department of Health and
Environmental Control – Region 5
Aiken Environmental Quality Control Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 641-7670

The public was notified of the public comment period through mailings of the *SRS Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia, and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspaper. The public comment period was also announced on local radio stations.

The Statement of Basis / Proposed Plan (SB/PP) 45-day public comment period began on September 17, 2012 and ended on November 1, 2012. A Responsiveness Summary, prepared to address any comments received during the public comment period, is provided in Appendix A of this Record of Decision (ROD). No comments were received

during the public comment period. A Responsiveness Summary will also be available in the final RCRA permit.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT

Due to the complexity and size of multiple waste units in different areas, the SRS is divided into watersheds for the purpose of managing a comprehensive cleanup strategy. The SRS is segregated into six watersheds: Upper Three Runs, Lower Three Runs, Fourmile Branch, Steel Creek, Pen Branch, and the Savannah River. In addition, the SRS also identifies six Integrator Operable Units (IOUs) which are the surface water bodies and associated wetlands that correspond to the six respective watersheds. Waste units within a watershed may be evaluated and remediated individually or grouped with other waste units and evaluated as part of a larger Area OU. Upon disposition of all the waste units within a watershed, a final comprehensive ROD for the corresponding IOU (i.e., surface water and associated wetlands) will be pursued with additional public involvement. The BAOU is located within the Upper Three Runs watershed (Figure 1).

In 2003, a new completion strategy for environmental restoration at SRS was developed to accelerate cleanup completion. A key component of the plan is to implement an area-by-area remediation strategy. Through the sequencing of environmental restoration and decommissioning activities, environmental cleanup can be completed for entire areas of the SRS. The USDOE, USEPA, and SCDHEC convened and agreed that using the Area OU strategy to manage surface units at the BAOU was appropriate and the waste units and facilities in the area were consolidated to form a single Area OU.

The NTCR action at the ECODS B-3 and B-5 subunit met residential (unrestricted land use) cleanup goals. In its current state, the ECODS B-3 and B-5 subunit of the BAOU poses no risk to human health and the environment and warrants unrestricted land use.

The NTCR action at HWCTR eliminated or controlled all routes of exposure to residual below-grade radioactive and chemical contamination. It also minimized the potential of stabilized contaminants to migrate to groundwater. Although the residual contamination was stabilized in place, LUCs are necessary to control all future routes of exposure to

below-grade contamination. Groundwater monitoring is necessary to monitor for any future impact to groundwater.

V. OPERABLE UNIT CHARACTERISTICS

This section presents the conceptual site model (CSM), provides an overview of the characterization activities, and presents the characterization results and constituents of concern (COCs).

Conceptual Site Model for the BAOU

The CSM is an objective framework for assessing data pertinent to the investigation. The CSM identifies and evaluates suspected sources of contamination, contaminant release mechanisms, potentially affected media (secondary sources of contamination), potential exposure pathways, and potential human and ecological receptors.

The following is a brief summary of the potentially complete exposure pathways that were evaluated in the respective RSER/EE/CA documents (prior to NTCR actions).

ECODS B-3 and B-5

ECODS B-3 and B-5 are in an area currently designated for industrial use. No current or projected future development of ECODS B-3 and B-5 is planned. In order to support risk management decision making, both unrestricted (i.e., residential) and industrial land use scenarios were evaluated. The primary exposure pathway for evaluation relative to the future resident and future industrial worker is exposure to surface (0- to 0.3-m [0- to 1-ft]) soil via the incidental ingestion, dermal contact, inhalation of windblown dust, and inhalation of volatile constituents pathways. All-depths soil offers a potential exposure pathway for a future industrial worker under an excavation scenario. This pathway was considered in the PTSM analysis for all soil depths. Leaching of contaminants from the contaminated media to groundwater constitutes a secondary contaminant release mechanism. The potential of contaminants to leach from soil to groundwater was evaluated in the CM analysis.

HWCTR

The streamlined risk evaluation assumed that external exposure to radionuclides present at the facility was the primary exposure path/risk driver. Although the facility contained hazardous materials such as lead, mercury, asbestos and PCBs, the risk posed by these substances was considered negligible compared to the risks posed by the radionuclides. Therefore, a total cumulative risk calculation that considered both radionuclides and hazardous substances was not presented in the streamlined evaluation. It was assumed that any risks posed by the nonradiological constituents would be addressed by the NTCR action. In addition, the potential of radioactive and hazardous substances within the facility leaching to groundwater was also evaluated in the CM analysis.

Media Assessment

ECODS B-3 and B-5

In March 2001, composite soil sampling was performed at 16 locations within or near ECODS B-3. A total of 52 samples were collected by hand auger at depths of 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft). Additional samples were collected at depths of 2.4 to 3.0 m (8 to 10 ft) (0.6 m [2 ft] below the estimated depth of the ECODS B-3 trench). During sampling activities, field personnel noted various waste materials, including metal, glass, and rubber. There was also the potential for this subunit to contain buried friable asbestos. Construction waste was identified in some samples at 2.9 m (9.5 ft) and 3.0 m (10 ft) below grade. However, no additional soil confirmation samples were collected below the waste. All samples were analyzed for USEPA Target Analyte List (TAL) inorganics, and Target Compound List (TCL) organics, pesticides, and PCBs. Based on field characterization methods, ground penetrating radar (GPR), and sampling results, the areal extent of ECODS B-3 was thought to be 1,270 m^2 (13,680 ft^2). The construction waste was encountered in ECODS B-3 down to a depth of 3.0 m (10 ft). Accordingly, the estimated volume of construction waste/impacted soil present at ECODS B-3 was thought to be 4,648 m^3 (164,160 ft^3).

In March 2002, composite soil sampling was performed at 22 locations within ECODS B-5. A total of 72 samples were collected by hand auger at depths of 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft). Additional samples were collected at depths of 2.7 to 3.3 m (9 to 11 ft) (0.6 m [2 ft] below the depth indicated by the GPR survey of the trench). During sampling activities, field personnel noted various waste materials, including metal, glass, and rubber in the samples. There was also the potential for this subunit to contain buried friable asbestos. Based on field characterization methods, GPR, and sampling results, the areal extent of ECODS B-5 was thought to be 115 m^2 (1,242 ft^2). Construction waste was encountered in ECODS B-5 to a depth of 2.7 m (9 ft). Accordingly, the estimated volume of construction waste/impacted soil present in ECODS B-5 was thought to be 387 m^3 (13,662 ft^3).

The uncertainty regarding a historical release of contaminants to groundwater at ECODS B-3 and B-5 was managed by using cone penetration testing equipment and collecting groundwater samples. In January 2010, groundwater samples were collected both up-gradient and down-gradient of ECODS B-3 and B-5 at four locations.

HWCTR

The identification of contaminants at the HWCTR facility was derived from radiological characterization activities that were conducted in 1975, 1994 and 1996, visual inspections of the facility, and an in-depth study of the facility drawings and historical records associated with the operational period. The radiation levels in the most accessible areas of the HWCTR containment building were low (i.e., less than 1 millirem per hour), and the residual radioactivity and contamination from operation and maintenance of the reactor and its associated components remained inside the containment building.

In 2009, the total amount of radioactivity remaining in the facility was estimated to be approximately 2,100 curies. More than 99 percent of the radioactivity in the HWCTR was associated with activated metal in the internal structure of the reactor vessel and associated steam generators. Radioactivity was also present in the concrete biological shield surrounding the reactor vessel. The predominate radionuclides present in the

reactor vessel were nickel-63 and cobalt-60. Because there were no direct measurements of the radionuclide activities or concentrations available for the HWCTR reactor vessel, the values listed in the RSER/EE/CA (SRNS, 2010c) were based on an estimate of the reactor vessel curie inventory for nickel-63, cobalt-60, and iron-55. This estimate was prepared using neutron-absorption modeling benchmarked to a measured dose rate outside the thermal shield. Then, using data from the 105-P reactor vessel investigation, a scaling factor was developed based on the nickel-63 ratio and was applied to estimate the relative concentrations of the HWCTR activation products.

The radioactivity in the remainder of the HWCTR building (not including the reactor vessel) was estimated using the data obtained during characterization efforts in the 1990s and documented in various reports. The values presented in the RSER/EE/CA represent actual HWCTR sample data for 9 radionuclides and estimated concentrations for 13 others. The estimated concentrations were developed by multiplying their nuclide-specific index factors by the maximum detected concentration of cesium-137. The index factors included fission yield ratios and decay corrections to 1996.

The facility also contained hazardous substances materials such as lead, mercury, asbestos, and PCBs associated with the existing equipment of previous operations (e.g., lights, piping, paints, etc.). The PCBs in paint are immobile because they are embedded within surface paints; however, there is potential for these constituents to become mobile over time (estimated 10^7 years) as the paints degrade or as a result of water infiltration.

Based on available information at the project initiation, no contaminants were known or expected to have migrated from the facility to the surrounding environment. This result was based on the results of soil samples taken at the conclusion of previous facility deactivation and decontamination actions, including the removal of the steam muffler, which showed no detectable radioactivity above background in the soil.

In the summer of 2009, four groundwater monitoring wells were installed at the HWCTR to assess potential groundwater impacts (Figure 5). Groundwater from these wells was collected in 2009 and the first quarter of 2010.

Media Assessment Results

A PTSM evaluation, human health risk assessment (HHRA), contaminant migration analysis, and an evaluation of the groundwater media were performed for the ECODS B-3 and B-5 subunit and the former HWCTR facility prior to initiation of the NTCR actions. A formal ecological risk assessment was not conducted at either subunit because it was acknowledged that the removal action would ultimately address any potential risks to wildlife receptors. The results are summarized below for each subunit (SRNS, 2010a and SRNS, 2010c).

ECODS B-3 and B-5

Based on the 2001-2002 soil sampling results, no PTSM RCOCs were identified for ECODS B-3 and ECODS B-5.

