United States Department of Energy

Savannah River Site

Early Action Record of Decision Remedial Alternative Selection for the C-Area Operable Unit (U)

CERCLIS Number: 79

SRNS-RP-2014-00836

Revision 1

May 2015

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

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Prepared for
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and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

EARLY ACTION RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

C-Area Operable Unit (U)

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Savannah River Site
Aiken, South Carolina

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Savannah River Nuclear Solutions, LLC
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Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE EARLY ACTION RECORD OF DECISION

Unit Name and Location

C-Area Operable Unit (CAOU)
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU - 79
Savannah River Site (SRS)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989
Aiken, South Carolina
United States Department of Energy (USDOE)

The CAOU 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 SRS.

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 (USDOE) that establishes the responsibilities and schedules for the comprehensive remediation of SRS. The media associated with this operable unit are soil, sediment, gravel, concrete, steel, and surface water. Groundwater is being addressed separately under the C-Area Groundwater Operable Unit (OU).

Statement of Basis and Purpose

This decision document presents the selected early action (EA) remedy for the CAOU, which is located at the SRS near Aiken, SC. The remedy was chosen in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act, 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 EA remedy.

Assessment of the Site

There has been a release of radionuclides (primarily cesium-137 and to a lesser extent strontium-90), polychlorinated biphenyls (Aroclor 1254, specifically), and polynuclear aromatic hydrocarbons (benzo(a)pyrene and benzo(b)fluoranthene, specifically) at portions of the CAOU into the environment. The early response action selected in this EA Record of Decision (EAROD) 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

An early remedial action is needed at portions of the CAOU because residual hazardous substances remain in place that may pose a threat to human health (HH). In order to prevent the potential exposure to the industrial worker and/or future resident to the contaminated or potentially contaminated media at CAOU, the preferred remedial alternative for the following CAOU subunits is Alternative 2 - Land Use Controls (LUCs), which was selected in order to prevent unrestricted land use:

- Building 717-C, Contaminated Maintenance Facility;
- C-Area Process Sewer Lines as Abandoned (including the Process Water Storage Tank [106-C], Cooling Water Effluent Sump [107-C], and Storage Basin [109-C]);
- C-Area Reactor Area Cask Car Railroad Tracks as Abandoned;
- Potential Release from C-Area Disassembly Basin (including the Pre-Manufactured Metal Shelter [710-C]);
- Potential Release from C-Area Reactor Cooling Water System (186/190-C);
- Early Construction and Operational Disposal Site C-1; and
- Outfall C-03.

In addition, there are two subunits not in the immediate vicinity of the C-Reactor Building (105-C) that do not pose a threat to HH and the environment and qualify for unrestricted land use. The EA remedial alternative for the following subunits is No Action:

- Building 904-89G, Retention Basin for 100-C Containment (including Containment Tank C803-7-1 [no building number]); and
- Outfall C-01.

Also, the following deactivation and decommissioning (D&D) facilities listed on FFA Appendix K.2 (D&D Facilities [or remnants] that Require No Further Evaluation) are located within C Area and are thus included in this decision document. However, these D&D facilities do not pose a threat to HH and the environment, and require no further action:

- Air Compressor Building (607-9C);
- Effluent Monitoring Building (614-2C); and
- Gatehouse Entrance at Building 105 (701-2C).

The following LUC objectives are necessary to ensure protectiveness of the selected remedy for the CAOU subunits where residual hazardous substances remain that pose a threat to HH:

- Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media (i.e., soil / gravel / concrete / steel).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

The RCRA permit will be revised to reflect selection of the final remedy using the procedures under 40 Code of Federal Regulation Part 270, and South Carolina Hazardous Waste Management Regulations R.61-79.264.101; 270.

Statutory Determinations

Based on the unit RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment report, portions of the CAOU pose a threat to HH and the environment. Therefore, Alternative 2 - LUCs has been selected as the EA remedy for the CAOU. As part of the selected EA remedy, the future land use for these portions of the CAOU 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 five years of initiation of the early remedial action, and every five years thereafter, to ensure that the remedy continues to be protective of HH and the environment.