At ECODs B-3, pesticides (alpha-chlordane, gamma-chlordane, DDD, DDE, DDT, heptachlor, and heptachlor epoxide) were identified as HH RCOCs for both the future resident scenario (risk = 1.1E-04) and the future industrial worker scenario (risk = 3.0E-05) in the 0- to 0.3-m (0- to 1-ft) surface soil interval.

At ECODS B-5, arsenic was identified as a HH RCOC for both the future resident scenario (risk = 4.9E-05) and the future industrial worker scenario (risk = 1.2E-05) in the 0- to 0.3-m (0- to 1-ft) surface soil interval.

The CM analysis concluded that no constituents were predicted to migrate to groundwater at concentrations above drinking water standards within 1,000 years. Therefore, no CM RCOCs were identified for ECODS B-3 and B-5.

The uncertainty regarding a historical release of contaminants to groundwater at ECODS B-3 and B-5 was managed by evaluating groundwater samples that were collected in January 2010 using cone penetration testing equipment. The samples indicated elevated concentrations of naturally occurring radionuclides. These radionuclides are believed to have been concentrated during the concretion formation process (i.e., formed by the

precipitation of mineral cement within the spaces between the sediment grains) within the Upland Unit and are not OU related. The groundwater samples did not detect any constituents identified as RCOCs at ECODS B-3 and B-5. This confirmed the CM modeling conclusions that the ECODS B-3 and B-5 constituents were not prone to migration to the water table.

As detailed in Section II, the removal action successfully addressed both the surficial exposure issues as well as the potential for exposure to buried waste in the subsurface. A generic CSM after completion of the NTCR action at ECODS B-3 and B-5 is shown in Figure 6.

HWCTR

For the HWCTR Reactor Vessel, radionuclides [americium-241, americium-242m (+D), americium-243 (+D), argon-39, bismuth-210m, carbon-14, cesium-137 (+D), chlorine-36, cobalt-60, curium-243, europium-152, europium-154, molybdenum-93, nickel-59, nickel-63, niobium-94, potassium-40, silver-108m, strontium-90 (+D), and tin-121m] in activated metal were identified as HH RCOCs for an industrial worker scenario with a total cumulative risk of 1.6E+02. Of these, americium-243 (+D), cesium-137 (+D), cobalt-60, nickel-63, niobium-94, and silver-108m had risk estimates greater than 1E-03 and were also identified as PTSM RCOCs.

For the HWCTR Facility Structure/Components, americium-241, barium-133, cesium-137 (+D), cobalt 60, europium-152, europium-154, plutonium-239/240, strontium-90 (+D) and uranium-238 (+D) were identified as HH RCOCs for an industrial worker scenario with a total cumulative risk of 5.6E-01. Of these, barium-133, cesium-137 (+D), cobalt-60, europium-152, and europium-154 had risk estimates greater than 1E-03 and were also identified as PTSM RCOCs.

Based on the CSM for the HWCTR, there was uncertainty about the potential for precipitation to infiltrate the above-grade portion of the facility over time and carry residual contamination into the floor drain system or through potential future cracks in

the building subfloor over time. In order to assess the long-term performance of the removal alternatives and the expected protection of groundwater of each, the potential for contaminant migration was analyzed. The results showed that the only radionuclide predicted to contaminate groundwater at a level exceeding its MCL was iodine-129. The results of this analysis indicated that if no action were taken at the HWCTR facility, there was a potential for radionuclides within the building structure and reactor vessel, specifically iodine-129, to migrate to groundwater at levels exceeding MCLs. Modeling also showed that lead, primarily in the form of stable lead shielding and stainless steel encapsulated lead, could impact groundwater above the MCL in 100,000 years.

Four groundwater monitoring wells were installed at HWCTR in 2009 to confirm that there was no impact to groundwater from historical releases and to provide a monitoring network if potential sources were not stabilized or removed (Figure 5). The 2009-2010 sampling results acknowledged that there was no historical impact to groundwater from HWCTR operations or the former underground storage tank location, and specifically, iodine-129 was not detected. As previously discussed in Section II, the NTCR action involved extraction of major equipment, including the reactor vessel and steam generators, removal of the above grade structures, grouting of below grade spaces, and placement of a concrete cover to prevent infiltration. The removal action eliminated the potential for future impacts to groundwater by the implementation of a removal and stabilization remedy.

A generic CSM after completion of the NTCR action at HWCTR is shown in Figure 6.

Site Specific Factors

No site-specific factors requiring special consideration that might affect the remedial action for the BAOU are present at the site.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

According to the Savannah River Site Future Use Project Report (USDOE, 1996a), residential uses of SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC, 2011a) designates B Area for industrial use and is primarily used as an administrative area. The future land use is reasonably anticipated to remain industrial with DOE maintaining control of the land.

Groundwater Uses/Surface Water Uses

There is no anticipated current or projected future use of groundwater as a drinking water source.

VII. SUMMARY OF OPERABLE UNIT RISKS

ECODS B-3 and B-5

Prior to implementation of the NTCR action, contaminants in the soil (arsenic and seven pesticides) and construction waste (potential exposure to buried asbestos) posed a threat to human health and the environment. Upon completion of the removal action, both the soil remaining after excavation and the material used to fill the void and bring the site to surface grade met the requirements for a residential (unrestricted) land use scenario. Currently, there are no surficial exposure issues at the ECODS B-3 and B-5 subunit and the potential for exposure to asbestos in the subsurface has been eliminated by virtue of the removal action. The cleanup goals for a residential scenario have been attained and the objectives of the removal action have been met.

HWCTR

Prior to the removal action, approximately 2,100 curies of radioactivity (activated metal and concrete) remained in the HWCTR facility, which exceeded the industrial worker risk threshold (risk >1E-06) and PTSM levels (risk >1E-03) should exposure occur. More than 99 percent of the radioactivity in the HWCTR facility was associated with

activated metal in the internal structure of the reactor vessel and associated steam generators. It is estimated that following deactivation activities and removal of the above grade structure, the reactor vessel and the steam generators, approximately 21 curies remain in the below grade structure. The primary radionuclides contributing to the estimated 21 curies remaining in the below grade structure are mostly fission products (e.g., strontium-90, cesium-137) and transuranics (e.g., plutonium-239, plutonium-241, americium-241). This residual contamination is present in the primary heat transfer loops that lead to the steam generators from the reactor vessel, in fixed contamination in the spent fuel basin, and within cracks and crevices in the concrete floors (USDOE, 1996b). In addition, the facility also contained hazardous materials such as lead, asbestos, and PCBs associated with existing equipment or previous operations (e.g., lights, piping, paints, etc.). The estimated mass of PCBs contained in paint and cables remaining in HWCTR is approximately 45 kg (100 pounds [lb]). All of the residual contamination is limited to the below-grade portions of the facility that were sealed in place with grout material to form the stabilized structure; there is no evidence that contaminants have migrated in the past or will migrate in the future from the facility to the surrounding soil or groundwater media. Following the NTCR action, grouting below grade and covering portions of the facility at-grade removed pathways for industrial worker exposure to remaining contaminants while reducing any future risk of contaminant migration to groundwater.

Summary of Human Health Risk Assessment

ECODS B-3 and B-5

There are no human health risks to current or future receptors following the NTCR action. The ECODS B-3 and B-5 is suitable for unrestricted use (i.e., residential).

HWCTR

The NTCR action of grouting below-grade and covering portions of the facility at-grade eliminated the pathways for industrial worker exposure to remaining contamination. The

HWCTR facility is in an area designated for industrial land use; LUCs will be part of any final action to ensure protection against unrestricted uses (i.e., residential).

Summary of Ecological Risk Assessment

There are no ecological risks to any wildlife receptors following the NTCR actions at either the ECODS B-3 and B-5 subunit or the former HWCTR facility.

Summary of Contaminant Fate and Transport Analysis

ECODS B-3 and B-5

There are no contaminant migration to groundwater risks following the NTCR action at ECODS B-3 and B-5.

HWCTR

The fate and transport modeling indicates that there are no contaminant migration to groundwater risks following the NTCR action at the HWCTR facility.

Conclusions

ECODS B-3 and B-5

There are no human health, ecological, or contaminant migration risks following the NTCR action at the ECODS B-3 and B-5 subunit. This BAOU subunit is suitable for unrestricted use.

HWCTR

The NTCR action successfully eliminated the potential for industrial worker exposure and minimized the potential to impact groundwater, but some residual contamination is still present in the below grade portions of the facility. This condition requires a remedial action.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

Remedial Action Objectives

Remedial action objectives (RAOs) are media- or OU-specific objectives for protecting human health and the environment. RAOs usually specify potential receptors and exposure pathways, and are identified during project scoping once the conceptual site model is understood. RAOs describe what the remediation must accomplish and are used as a framework for developing remedial alternatives. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure.

ECODS B-3 and B-5

There is no current or potential threat to public health, welfare, or the environment from the ECODS B-3 and B-5 subunit, and there are no applicable or relevant and appropriate requirements (ARARs). Therefore, no RAOs are required and no remedial goals are established for ECODS B-3 and B-5.

HWCTR

The future land use of the BAOU is assumed to be industrial land use with USDOE maintaining control of the land. The following RAOs have been identified for the former HWCTR facility to support the future land use:

- Eliminate or control all routes of exposure to residual below grade radioactive or chemical contamination posing human health risks exceeding 1E-06 in media or structures associated with the HWCTR facility.

- Prevent the potential migration of residual radionuclides and chemical constituents remaining below grade so that they will not contribute contamination to groundwater above MCLs.

Remedial Goals

Remedial goals (RGs) can be qualitative statements or numerical values often expressed as concentrations in soil and groundwater, or actions (installation of engineered barriers, placement of caps and covers, etc.) that achieve the RAO. These cleanup goals are either concentration levels that correspond to a specific risk or hazard or are based on ARARs. Final RGs will be monitored to determine when the remedial action is complete.

The removal goals identified in the removal action decision documents (SRNS, 2010a and SRNS, 2010c) have been achieved by virtue of performing the NTCR actions at the ECODS B-3 and B-5 subunit and the former HWCTR facility. The post-removal RARs (SRNS, 2011a and SRNS, 2011b) document attainment of these goals. Therefore, concentration-based RGs have not been developed for the final remedial action.

Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended by the Superfund Amendments Reauthorization Act (SARA), requires that remedial actions for cleanup of hazardous substances must comply with requirements and standards set forth under federal and state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs). ARARs include only federal or state environmental or facility laws and regulations and do not include occupational safety or worker protection requirements. SARA requires that the remedial action for a site meet all ARARs unless a waiver is invoked.

ARARs consist of two sets of requirements: those that are applicable, and those that are relevant and appropriate. Applicable requirements are those substantive standards that specifically address the situation at a CERCLA site and are promulgated under federal or state environmental laws. If a requirement is not applicable, it may still be relevant and appropriate. "Applicability" is a legal and jurisdictional determination, while the determination of "relevant and appropriate" relies on professional judgment, considering environmental and technical factors at the site. A requirement may be "relevant", in that it covers situations similar to that at the site, but may not be "appropriate" to apply for

various reasons and, therefore, not well suited to the site. In some situations, only portions of a requirement or regulation may be judged relevant and appropriate; if a requirement is applicable, however, all substantive parts must be followed. In addition, to ARARs, many federal and state environmental and public health programs include criteria, guidance, and proposed standards that are not legally binding but provide useful approaches or recommendations. Such information is required to-be-considered when RGs are developed.

ARARs for the NTCR actions were previously identified in the respective RSER/EE/CA documents (SRNS, 2010a and SRNS, 2010c). ARARs were re-evaluated for the preferred remedial action for BAOU. Because no remedial action is needed for ECODS B-3 and B-5, no ARARs are presented for this subunit. A summary of the potential ARARs for the selected remedial alternative for the HWCTR subunit is presented in Table 1.

IX. DESCRIPTION OF ALTERNATIVES

This section presents and summarizes the remedial alternatives for the BAOU. Under CERCLA, it is desirable, when practical, to offer a range of alternatives to compare during the detailed analysis to arrive at the most effective cost-efficient remedial action. The range of alternatives may include options that 1) immobilize chemicals, 2) reduce the contaminant volume, or 3) reduce the need for long-term, onsite management. For the subunits that comprise the BAOU, alternatives were previously evaluated in the removal action decision documents (SRNS, 2010a and SRNS, 2010c) and a Focused Feasibility Study (USDOE, 2012). No further evaluation of alternatives is needed for the ECODS B-3 and B-5 subunit. For the final action at the HWCTR subunit, the following three remedial alternatives were evaluated.

Alternative BAOU-1: No Further Action

The No Further Action (following the NTCR action) alternative does not restrict access, limit exposure, or reduce contaminant toxicity, mobility or volume. This alternative

would leave the BAOU in its current condition with no additional LUCs. This alternative does not include five-year remedy reviews.

The detailed present value cost estimate is provided in Table 2. A summary of the costs for this alternative is provided below:

Capital:	*$0*
Operation and Maintenance (O&M) Costs:	*$0*
Total Present-Worth Cost:	*$0*

Alternative BAOU-2: Land Use Controls

Under this alternative, LUCs (i.e., engineering controls [ECs] and institutional controls [ICs]) would be implemented. ECs (e.g., physical barriers and signs) and ICs (e.g., excavation permit restrictions and deed restrictions) would be used to restrict access or activities that can be performed. As part of the NTCR action, a concrete cover was installed at the ground surface, access control signs were installed, and surveillance and maintenance activities were initiated. LUCs implemented as part of the removal action would be continued as a final action for the BAOU. The area subject to these activities is shown in Figure 4.

The surveillance and monitoring activities will include an annual inspection to verify the following: 1) that the area is accessible for authorized maintenance and inspections; 2) that the warning signs (4 total) are in acceptable condition, have the correct information, and are legible from a distance of 7.6 m (25 ft); 3) that excessive deterioration of the concrete cover has not occurred and the cover is free of vegetation, and; 4) that there are no unauthorized excavations, digging, or construction activities within the HWCTR boundaries. Maintenance activities will be performed on an as-needed basis pending the results of these inspections. This alternative includes five-year remedy reviews.

The detailed present value cost estimate for this alternative is provided in Table 2. A summary of the costs is provided below:

Capital:	*$0*
O&M Costs:	*$1,784,129*
Total Present-Worth Cost:	*$1,784,129*

Alternative BAOU-3: Land Use Controls and Groundwater Monitoring

Under this alternative, the LUCs that are described previously in Alternative BAOU-2 apply. Although groundwater is not part of the BAOU, periodic groundwater monitoring will be implemented for four wells at the HWCTR facility subunit to confirm that there is no future impact to groundwater should an unacceptable degradation of the stabilization materials (i.e., in-situ grout and surface concrete cover) occur. Groundwater monitoring for the HWCTR facility adds another layer of protection in addition to LUCs and is consistent with other in-situ remedies performed at the SRS.

The groundwater monitoring will consist of sampling the uppermost aquifer at HWCTR using the existing network of four wells (Figure 5). The wells will be sampled for gross radionuclide parameters (i.e., gross alpha and nonvolatile beta), iodine-129, tritium, lead, and PCBs (i.e., Aroclor 1254 and Aroclor 1260). Groundwater samples will be collected every five years to support the five-year remedy reviews for the HWCTR facility end state.

The detailed present value cost estimate for this alternative is provided in Table 2. A summary of the costs is provided below:

Capital:	*$0*
O&M Costs:	*$1,808,843*
Total Present-Worth Cost:	*$1,808,843*

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

According to USEPA guidance, if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements are not triggered. If the requirements are not triggered, there is no need to evaluate other cleanup alternatives or to evaluate the No Further Action alternative against the nine remedy

selection criteria under CERCLA. These nine criteria are used as a basis for selecting cleanup remedies that are protective of human health and the environment, implementable, cost-effective, and acceptable to the state regulatory agency.

No further evaluation of alternatives is needed for the ECODS B-3 and B-5 subunit. The proposed No Further Action alternative will be the final action for the ECODS B-3 and B-5 OU. This alternative will provide protection to human health and the environment at the ECODS B-3 and B-5 subunit of the BAOU.

For the final remedial action at the HWCTR subunit, the potential remedial alternatives have been evaluated against the threshold and primary balancing criteria. The nine evaluation criteria are described in Table 3. Provided below is a summary of the comparison of the alternatives for the HWCTR subunit against the CERCLA evaluation criteria. Key advantages and disadvantages for each alternative relative to one another and in relation to the two threshold criteria and five primary balancing criteria are discussed below and summarized in Table 4.

Overall Protection of Human Health and the Environment

Alternative BAOU-1 is not protective of human health since no controls are in place to prevent potential exposure to contaminated media or structures. Alternatives BAOU-2 and BAOU-3 are protective of human health (industrial workers and residents) by preventing potential exposure to contaminated structures and media through LUCs (i.e., ECs and ICs). Alternative BAOU-3 provides additional assurance regarding the protection of the groundwater by inclusion of a monitoring program.

Compliance with ARARs

ARARs are associated with the selected action at HWCTR (Table 1). Chemical and action-specific ARARs identified in the NTCR action were met during the removal. The only chemical-specific ARAR applicable to the final remedial alternative evaluation for the HWCTR subunit is for the groundwater monitoring component. The chemical specific-ARAR is not met for Alternatives BAOU-1 or BAOU-2 because groundwater

monitoring is not a component of either alternative. Alternative BAOU-3 includes groundwater monitoring to ensure that the HWCTR NTCR action is effective in preventing migration of residual radionuclides and chemical constituents above MCLs.

Short-Term Effectiveness

The remedial alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts to workers, potential environmental impacts and the time until protection is achieved. Alternative BAOU-1 does not provide short-term effectiveness since there are no controls in place to prevent potential exposure to contaminated structures and media. Alternatives BAOU-2 and BAOU-3 achieve RAOs in a short period of time with essentially no risk to workers and the public.

Long-Term Effectiveness and Permanence

The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation. Alternative BAOU-1 does not provide long-term effectiveness and permanence since there are no controls in place to prevent the potential exposure to contaminated structures and media. Alternatives BAOU-2 and BAOU-3 are protective and provide long-term effectiveness and permanence as long as LUCs are maintained. Alternative BAOU-3 provides additional assurance regarding the protection of the groundwater by inclusion of a monitoring program.

Reduction of Toxicity, Mobility, or Volume through Treatment

None of the remedial alternatives provide reduction of toxicity, mobility, or volume through active treatment. These objectives were addressed at the ECODS B-3 and B-5 subunit and the HWCTR facility subunit by the implementation of the NTCR actions.

Implementability

The remedial alternatives are assessed by considering the difficulty of implementing the alternative, including technical feasibility, constructability, reliability of technology, ease of undertaking remedial actions (if required), monitoring considerations, administrative feasibility (regulatory requirements), and availability of services and materials. All three alternatives are easily implementable.

Cost

Alternative BAOU-1 is the least expensive ($0) as compared to Alternatives BAOU-2 ($1,784,129) and BAOU-3 ($1,808,843). Detailed cost analyses are provided in Table 2. Five year remedy reviews are provided for Alternatives BAOU-2 and BAOU-3. Groundwater monitoring for 100 years is included in Alternative BAOU-3.

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

ECODS B-3 and B-5

The No Further Action alternative is the preferred alternative for the ECODS B-3 and B-5 subunit of the BAOU. There is no waste to treat, no institutional or engineering controls are required, and there are no ARARs after completion of the NTCR action. Because there are no problems warranting action at the ECODS B-3 and B-5, no remedial action will be taken. The ECODS B-3 and B-5 subunit poses no risk to human health and the environment and supports unrestricted land use.

No capital and/or operation and maintenance costs will be involved for the No Further Action alternative.

HWCTR

The preferred remedial action for the HWCTR portion of the BAOU is Alternative BAOU-3: LUCs with Groundwater Monitoring. The NTCR action reduced the human

health risk by eliminating the human exposure pathway and minimized the potential of contaminants to migrate to groundwater. This alternative implements LUCs as part of the remedial action and also provides additional assurance regarding the protection of the groundwater by inclusion of a monitoring program.