The selected EA remedy is protective of HH and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The EA remedy in this OU does not satisfy the statutory preference for treatment as a principal element of the remedy since LUCs are not a form of 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 United States 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 Record of Decision 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 EA remedy for the CAOU 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 HH 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 EA Land Use Control Implementation Plan (EALUCIP) incorporated by reference into this EAROD 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 EAROD. The EALUCIP, 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 EALUCIP will be appended to the LUCAP and is considered incorporated by reference into the EAROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved EALUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The EALUCIP will remain in effect unless and until modifications are approved by the USEPA

and SCDHEC as needed to be protective of HH and the environment. EALUCIP modification will only occur through another CERCLA document.

Data Certification Checklist

This EAROD 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 BRA and EAROD (Section VI).
- Potential land 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).
- How source materials constituting principal threats are addressed (Section XI).

07.16.15
Date

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

7/23/15
Date

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

C-Area Operable Unit

CERCLIS Number: 79

SRNS-RP-2014-00836
Rev. 1

May 2015

Savannah River Site
Aiken, South Carolina

Prepared by:

Savannah River Nuclear Solutions, LLC
for the
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Savannah River Operations Office
Aiken, South Carolina

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
ARAR	applicable or relevant and appropriate requirement
ARF	Administrative Record File
bgs	below ground surface
BRA	Baseline Risk Assessment
CADC	C-Area Reactor Discharge Canal
CAGW	C-Area Groundwater
CAOU	C-Area Operable Unit
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CM	contaminant migration
CMS	Corrective Measures Study
CFR	Code of Federal Regulation
COC	constituent of concern
COPC	constituent of potential concern
CSM	conceptual site model
CWS	Cooling Water System
+D	plus daughters
D&D	deactivation and decommissioning
DPFR	Decommissioning Project Final Report
EA	early action
EASB/PP	Early Action Statement of Basis/Proposed Plan
EALUCIP	Early Action Land Use Control Implementation Plan
EAROD	Early Action Record of Decision
ECO	ecological
ECODS	Early Construction and Operational Disposal Site
EPC	exposure point concentration
ERA	ecological risk assessment
FFA	Federal Facility Agreement
FMB	Fourmile Branch
FS	Feasibility Study
ft, ft^2	foot, feet, square feet
gal	gallon
GPR	ground penetrating radar
HH	human health
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IOU	integrator operable unit
km, km^2	kilometer, square kilometer

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued)*

L	liter
LaBr	lanthanum bromide
LLC	Limited Liability Company
LUC	Land Use Control
LUCAP	Land Use Control Assurance Plan
m, m^2, m^3	meter, square meter, cubic meter
M	million
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mi, mi^2	mile, square mile
NBN	no building number
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect
NTCR	non-time critical removal
O&M	operations and maintenance
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PAOU	P-Area Operable Unit
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
ppm	part per million
PRG	preliminary remediation goal
PSA	potential source area
PSL	process sewer line
PTSM	principal threat source material
RAO	remedial action objective
RAOU	R-Area Operable Unit
RBC	reactor building complex
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
RSL	regional screening level
ROD	Record of Decision
SAP	Sampling Analysis Plan
SARA	Superfund Amendments Reauthorization Act
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SE	Site Evaluation

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued/End)*

SPRG	surface preliminary remediation goal
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TAL	Target Analyte List
TCL	Target Compound List
TCR	total cumulative risk
TPH	total petroleum hydrocarbon
UCL	upper confidence limit
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WSRC	Washington Savannah River Company, LLC
yd, yd^3	yard, cubic yard

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

Unit Name, Location, and Brief Description

C-Area Operable Unit (CAOU)
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU-79
Savannah River Site (SRS)
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989
Aiken, South Carolina
United States Department of Energy (USDOE)

SRS occupies approximately (~) 802.9 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 ~40.2-km (25-mi) southeast of Augusta, Georgia, and 32.1-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 CAOU as a Resource Conservation and Recovery Act (RCRA) Solid Waste Management Unit/CERCLA unit requiring further evaluation.

The CAOU 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 February 11, 2014. Module VIII of the Hazardous and Solid Waste Amendments 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. 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 CAOU is one of several operable units (OUs) identified at SRS. In 1955, C-Reactor began operations with a mission of producing nuclear materials for the defense program. SRS reactors were both low pressure and low temperature reactors with heavy water cooling of the core. C-Reactor was placed on cold standby in 1987, followed by shutdown due to reduced requirements for defense-related products. Reactor operations resulted in the generation of chemical and radioactive wastes. The C-Reactor is currently used as a storage site for tritiated-moderator water in tanks and for cask car refurbishment.