Alternative BAOU-3 will achieve the following LUC objectives:

- Maintain the integrity of ECs which provide an exposure barrier (including in-situ grouting and concrete cover);
- Maintain the integrity of the groundwater monitoring well system;
- Restrict or prohibit groundwater use as determined to be necessary based on monitoring results;
- Restrict access by posting and maintaining warning signs and enforcing SRS security procedures;
- Prohibit the development and use of property for any use other than industrial; no residential use, school use, child care facilities or recreational use shall be allowed.

The LUC objectives will be accomplished through:

- Implementation of a detailed Land Use Control Implementation Plan (LUCIP) for providing annual inspections of ECs, maintenance of engineering and access controls (i.e., concrete cover, warning signs), and institutional controls limiting land and groundwater use, as necessary;
- Administrative controls to ensure worker safety including the Site Use/Site Clearance Program, worker training on use restrictions and health and safety requirements;
- Implementation of access controls limiting exposure to trespassers as described in the 2000 RCRA Part B Permit Renewal Application, Volume 1, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

The area subject to LUCs is shown in Figure 4; LUCs for the BAOU are presented in Table 5.

In the long term, if the property, or any portion thereof, is ever transferred from USDOE, the U.S. Government and/or USDOE will take those actions necessary pursuant to Section 120(h)(1) of CERCLA. Those actions will include in any contract, deed, or other transfer document, notice of the type and quantity of any hazardous substances that were known to have been stored (for more than one year), released, or disposed of on the property. The notice will also include the time at which the storage, release, or disposal took place to the extent such information is available.

In addition, if the property, or any portion thereof, is ever transferred by deed, the U.S. Government will also satisfy the requirements of CERCLA 120(h)(3). The requirements include: a description of the remedial action taken, a covenant, and an access clause. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The LUCs will be implemented through the following:

- The contract, deed, or other transfer document shall also include restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the LUCs will be done through an amended ROD with USEPA and SCDHEC review and approval.

- In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the OU will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

In the event of a property lease or interagency agreement, the equivalent restrictions will be implemented as required by CERCLA Section 120(h).

The selected remedy for the BAOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a LUCAP to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the *SRS Federal Facility Agreement*. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The LUCs shall be maintained until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. Approval by EPA and SCDHEC is required for any modification or termination of the OU specific LUCs.

USDOE has recommended that residential use of SRS land be controlled; therefore, future residential use and potential residential water usage will be restricted to ensure long-term protectiveness. LUCs will restrict the BAOU to future industrial use and will prohibit residential use of the unit. Unauthorized excavation will also be prohibited and the waste unit will remain undisturbed. LUCs selected as part of this action will be maintained for as long as they are necessary and termination of any LUCs will be subject to CERCLA requirements for documenting changes in remedial actions.

Cost Estimate for the Selected Remedy

A detailed, activity-based breakdown of the estimated costs associated with implementing and maintaining the selected remedy is presented in Table 2. A summary of the costs is provided below:

Capital:	*$0*
O&M Costs:	*$1,808,843*
Total Present-Worth Cost:	*$1,808,843*

The information in the cost estimate table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record File, an Explanation of Significant Difference (ESD), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

Estimated Outcomes of Selected Remedy

LUCs will be maintained for protection of human health and the environment at the former HWCTR facility by maintaining the integrity of ECs which provide an exposure barrier (including in-situ grouting and concrete cover), restricting land disturbance activities, and by restricting land use to industrial use only. The use of the groundwater will also be restricted as determined to be necessary based on monitoring results.

The selected remedy for the HWCTR portion of the BAOU meets the RAOs through the following means:

- Eliminating or controlling all routes of exposure to residual below grade radioactive or chemical contamination posing human health risks exceeding 1E-06 in media or structures associated with the HWCTR facility.

- Preventing the potential migration of residual radionuclides and chemical constituents remaining below grade so that they will not contribute contamination to groundwater above MCLs.

Waste Disposal and Transport

Because LUCs with Groundwater Monitoring is the selected remedy, groundwater sampling wastes will be managed in accordance with the *SRS Investigation-Derived Waste Management Plan* (WSRC, 2007).

XII. STATUTORY DETERMINATIONS

Regulatory decisions were made on both of the BAOU subunits as documented in the Action Memoranda for each of the NTCR actions. Following successful completion of the NTCR action at the ECODs B-3 and B-5 subunit, no residual hazardous substances remain that pose a threat to human health and the environment, and the selected remedy is No Further Action. After successful completion of the NTCR action at HWCTR, residual hazardous and radioactive substances still remain in the below grade portions of the facility that pose a potential threat to human health and the environment. Therefore, Alternative BAOU-3: Land Use Controls with Groundwater Monitoring has been selected for the HWCTR subunit. As part of the selected remedy, the future land use of the former HWCTR facility will be industrial.

In accordance with Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(c), a statutory review will be conducted within 5 years of initiation of the remedial action, and every 5 years thereafter, to ensure that the remedy continues to be protective of human health and the environment.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action (unless justified by a waiver), and is cost-effective. The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy

because it does not reduce the toxicity, mobility, or volume of material comprising principal threats through treatment.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy selected in this ROD does not contain any significant changes from the preferred alternative presented in the SB/PP.

XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary is included as Appendix A of this document.. No comments were received during the public comment period.

XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

An implementation schedule showing the ROD submittal date, post-ROD document submittals, and remedial action start date is provided in Figure 7. A Groundwater Monitoring Plan will be included in the Corrective Measures Implementation / Remedial Action Completion Report.

This page intentionally left blank.

XVI. REFERENCES

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2010a. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 Operable Unit (OU) (U),* Revision 1, SRNS-RP-2009-01443, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2010b. *Sampling and Analysis Plan for Removal Confirmation at ECODS B-3 and B-5 (U),* SGCP-SAP-2010-00002, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2010c. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the Heavy Water Components Test Reactor (HWCTR) (U),* SRNS-RP-2009-01102, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Removal Action Report (RAR) for the Early Construction and Operational Disposal Site (ECODS) B-3 and B-5 Operable Unit (OU) (U),* Revision 1, SRNS-RP-2011-00210, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2011b. *Removal Action Report (RAR) for the Heavy Water Components Test Reactor (770-U) (U), SRNS-RP-2011-01213*, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Statement of Basis/Proposed Plan for the B-Area Operable Unit (U),* Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken SC

USDOE, 1996a. *SRS Future Use Project Report, Stakeholder Preferred Recommendations for SRS Land Use Facilities*, United States Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 1996b. *Analysis of Removal Alternatives for the Heavy Water Components Test Reactor at the Savannah River Site*, United States Department of Energy, Savannah River Site, Aiken, SC

USDOE, 2012. *Submittal of Focused Feasibility Study Memorandum for the B-Area Operable Unit*, ACP-12-179, dated August 9, 2012, United States Department of Energy, Savannah River Operations Office, Aiken, SC

WSRC, 2002. *Site Evaluation Report for the Early Construction and Operational Disposal Site (ECODS) B-3 (NBN) (U)*, WSRC-RP-2001-4274, Revision 0, Westinghouse Savannah River Company, Aiken, SC

WSRC, 2003. *Site Evaluation Report for the Early Construction and Operational Disposal Site (ECODS) B-5 (NBN) (U),* WSRC-RP-2003-4012, Revision 0, Westinghouse Savannah River Company, Aiken, SC

WSRC, 2007. *Savannah River Site Investigation-Derived Waste Management Plan*, WSRC-RP-94-1227, Revision 9, Washington Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2011a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, August 1999, updated October 2011, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2011b. *Savannah River Site Federal Facility Agreement Community Involvement Plan (U),* Revision 7, WSRC-RP-96-120, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

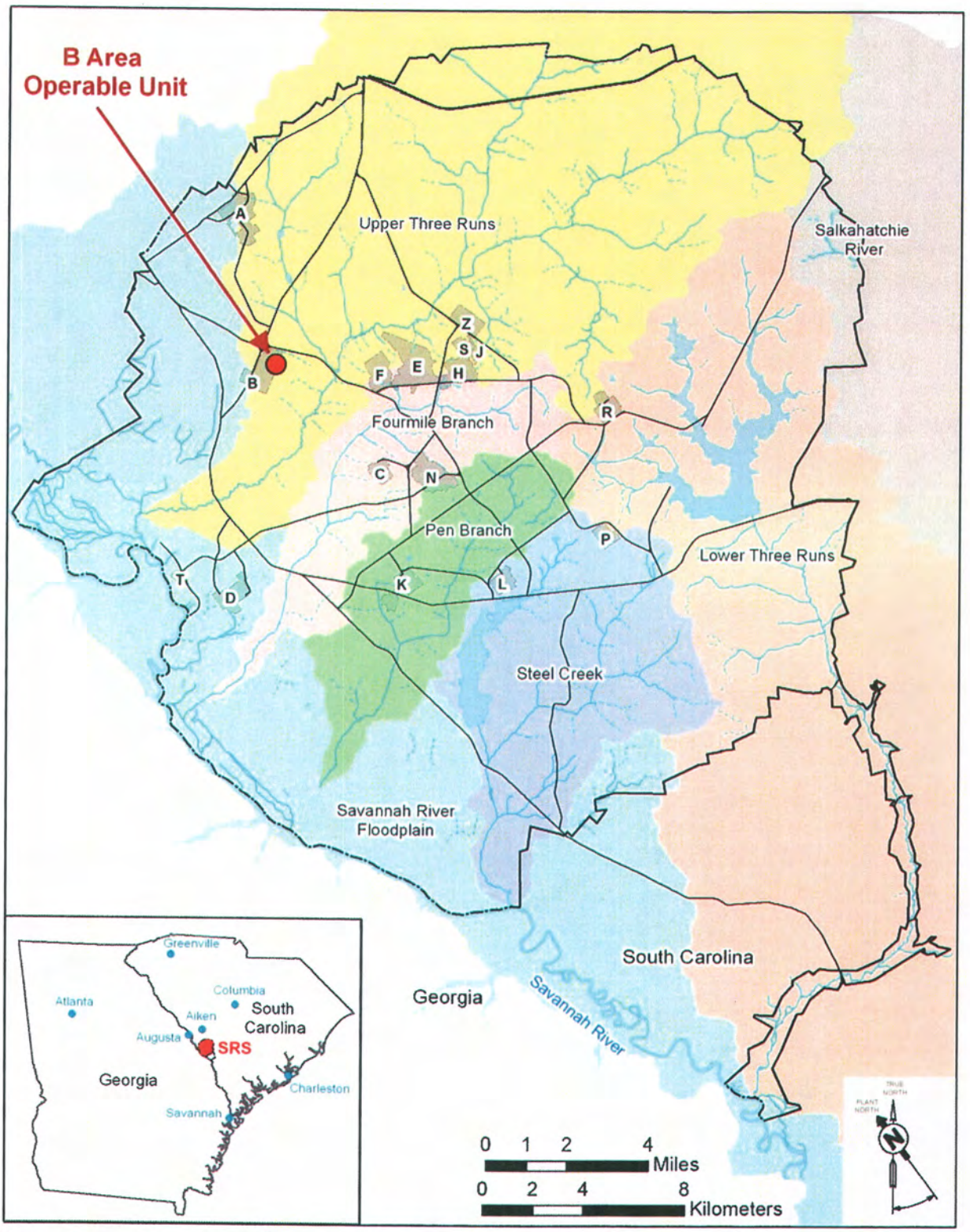
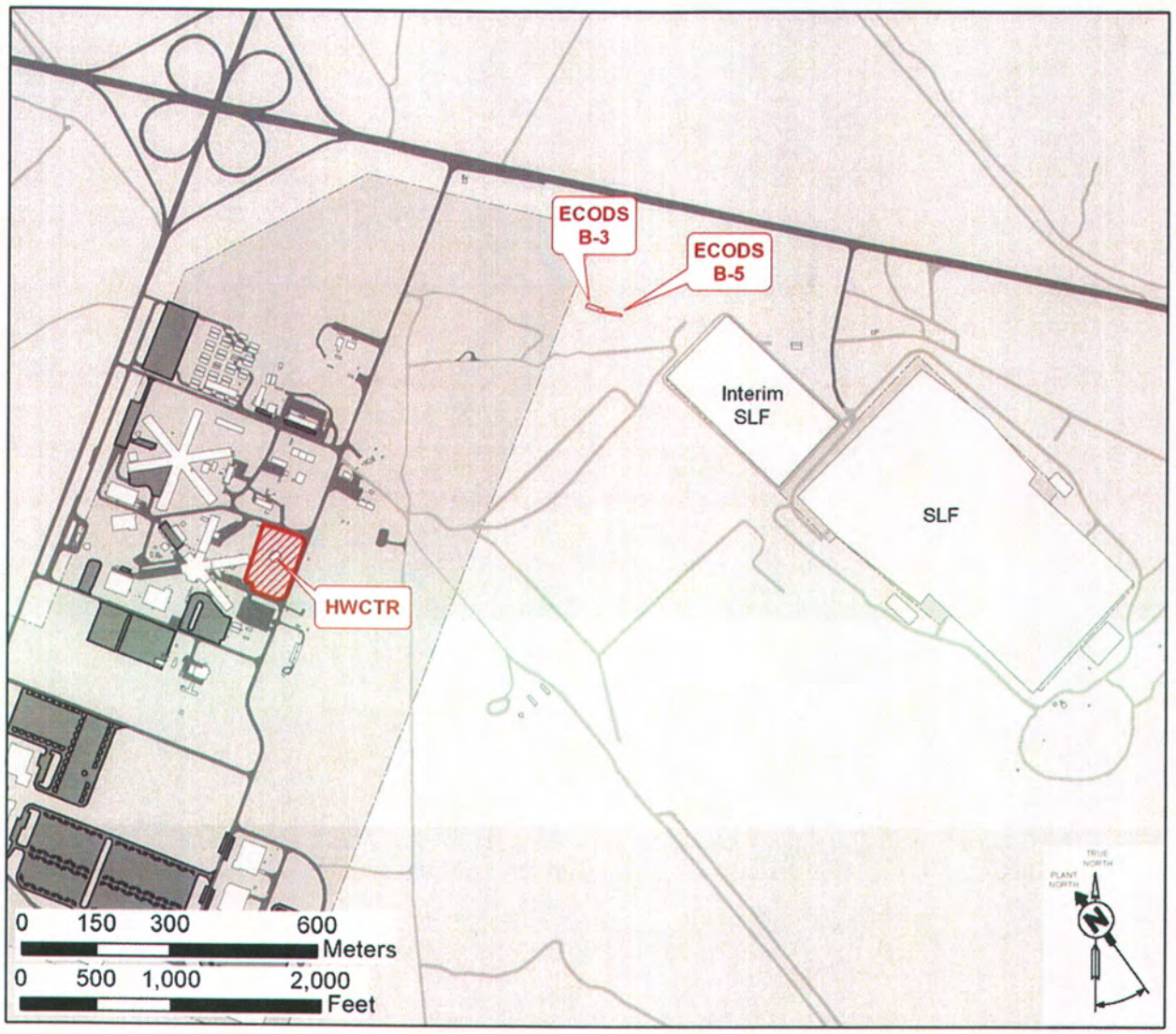


Figure 1. Location of the BAOU within the Savannah River Site and the Upper Three Runs Watershed



SLF = Sanitary Landfill

Figure 2. Layout of the BAOU

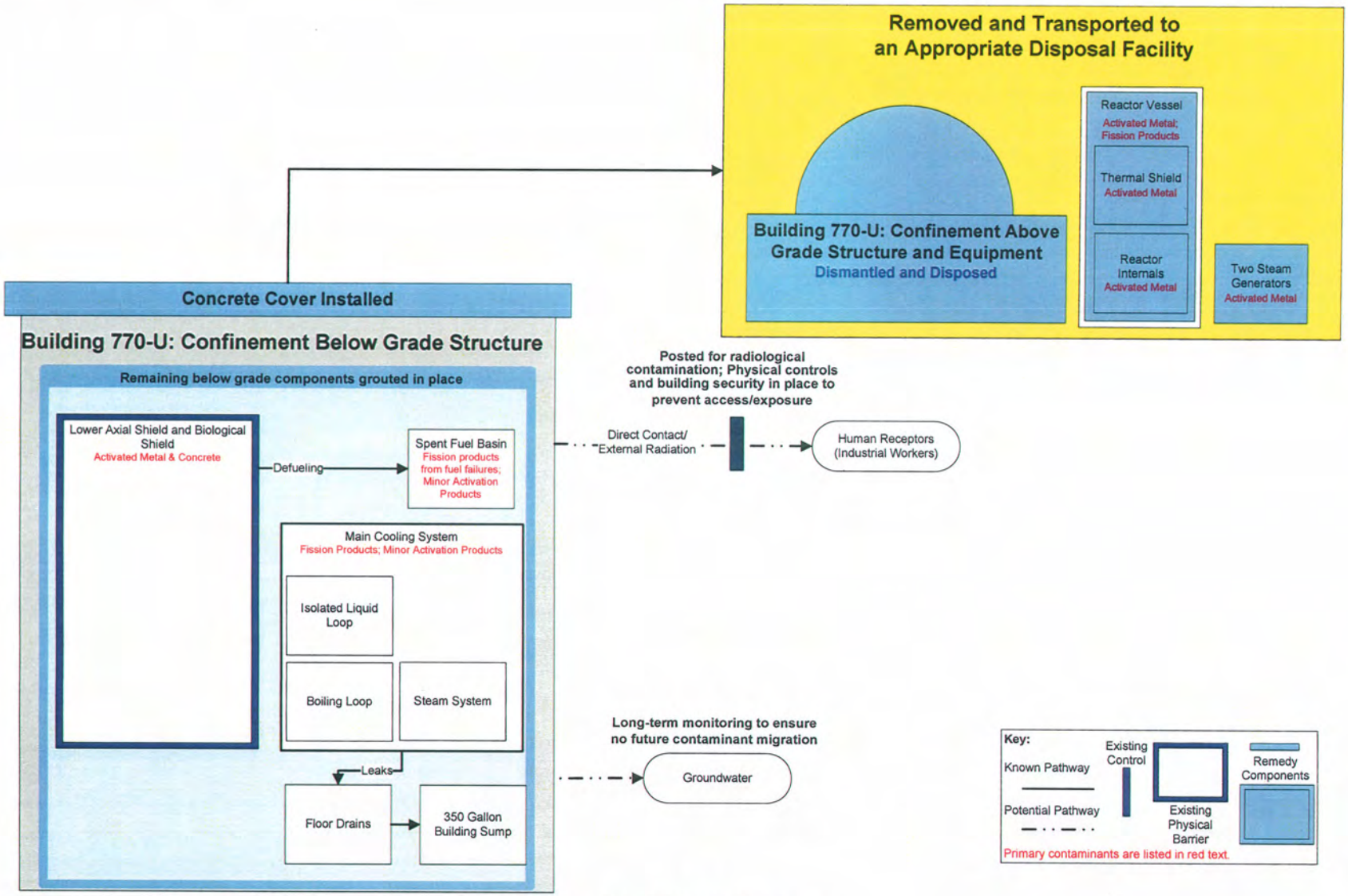


Figure 3. HWCTR Site Model After Completion of the NTCR Action

This page intentionally left blank.