The CAOU is located in an area currently designated for industrial land use, and is expected to remain industrial in the future. The *Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes* (SRNS 2009) selected In Situ Decommissioning as the preferred end-state, with current land use controls (LUCs) in place for the C-Reactor Complex as specified by the *Early Action Land Use Control Implementation Plan (EALUCIP) for the C-, K-, and L-Reactor Complexes* (SRNS 2010a).

Within the CAOU are waste units, Potential Source Areas (PSAs), and Deactivation and Decommissioning (D&D) Facilities. The FFA (FFA 1993) Appendix C.5 (Area Operable Units) identifies the following as comprising the CAOU:

- Building 106-C, Process Water Storage Tank;
- Building 107-C, Cooling Water Effluent Sump;
- Building 108-3C, Fuel Unloading Facilities Power – Area Supv;
- Building 109-C, Storage Basin;
- Building 710-C, Pre-Manufactured Metal Shelter;
- Building 717-C, Contaminated Maintenance Facility;
- Building 904-89G, Retention Basin for 100-C Containment;

- C-Area Process Sewer Lines (PSLs) as Abandoned, no building number (NBN);
- C-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN;
- C-Area Reactor Discharge Canal (CADC), NBN;
- Containment Tank C803-7-1, NBN;
- Early Construction and Operational Disposal Site (ECODS) C-1 (Near CADC), NBN;
- Potential Release from C-Area Disassembly Basin, NBN; and
- Potential Release from C-Area Reactor Cooling Water System (CWS), 186/190-C.

Note: The Process Water Storage Tank (106-C), Cooling Water Effluent Sump (107-C), and Storage Basin (109-C) have been combined with the C-Area PSLs as Abandoned (NBN) for the purposes of this document because of the interconnectedness of these subunits. Likewise, the Pre-Manufactured Metal Shelter (710-C) has been combined with the Potential Release from C-Area Disassembly Basin (NBN) because of the interconnectedness of these two subunits.

The following outfalls are identified as PSAs of the CAOU due to their association with the C-Area PSLs as Abandoned, NBN:

- Outfall C-01 (associated with the C-Area PSLs); and
- Outfall C-03 (associated with the C-Area PSLs).

The scope of this Early Action Record of Decision (EAROD) for the CAOU does not include the D&D facilities listed on FFA Appendix K.1 (D&D Facilities to be Decommissioned) including the C-Reactor Building (105-C); however, the following D&D facilities listed on FFA Appendix K.2 (D&D Facilities [or remnants] that Require No Further Evaluation) will be discussed as part of the CAOU because no further evaluation is needed for these facilities:

- Air Compressor Building (607-9C);

- Effluent Monitoring Building (614-2C); and
- Gatehouse Entrance at Building 105 (701-2C).

Each of these facilities was decommissioned using a Simple Model for clean facilities. The above grade structure was removed to slab, which was free of chemical or radioactive contamination, thus posing no potential risk to HH or the environment. Decommissioning activities were completed in 2005, and documented in Decommissioning Project Final Reports (WSRC 2006a, WSRC 2005a, WSRC 2005b). Figure 2 identifies the subunits and the D&D facilities associated with the CAOU.

A description of each of the CAOU subunits is provided below. Photographs of each of the subunits can be found in the *RCRA Facility Investigation / Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment (BRA) and Focused Corrective Measures Study / Feasibility Study (CMS/FS) for the C-Area Operable Unit (U)* (SRNS 2014a).

Building 108-3C, Fuel Unloading Facilities Power- Area Supervisor

Emergency power required for the operation of SRS reactors was met by diesel generators, which were fueled by a system of above ground storage tanks in each reactor area. The Fuel Unloading Facilities Power (108-3C) was the location of the above ground storage tanks in C-Area, and various spills and/or leaks over time resulted in soils contaminated with petroleum. In 1994, removal of 383 m^3 (500 yd^3) of contaminated soil to a depth of 6.1 m (20 ft) was performed. At the bottom of the 6.1-m (20-ft) pit several hand auger samples were collected, which determined contamination continued another 3-m (10 ft), or 9.1-m (30 ft) below ground surface (bgs) (WSRC 1997). However, rather than continue excavating the soil, the initial 383 m^3 (500 yd^3) was back-filled into the pit, and SRS implemented a bioventing system to remediate the hydrocarbons found in petroleum. After eight months, the total petroleum hydrocarbons (TPH) had decreased from a mean value of 1,122 ppm to a mean value of 116 ppm in the 0- to 6-m (0- to 20-ft) zone, which was close to the remedial goal (RG) of 100 ppm. However, the 6.1- to 9.1-m (20- to 30-ft) interval TPH had only decreased from a mean value of 3,800 ppm to a mean value of 1,700 ppm, and it was estimated to take another 1 to 3 years before

remediation would be complete. Soil samples were collected in 1998 and a closure report was submitted indicating that all contaminants had been reduced to acceptable levels (WSRC 1999a). SCDHEC approved the closure on January 26, 1999. Due to concerns of residual contaminants migrating into the groundwater, the Fuel Unloading Facilities Power (108-3C) facility was added as a subunit to the CAOU.

Although this subunit was evaluated in the RFI/RI/BRA/CMS/FS (SRNS 2014a), there continues to be an uncertainty whether there is a problem warranting action at the Building 108-3C, Fuel Unloading Facilities Power – Area Supervisor subunit with respect to TPH. The presence of TPH in soil and groundwater samples is a potential contaminant migration (CM) to groundwater issue that indicates further characterization is necessary. Therefore, the Building 108-3C, Fuel Unloading Facilities Area Supervisor subunit has been moved from the CAOU to the C-Area Groundwater (CAGW) OU and will not be carried forward in this document in an effort to complete the characterization necessary to address this issue. Contamination associated with the Building 108-3C, Fuel Unloading Facilities Area Supervisor subunit will be addressed under the CAGW OU.

Building 717-C, Contaminated Maintenance Facility

The Contaminated Maintenance Facility (717-C) was the C-Area "Hot Shop". The Hot Shop was constructed in 1985 to maintain reactor components. It was a single-story structure constructed on a concrete slab with a footprint area of ~435 m^2 (4,684 ft^2). The Hot Shop was active until 1990. Contaminated equipment such as lathes, a bearing press, and a band saw were removed and disposed of in the E-Area Low-Level Waste Facility slit trench disposal units. The Hot Shop structure was demolished leaving only the contaminated slab, which was scabbled. All equipment and piping were removed from the sump located on the east side of the Contaminated Maintenance Facility (717-C). A visual inspection determined the sump was structurally sound with no holes or cracks. After a radiological survey determined no activity was present, the sump was filled with gravel. The Hot Shop had eight floor drains that drained into an outside tank, which was removed as part of D&D of the facility. Five of the floor drains were located in the

radiological process area. During D&D activities, radiation detectors were used to determine if any levels of activity were present within the drains and the outside tank; no activity was detected. The drains were then sealed with grout.

A Facility Decommissioning Evaluation was completed for the Contaminated Maintenance Facility (717-C). Additionally, a Decommissioning Project Final Report (DPFR) was completed in 2006. The DPFR documents that the structure and maintenance equipment were completely dismantled and removed. Penetrations were cut flush with the surrounding grade level. Openings greater than 2 inches, including an underground sump were plugged. Final verification sampling was conducted on the concrete slab as part of the DPFR (WSRC 2006b). Following D&D activities, the Contaminated Maintenance Facility (717-C) was added to Appendix C of the FFA as a subunit of CAOU.

Building 904-89G, Retention Basin for 100-C Containment

The Retention Basin for 100-C Containment (904-89G) is part of the emergency cooling system for C-Reactor. The 190 million (M) liter (L) (50M gallon [gal]) Retention Basin was constructed in 1963 for emergency cooling of the reactor. In 1979, a 1,892,500 L (500,000 gal) Containment Tank (C803-7-1) was added to the retention basin. In the event of a cooling water (light- or heavy-water) leak, water in excess of 227,125 L (60,000 gal) (106-C Process Water Storage Tank) was to be pumped to the Containment Tank (C803-7-1) in the Retention Basin, which would then be diverted to the Retention Basin if the Containment Tank (C803-7-1) overflowed. Water from leaks originating in the reactor room zero-level (ground-level) or from pump operations was to go directly to the Retention Basin. The Retention Basin was never used for an emergency. However, the emergency cooling water system was periodically tested with clean river water. The Containment Tank (C803-7-1) contained water with elevated concentrations of tritium, potassium, potassium-40, arsenic, and chromium. Groundwater samples, obtained as part of previous C Area characterizations, were collected using direct push technology from

locations surrounding the retention basin. These data indicated that groundwater was not contaminated with tritium adjacent to the basin.