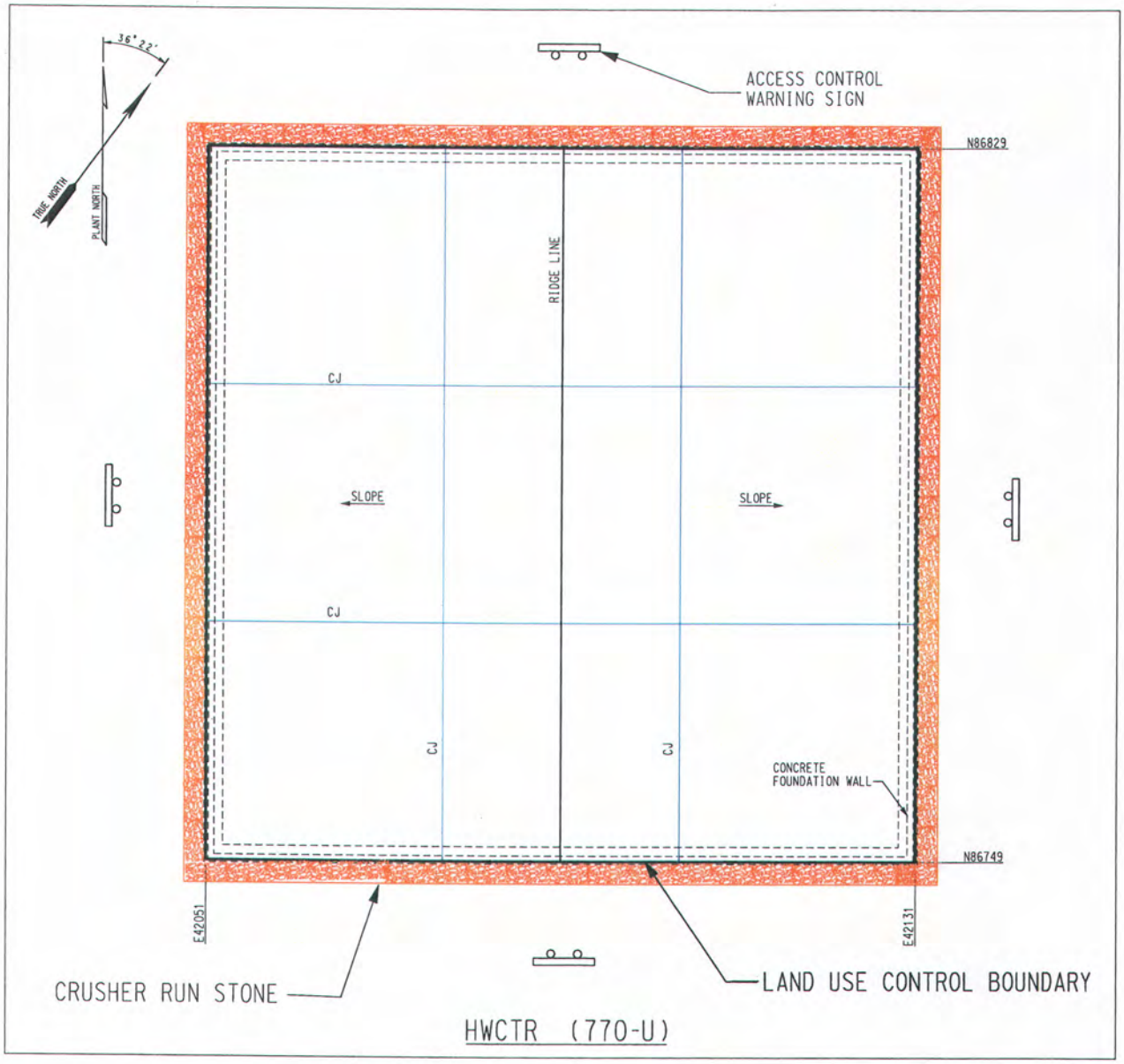


Figure 4. HWCTR Land Use Control Boundary

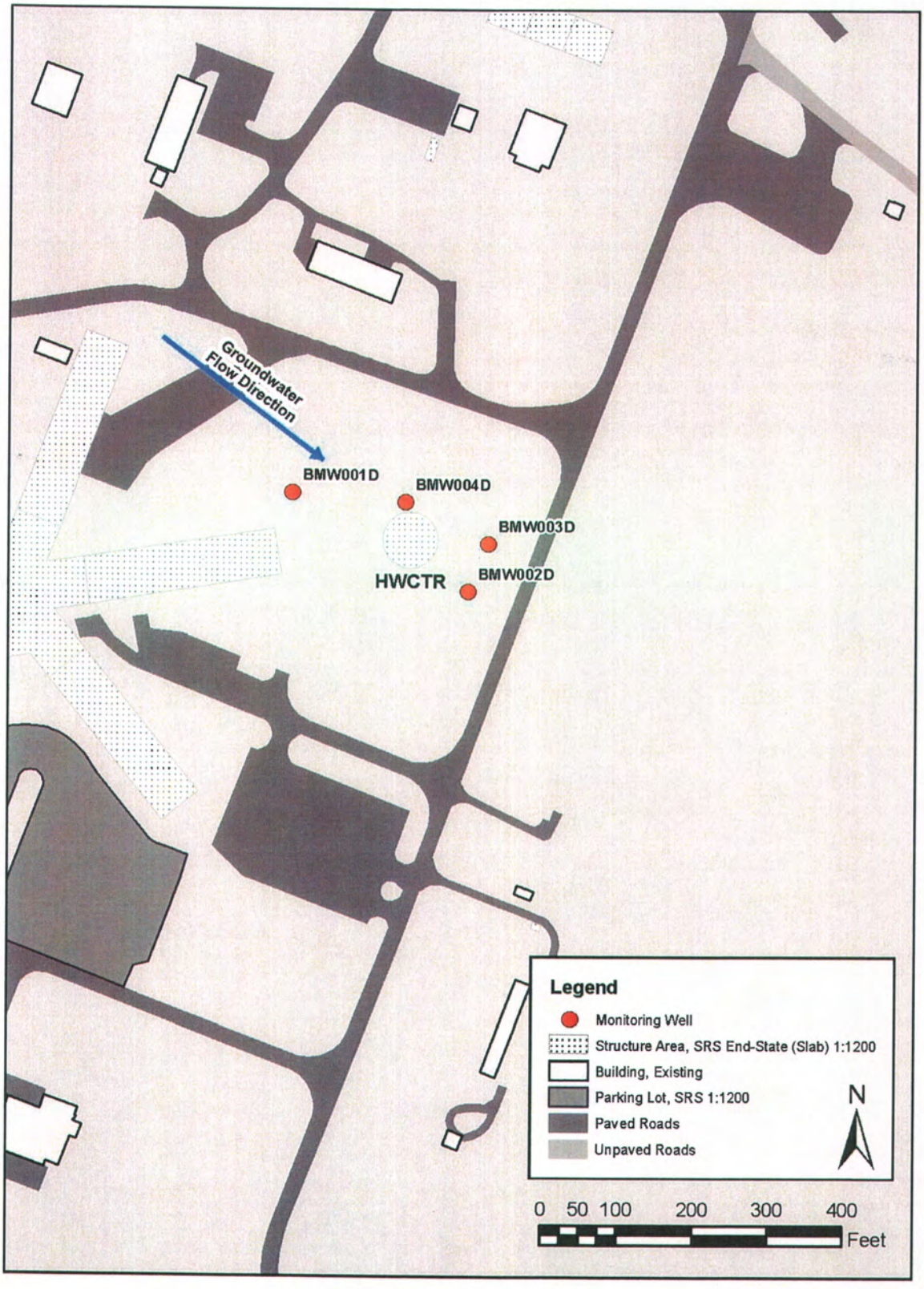
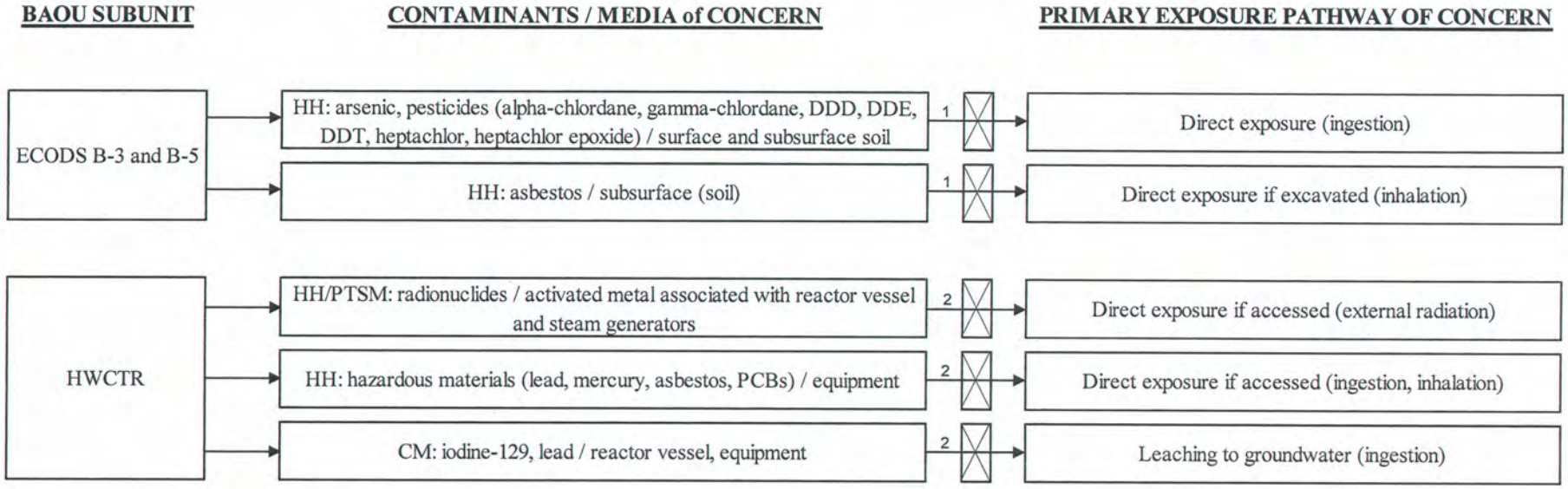


Figure 5. Location of Groundwater Monitoring Wells at HWCTR



HH = human health
PTSM = principal threat source material
CM = contaminant migration

1 - NTCR action was "Removal and Offsite Disposal" of all construction debris and impacted soil. Currently there are no surficial exposure issues and the potential for exposure to metals, pesticides, and asbestos in the subsurface was eliminated by successful completion of the removal action. The NTCR action met residential cleanup goals and does not require any land use restrictions. The *RAR for the ECODS B-3 and B-5* (SRNS 2011a) documents USDOE performance of the NTCR action.