The water was removed from the Containment Tank (C803-7-1) by the end of March 2012 and trucked to the C-Reactor (105-C) Disassembly Basin for forced evaporation. Demolition and disposition of the Containment Tank (C803-7-1) down to the concrete slab and isolation of building utilities was subsequently completed. A DPFR was issued on August 22, 2012 (SRNS 2012a). Per the DPFR, the facility remnants were added to Appendices C.4 and C.5 of the FFA. Four soil borings were conducted in August 2012 after demolition and disposition had been completed to verify no contamination leaked to the 904-89G Retention Basin due to D&D activities. Samples were collected to a depth of 10 ft for arsenic, chromium, gamma spectroscopy (e.g. cesium-137 and potassium-40), and tritium at four new borings, which were adjacent to four exiting borings for comparison. The soil borings did not indicate any contamination due to past releases or D&D of the Containment Tank (C803-7-1)

C-Area Process Sewer Lines (PSLs) Combined Subunit

The C-Area PSLs as Abandoned subunit is defined only by the process sewer system components that are considered abandoned and no longer provide a service to the ongoing activities in the C-Area Reactor Building Complex (RBC) (105-C). These system components are primarily comprised of concrete and/or steel. The C-Area PSL structures that define this subunit include the following:

- C-Area PSLs as Abandoned (NBN);
- Building 106-C, Process Water Storage Tank;
- Building 107-C, Cooling Water Effluent Sump;
- Building 109-C, Purge Water Storage Basin; and
- Inactive manholes, boxes (access, diversion and junction), and other miscellaneous access points.

Reactor cooling water lines, fire water lines, water treatment lines, and sanitary sewers are not considered as part of the C-Area PSLs. These lines never received direct discharges from the C-Reactor Building (105-C). Water treatment lines from the Reactor CWS (186/190-C) and water treatment facilities are not considered as part of the C-Area PSLs and would not be contaminated since they are located upstream of the reactor process.

All active sewer systems, process lines, and structures that service the ongoing mission of the C-Area RBC due to their receipt of facility water runoff and storm water are defined within the scope of the C-Area RBC and include Manhole (904-1C), 100-C Effluent Outfall Structure (904-5G) and storm water sewer lines. These active sewer lines and structures will be closed as part of the final action for the C-Area RBC and are not included in the scope of the C-Area PSL subunit.

The 106-C, 107-C, and 109-C facilities are connected to the C-Area PSLs, and therefore, have been included as part of the C-Area PSL combined subunit. The Process Water Storage Tank (106-C) is a below-ground concrete tank, the bottom of which is 6.1-m (20-ft) bgs. The top of the structure is at ground level and resembles a concrete slab. It is located on the northeast end of the C-Reactor Building (105-C). The primary design purpose of the Process Water Storage Tank (106-C) was to retain reactor moderator and contaminated cooling water that would be released following an addition of emergency cooling water during an emergency in the reactor system, however, it was never used for this purpose. During normal reactor operations the Process Water Storage Tank (106-C) served other operational purposes that were associated with leak collection, spill collection, and receipt of water pumped from various below ground sumps. The Cooling Water Effluent Sump (107-C) is a large in-ground concrete structure that extends to a depth of ~10 m (32.7 ft). The Cooling Water Effluent Sump (107-C) is connected to the C-Reactor Building (105-C), 186-C Reactor Cooling Water Basins and the Effluent Canal (Discharge Canal) by underground pipelines. The piping connects to the 107-C structure at varying depths to ~8.5-m (28-ft) bgs, which was designed to direct flow to the Effluent Canal or to recirculate a small volume of water back to 186-C basin to stabilize cooling

water temperatures during cold weather. The Purge Water Storage Basin (109-C) received purged out-of-specification deionized water from the 105-C Reactor Vessel Shield system. It is a concrete tank that is 2-m (6.5-ft) below grade. The gross estimated volume is 32 m^3 (42 yd^3). The basin is designed with a series of baffles to slow the flow to the process sewer, allowing particles of short-lived radionuclides to settle and time to decay. Use of the basin ceased along with operation of the C Reactor in 1986.