2 - NTCR action was "In Situ Decommissioning with Reactor Vessel and Steam Generator Removal." Because residual contamination remains in the below-grade portion of the former facility, it will require land use controls to maintain the integrity of the engineering controls which provide an exposure barrier (including in-situ grouting and concrete cover) and prevent unrestricted land use. The *RAR for the HWCTR* (SRNS 2011b) documents USDOE performance of the NTCR action.

Figure 6. Generic Conceptual Site Model After Completion of NTCR Actions

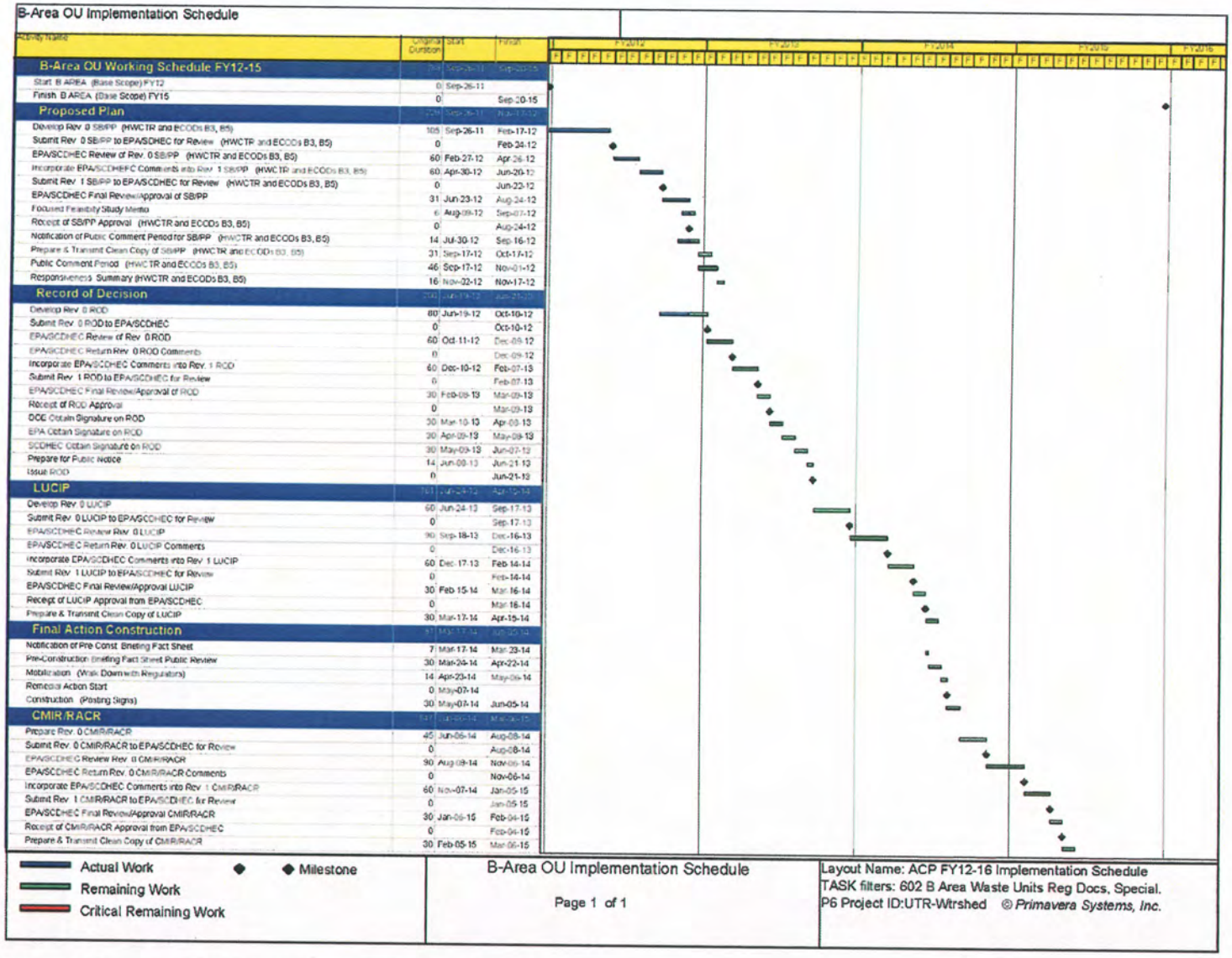


Figure 7. BAOU Implementation Schedule

Table 1. Potential ARARs for the Selected Remedial Alternative for the HWCTR Subunit of the BAOU

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Chemical Specific			
National Primary Drinking Water Regulations 40 CFR 141 SC R. 61-58 State Primary Drinking Water Regulations SC R. 61-68 Water Classification and Standards	Applicable	Establishes requirements and standards for chemicals and radionuclides to protect human health from the potential effects of drinking-water contamination.	The state of South Carolina classifies all groundwater as potential sources of drinking water, and mandates that groundwater must meet maximum contaminant levels (MCLs).

CFR = Code of Federal Regulations

Table 2. Summary of the Present Value Costs of the Alternatives for the BAOU

Alternative BAOU-1
No Further Action
B Area Operable Unit
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
No Action					
Subtotal - Direct Capital Cost				$0	*
Mobilization/Demobilization	10%	of subtotal direct capital		$0	*
Site Preparation/Site Restoration	10%	of subtotal direct capital		$0	*
Total Direct Capital Cost		(sum of * items)		**$0**	
Indirect Capital Costs					
Engineering & Design	15%	of direct capital		$0	
Project/Construction Management	25%	of direct capital		$0	
Health & Safety	5%	of direct capital		$0	
Overhead	30%	of direct capital + indirect capital		$0	
Contingency	20%	of direct capital + indirect capital		$0	
Total Indirect Capital Cost				**$0**	
Total Estimated Capital Cost				**$0**	
Direct O&M Costs	2.7%	discount rate for costs > 30 years duration			
Annual Costs (Existing System during Post-ROD Design & Const)	100	year O&M period		*Years 2015 - 2115*	
Subtotal - Annual Costs				$0	
Present Worth Annual Costs				$0	
Five Year Costs	0				
Remedy Review	0	ea	$15,000	$0	
Subtotal - Five Year O&M Costs				$0	
Present Worth Five Year Costs				$0	
Total Present Worth Direct O&M Cost				**$0**	
Indirect O&M Costs					
Project/Admin Management	40%	of direct O&M		$0	
Health & Safety	10%	of direct O&M		$0	
Overhead	30%	of direct O&M + indirect O&M		$0	
Contingency	15%	of direct O&M + indirect O&M		$0	
Total Present Worth Indirect O&M Cost				**$0**	
Total Estimated Present Worth O&M Cost				**$0**	
TOTAL ESTIMATED COST				**$0**	

There are no O&M or 5-year review costs for the No Action alternative, as per EPA-540-R-98-031 guidance.

Table 2. Summary of the Present Value Costs of the Alternatives for the BAOU *(Continued)*

Alternative BAOU-2
Land Use Controls
B Area Operable Unit
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
None				
Covered as part of the NTCR Action for HWCTR.				
Subtotal - Direct Capital Cost				$0 *
Mobilization/Demobilization	15%	of subtotal direct capital		$0 *
Site Preparation/Site Restoration	15%	of subtotal direct capital		$0 *
Total Direct Capital Cost	(sum of * items)			**$0**
Indirect Capital Costs				
Engineering & Design	14%	of direct capital		$0
Project/Construction Management	25%	of direct capital		$0
Health & Safety	6%	of direct capital		$0
Overhead	30%	of direct capital + indirect capital		$0
Contingency	20%	of direct capital + indirect capital		$0
Total Indirect Capital Cost				**$0**
Total Estimated Capital Cost				**$0**
Direct O&M Costs	2.7%	discount rate for costs > 30 years duration[1]		
Annual Costs (Existing System during Post-ROD Design & Const)	0	years O&M		*Years 2014 - 2015*
Access Controls	1	ea	$500	$500
Subtotal - Annual Costs				$500
Present Worth Annual Costs (0.9% Discount Rate)				$0
Annual Costs (Institutional Controls)	100	years O&M		*Years 2015 - 2115*
Access Controls	1	ea	$500	$500
Annual Inspections / Maintenance	1	ea	$5,000	$5,000
Subtotal - Annual Costs				$5,500
Present Worth Annual Costs (2.7% Discount Rate)				$189,515
Five Year Costs	20			
Remedy Review	1	ea	$15,000	$15,000
Subtotal - Five Year O&M Costs				$15,000
Present Worth Five Year Costs				$97,938
Ten Year Costs	10			
Ten Year Major Repairs	1	ea	$15,000	$15,000
Subtotal - Ten Year O&M Costs				$15,000
Present Worth Ten Year Costs				$45,712
Total Present Worth Direct O&M Cost				**$333,165**
Indirect O&M Costs				
Project/Admin Management	234%	of direct O&M		$780,273
Health & Safety	24%	of direct O&M		$79,960
Overhead	30%	of direct O&M + indirect O&M		$358,019
Contingency	15%	of direct O&M + indirect O&M		$232,713
Total Present Worth Indirect O&M Cost				**$1,450,964**
Total Estimated Present Worth O&M Cost				**$1,784,129**
TOTAL ESTIMATED COST				**$1,784,129**

1. Interest rate for costs with duration < 30 years (i.e., before 2043) based on SRNS's 25 August 2009 Technical Memorandum, ERTEC-2009-00004.