A non-time critical removal (NTCR) action was completed in May 2012 for the C-Area PSLs as Abandoned subunit to stabilize radioactive contamination (SRNS 2011a and SRNS 2013a). Principal threat waste is defined as those source materials that have a high toxicity or mobility and cannot be reliably contained or present a significant risk to HH or the environment (USEPA 1991). This source material is referred to as principal threat source material (PTSM) at SRS. The NTCR action for the C-Area PSLs as Abandoned subunit stabilized radionuclide contamination exceeding PTSM levels. This action included dewatering of the PSLs and structures; removal of equipment and placement within below grade structures; grouting accessible openings to grade, including structures, manholes, and other miscellaneous access points, and; installation of concrete plugs in openings and/or placement of concrete covers where required.

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN)

The C-Area Reactor Area Cask Car Railroad Tracks as Abandoned subunit is an area west of the C-Reactor Disassembly Basin. The C-Area Railroad Tracks include all existing railroad tracks within the C-Area perimeter fence line. The section of railroad track that is currently being used in support of ongoing C-Reactor missions, including two spurs leading to the disassembly basin, will be remediated as part of the C-Reactor D&D activities and is not included as part of the CAOU scope.

The primary source of contamination at the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned is due to releases of cesium-137 from cask-laden railroad cars. Radiological materials from C-Reactor were transferred into metal casks inside the C-Reactor Disassembly Basin. The casks were loaded onto railroad carriages inside the

building and were routinely parked in various locations while awaiting transfer to the separation area facilities. During rain events, radiological materials washed from the casks onto the soil and gravel rail bed below.

A NTCR action was completed for the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned subunit to remove surface cesium-137 contamination in soil and rail bed gravel (SRNS 2010b and SRNS 2013b). At one location, the contamination levels equaled the PTSM threshold value prior to removal. The NTCR action included the offsite disposal of the contaminated material.

C-Area Reactor Discharge Canal (CADC)

The CADC subunit received process sewer discharges and storm water discharges from C-Area from 1955 to present. The CADC receives storm water via Outfall C-03 and process sewer discharges from outfall C-04. Currently, the only potential process sewer discharges to the CADC are from dewatering process within the C-Reactor Building (105-C) and storm sewer discharge. The CADC currently consists of an engineered canal beginning southwest of the C-Area RBC and extending ~760-m (2,493-ft) south of C Area before intersecting with Castor Creek. After this intersection, the CADC is a gaining stream and is not a potential source for groundwater contamination. The engineered canal and Castor Creek flow together for 425 m (1,394 ft) before they diverge. The canal flows west from the divergence for nearly 1,000 m (3,280 ft) before rejoining Castor Creek, and Castor Creek flows nearly 1,600 m (5,248 ft) before rejoining with the canal before flowing to Fourmile Branch (FMB). Groundwater contamination that contributes to surface water contamination in Castor Creek downgradient of the CADC is being monitored concurrently as part of the CAGW OU.

The data and analysis for the CADC was included in the CAOU RFI/RI/BRA/CMS/FS (SRNS 2014a), but will not be carried forward in this early action (EA) decision for the CAOU due to the presence of an existing PSL that discharges to the CADC from the CAOU. This line is not currently active (i.e., it is not in use for any ongoing operational mission at C-Reactor), but its genesis is within the C-Area RBC. The C-Area RBC has

not been completely deactivated and decommissioned and is currently used as a storage site for tritiated moderator water in tanks and for cask car refurbishment. For this reason, there is the potential for release of contamination through the PSL to the CADC due to ongoing and/or future waste management practices within the facility. The final remedial decision for the CADC will be included in the final Statement of Basis/Proposed Plan (SB/PP) and Record of Decision (ROD) for the CAOU. It is anticipated that the existing data and analysis presented in the RFI/RI/BRA/CMS/FS will be used for the final CAOU SB/PP and ROD provided no new missions begin operations within the CAOU. An evaluation of the need for any additional data collection to support the final remedial action at the CAOU will be made prior to the development of these final documents. Existing missions do not currently discharge into the CADC.