Table 2. Summary of the Present Value Costs of the Alternatives for the BAOU (*Continued/End*)

Alternative BAOU-3
Land Use Controls & Groundwater Monitoring
B Area Operable Unit
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
None				
Covered as part of the NTCR Action for HWCTR.				
Subtotal - Direct Capital Cost				$0 *
Mobilization/Demobilization	15%	of subtotal direct capital		$0 *
Site Preparation/Site Restoration	15%	of subtotal direct capital		$0 *
Total Direct Capital Cost		(sum of * items)		**$0**
Indirect Capital Costs				
Engineering & Design	14%	of direct capital		$0
Project/Construction Management	25%	of direct capital		$0
Health & Safety	6%	of direct capital		$0
Overhead	30%	of direct capital + indirect capital		$0
Contingency	20%	of direct capital + indirect capital		$0
Total Indirect Capital Cost				**$0**
Total Estimated Capital Cost				**$0**
Direct O&M Costs	2.7%	discount rate for costs > 30 years duration[1]		
Annual Costs (Existing System during Post-ROD Design & Const)	0	years O&M		*Years 2014 - 2015*
Access Controls	1	ea	$500	$500
Subtotal - Annual Costs				$500
Present Worth Annual Costs (0.9% Discount Rate)				$0
Annual Costs (Institutional Controls)	100	years O&M		*Years 2015 - 2115*
Access Controls	1	ea	$500	$500
Annual Inspections / Maintenance	1	ea	$5,000	$5,000
Subtotal - Annual Costs				$5,500
Present Worth Annual Costs (2.7% Discount Rate)				$189,515
Five Year Costs	20			
Groundwater Sampling & Analysis (4 Wells, Once Every 5 Years)	1	ea	$2,500	$2,500
Remedy Review	1	ea	$15,000	$15,000
Subtotal - Five Year O&M Costs				$17,500
Present Worth Five Year Costs				$114,261
Ten Year Costs	10			
Ten Year Major Repairs	1	ea	$15,000	$15,000
Subtotal - Ten Year O&M Costs				$15,000
Present Worth Ten Year Costs				$45,712
Total Present Worth Direct O&M Cost				**$349,488**
Indirect O&M Costs				
Project/Admin Management	223%	of direct O&M		$780,058
Health & Safety	23%	of direct O&M		$80,382
Overhead	30%	of direct O&M + indirect O&M		$362,978
Contingency	15%	of direct O&M + indirect O&M		$235,936
Total Present Worth Indirect O&M Cost				**$1,459,354**
Total Estimated Present Worth O&M Cost				**$1,808,843**
TOTAL ESTIMATED COST				**$1,808,843**

1. Interest rate for costs with duration < 30 years (i.e., before 2043) based on SRNS's 25 August 2009 Technical Memorandum, ERTEC-2009-00004.

Table 3. Description of CERCLA Evaluation Criteria

Threshold Criteria:
• *Overall Protectiveness of Human Health and the Environment* determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
• *Compliance with ARARs* evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site. ARARs may be waived under certain circumstances. ARARs are divided into chemical-specific, location-specific, and action-specific criteria.
Primary Balancing Criteria:
• *Long-Term Effectiveness and Permanence* considers the ability of an alternative to maintain protection of human health and the environment over time. It evaluates magnitude of residual risk and adequacy of reliability of controls.
• *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment* evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
• *Short-Term Effectiveness* considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
• *Implementability* considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
• *Cost* includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
Modifying Criteria:
• *State Support/Agency Acceptance* considers whether USEPA and SCDHEC agree with the analyses and recommendations by the USDOE. Approval of the Record of Decision constitutes approval of the selected alternatives by the regulatory agencies.
• *Community Acceptance* considers whether the local community agrees with the Preferred Alternative. Comments received on the Statement of Basis/Proposed Plan during the public comment period are an important indicator of community acceptance. Comments from the public are considered in the final remedy selection in the ROD.

Table 4. Comparison of Alternatives Against the CERCLA Evaluation Criteria

Criteria	Alternative BAOU-1 No Further Action	Alternative BAOU-2 Land Use Controls (only)	Alternative BAOU-3 Land Use Controls with Groundwater Monitoring
Overall protection of human health and the environment			
Protection of Human Health	Not protective.	Protective.	More protective with addition of groundwater monitoring.
Protection of the Environment	Not protective.	Protective.	Protective.
Compliance with ARARs			
Chemical-specific	Not applicable.	Not applicable.	Applicable. Provides additional assurance that groundwater classification and groundwater protection standards are maintained.
Action-specific	Not applicable.	Not applicable.	Not applicable.
Location-specific	Not applicable.	Not applicable.	Not applicable.
Long-term effectiveness and permanence			
Magnitude of Residual Risks	Not applicable. Risk remains unchanged.	Risks are reduced to acceptable levels by installation of a concrete cover and controlling exposure.	Risks are reduced to acceptable levels by installation of a concrete cover and control of exposure. Provides additional assurance that groundwater protection standards are maintained.
Adequacy of Controls	Not adequate.	Adequate.	Adequate.
Permanence	Not permanent.	Permanent as long as LUCs remain in place.	Permanent as long as LUCs remain in place.
Reduction of toxicity, mobility, or volume through treatment			
Treatment Process	No treatment.	No treatment.	No treatment.
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None.	None.	None.
Short-term effectiveness			
Risk to Remedial Workers	Not applicable; no remedial action involved.	None.	None.
Risk to Community	Not applicable; no remedial action involved.	None.	None.
Risk to Environment	Not applicable; no remedial action involved.	None.	None.
Estimated Time Frame to Achieve RAOs or RGs	RAO is not achieved.	Immediate.	Immediate.

Table 4. Comparison of Alternatives Against the CERCLA Evaluation Criteria *(Continued/End)*

Short-term effectiveness			
Risk to Remedial Workers	Not applicable; no remedial action involved.	None.	None.
Risk to Community	Not applicable; no remedial action involved.	None.	None.
Risk to Environment	Not applicable; no remedial action involved.	None.	None.
Estimated Time Frame to Achieve RAOs or RGs	RAO is not achieved.	Immediate.	Immediate.
Implementability			
Availability of materials, equipment, and skilled labor	No implementation.	Readily implemented.	Readily implemented.
Ability to construct and operate remedial technology	Not applicable.	Readily available. No specialized materials, equipment or labor required.	Readily available. No specialized materials, equipment or labor required.
Ability to obtain permits/approvals from Agencies	Not applicable.	Not applicable.	Readily implemented for groundwater wells.
Ease of undertaking additional actions	Not applicable.	Compatible.	Compatible.
Time to implement	Not applicable since no additional work is required.	Readily implementable.	Readily implementable.
Cost			
Total Present-Worth Costs	$0	$1,784,129	$1,808,843
State Support/Agency Acceptance	Not acceptable.	Not acceptable.	Both EPA and SCDHEC support the preferred remedy.
Community Acceptance	This criterion will be completed following public review.	This criterion will be completed following public review.	This criterion will be completed following public review.

Table 5. Land Use Controls for the BAOU

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas[a]
1. Property Record Notices[b]	Provide notice to anyone searching records about the existence and location of contaminated areas.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	BAOU area identified in this ROD where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
2. Property record restrictions[c]: A. Land Use B. Groundwater	Restrict use of property by imposing limitations. Prohibit the use of groundwater.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Drafted and implemented by USDOE upon any transfer of affected areas. Recorded by USDOE in accordance with state law at County Register of Deeds office.	BAOU area identified in this ROD where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
3. Other Notices[d]	Provide notice to city &/or county about the existence and location of waste disposal and residual contamination areas for zoning/planning purposes.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	BAOU area identified in this ROD where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
4. Site Use Program[e]	Provide notice to worker/developer (i.e., permit requestor) on extent of contamination and prohibit or limit excavation/penetration activity.	As long as property remains under USDOE control.	Implemented by USDOE and site contractors Initiated by permit request.	BAOU area identified in this ROD where hazardous substances are left in place at levels requiring land use and / or groundwater restrictions.
5. Physical Access Controls[f] (e.g., fences, gates, portals)	Control and restrict access to workers and the public to prevent unauthorized access.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Controls maintained by USDOE.	Security is provided at site boundaries in accordance with SRS procedures.

Table 5. Land Use Controls for the BAOU *(Continued/End)*

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas[a]
6. Warning Signs[g]	Provide notice or warning to prevent unauthorized uses.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Signage maintained by USDOE.	Warning signs have been posted in accordance with applicable site procedures and have been placed in appropriate areas at the BAOU.
7. Security Surveillance Measures	Control and monitor access by workers/public.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Established and maintained by USDOE. Necessity of patrols evaluated upon completion of remedial actions or property transfer.	Patrol of BAOU area identified in this ROD, as necessary.

[a]Affected areas – Specific locations identified in the OU-specific LUCIP or subsequent post-ROD documents.
[b]Property Record Notices – Refers to any non-enforceable, purely informational document recorded along with the original property acquisition records of USDOE and its predecessor agencies that alerts anyone searching property records to important information about residual contamination; waste disposal areas in the property.
[c]Property Record Restrictions – Includes conditions and/or covenants that restrict or prohibit certain uses of real property and are recorded along with original property acquisition records of USDOE and its predecessor agencies.
[d]Other Notices – Includes information on the location of waste disposal areas and residual contamination depicted on as survey plat, which is provided to a zoning authority (i.e., city planning commission) for consideration in appropriate zoning decisions for non-USDOE property.
[e]Site Use Program – Refers to the internal USDOE/USDOE contractor administrative program(s) that requires the permit requestor to obtain authorization, usually in the form of a permit, before beginning any excavation/penetration activity (e.g., well drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities/structures, or in the case contaminated soil or groundwater, will not disturb the affected areas without the appropriate precautions and safeguards.
[f]Physical Access Controls – Physical barriers or restrictions to entry.
[g]Signs – Posted command, warning or direction.

This page intentionally left blank.

APPENDIX A –

RESPONSIVENESS SUMMARY

This page intentionally left t blank.

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the B-Area Operable Unit began on September 17, 2012, and ended on November 1, 2012.

Public Comments

No comments were received during the public comment period.

This page intentionally left t blank.