Early Construction and Disposal Sites (ECODS) C-1

The ECODS C-1 is located near the CADC and has been investigated by the Site Evaluation (SE) program. These sites were used during the construction and early operation of SRS for disposal of construction debris and other waste material. ECODS C-1 (NBN) is a set of two trenches that were used to dispose of materials associated with C Area construction, which were in use from January 1953 to sometime after June 1954 based on aerial photographs (WSRC 2003). The trenches contained trash and construction debris, such as rubble and concrete (WSRC 2003). The two trenches are ~100-m (328-ft) long, 4.6-m (15-ft) deep, and 7-m (23-ft) wide, and a third excavation area ~19-m (62-ft) long, 12-m (39-ft) across at the widest point, and 4-m (13-ft) deep, which were identified by aerial photographs and a SE ground penetrating radar (GPR) survey (WSRC 2003). SE sampling found waste materials (wire, nails, and broken glass) at depths between 0.0 and 3.0 m (1 and 10 ft) at four sample locations and debris in the 0.0- to 0.3-m (0- to 1-ft) interval at one sample location (WSRC 2003). Construction debris such as concrete, broken glass, wire, and nails was also found in the trenches. Sections of the trenches were used as burning pits for combustible waste.

Potential Release from the C-Area Reactor Disassembly Basin (105-C)

The C-Area Reactor Disassembly Basin (105-C) is a series of large concrete, interconnected basins located on the south side of the C-Reactor Building (105-C). The Disassembly Basin is divided into several discreet but contiguous basins used for different fuel handling processes, including storage, cooling, disassembly, and preparation for transport to the separation area. The basin floor is ~9 m (30 ft) in depth and contained ~2.84 M gal of water in 2002. Its volume was ~10,758 m^3 (379,900 ft^3) and is ~1,394 m^2 (15,006 ft^2) in area. A NTCR action was also conducted for the C-Reactor (105-C) Disassembly Basin to evaporate the contaminated basin water and grout the contaminated sediment and irradiated scrap metal in the basin to ground surface (SRNS 2011b and SRNS 2013c). The forced evaporation of the water was completed using diesel powered evaporators that were operated within the temporary 710-C Pre-Manufactured Metal Shelter constructed to house them. The DPFR for the 710-C Pre-Manufactured Metal Shelter (SRNS 2012b) describes the D&D of this facility. The Disassembly Basin grouting began on September 14, 2011, and was completed on August 16, 2012. The residual sediment/sludge and scrap metal in the basin, which was radiologically contaminated at levels exceeding PTSM thresholds, was grouted and stabilized to surface as part of this action.

Historically, the primary source of contamination release associated with the C-Reactor Disassembly Basin was contaminated water that may have been released from process piping or equipment connected to the basin. These potential releases may have resulted in subsurface soil contamination and potential CM concerns, primarily for tritium. There is no surficial soil expression of overflow or large leaks from the disassembly basin based on the 1998 gamma (cesium-137) overflight surveys and soil sampling results for the PSLs and the cask car railroad tracks.

Potential Release from the C-Area Reactor Cooling Water System (186/190-C)

The C-Area Reactor Cooling Water System is comprised of the C-Area Cooling Water Reservoir (186-C) and the C-Area Cooling Water Pump House (190-C). The Cooling

Water Reservoir is commonly referred to as the C-Area Concrete Lakes or the C-Area Cooling Water Basin. The reservoir consists of three basins (total capacity of 94,600 m^3 [25M gal]), which were used to supply cooling water to the reactor. It is divided by interior walls into three interconnected basins. During operation, the basins could be isolated, but were also interconnected by sluice gates and pipes. Reservoir depth is ~9 m (30 ft). The Cooling Water Pump House (190-C) housed the pumps that moved water from the basins to the reactor. Cooling water was fed from one of two river water intakes at the Savannah River near the TNX facility. The water inside the C-Area Cooling Water Reservoir (186-C) was drained in March 2004, and the river water lines have been disconnected.

The C-Area Reactor CWS basins contained unfiltered Savannah River water and could have been contaminated from sources up-gradient of the SRS. The water inside the three basins was tested in 2003 and found to be clean. The river water sediment inside each of the three basins was tested for a limited analytical suite. The results indicated the sediment inside the basins was non-hazardous and below SRS radiological limits. The 186/190-C structures are included on Appendix K.1 in the FFA and will be addressed as part of the D&D program.

Outfall C-01 Potential Source Area (PSA)

Due to radiological contamination discovered in the soils at drainage outfalls in both P Area and R Area, Outfall C-01 was investigated to determine impacts to the environment from potential releases that may have occurred in C-Area. Surface spills and potential cross-connections with the PSLs may have impacted surface soils/sediments with radiological constituents (e.g., cesium-137).

Outfall C-01 catches storm water runoff from the northern half of C-Area. A portion of the C-Reactor Building (105-C) is located within this drainage. The C-01 Outfall begins as an engineered concrete and granitic block drainage structure at the end of a storm sewer line to the northwest of C-Area, crosses a gravel road where the C-01 Outfall water

sampling station is located, and eventually discharges to FMB. Outfall C-01 was identified as a PSA for soil contamination.

Outfall C-03 Potential Source Area (PSA)

Due to radiological contamination being discovered in the soils at drainage outfalls in both P Area and R Area, Outfall C-03 was investigated to determine impacts to the environment from potential releases that may have occurred in C Area. Surface spills and potential cross-connections with the PSLs may have impacted surface soils/sediments with radiological constituents (e.g., cesium-137).

Outfall C-03 receives storm water runoff from the southern half of C-Area. A portion of the C-Reactor Building (105-C) is located within this drainage. The flow from C-03 Outfall is discharged into a ditch that drains into the CADC that eventually leads to FMB. Outfall C-03 was identified as a PSA for soil contamination.

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 (ARF) that documents the investigation and selection of the remedial alternative for addressing the CAOU soil. The ARF must be established at or near the facility at issue.

The SRS FFA Community Involvement Plan (WSRC 2011) 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. 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 *Early Action Statement of Basis/Proposed Plan for the C-Area Operable Unit (U)* (SRNS 2014b), a part of the ARF, highlights key aspects of the investigation and identifies the preferred action for addressing the CAOU.

The FFA ARF, 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 ARF 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
2600 Bull Street
Columbia, South Carolina 29201
(803) 898-2000

The South Carolina Department of Health and Environmental Control
Midlands EQC Region - Aiken
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 642-1637

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 Early Action Statement of Basis/Proposed Plan (EASB/PP) 45-day public comment period began on November 17, 2014, and was scheduled to end on January 1, 2015. However, the 45-day public comment period was extended 30 days to January 31, 2015, at the request of the Savannah River Site Citizens Advisory Board to accommodate a public meeting to discuss the preferred remedy. The public meeting was held to discuss the preferred remedy on January 26, 2015, at the USDOE Meeting Center in Aiken, SC.

A Responsiveness Summary, prepared to address the comments received during the public comment period, is provided in Appendix A of this EAROD. A Responsiveness Summary will also be available with 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, FMB, 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 CAOU is located within the FMB 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 have agreed that using the Area OU strategy to manage surface units at the CAOU was appropriate and the waste units and facilities in the area were consolidated to form a single Area OU.

The CAOU subunits, PSAs, and D&D facilities are grouped based on potential future land use scenarios. Subunits located within the C-Area Perimeter Fence were evaluated for industrial land use only since this area will not support unrestricted land use. Therefore, all subunits inside the Perimeter Fence will require LUCs as part of any remedial decision to prevent unrestricted land use. For risk management purposes, subunits and PSAs outside the C-Area Perimeter Fence were evaluated for both the

industrial and residential land use scenarios since some subunits may be able to support unrestricted land use if residual risks do not pose a threat to HH and the environment. Where appropriate, individual FFA subunits are also combined when dictated by related process history or action.

As discussed in Section II, NTCR actions were completed for the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) and the C-Area PSLs as Abandoned subunits in June 2011 and May 2012, respectively. An NTCR action was also conducted for the C-Reactor (105-C) Disassembly Basin to evaporate the basin water and grout the basin to ground surface. This NTCR action also included removal and evaporation of the tritiated water from the Containment Tank (C803-7-1). Upon future completion of ongoing missions at the C-Reactor Building Complex, the details of the final in situ decommissioning remedy will be selected in the final CAOU ROD.

LUCs are the preferred early remedial action at the following subunits to prevent unrestricted use and/or meet RGs:

- Building 717-C, Contaminated Maintenance Facility;
- C-Area PSLs as Abandoned (including the Process Water Storage Tank [106-C], Cooling Water Effluent Sump [107-C], and Storage Basin [109-C]);
- C-Area Reactor Area Cask Car Railroad Tracks as Abandoned;
- Potential Release from C-Area Disassembly Basin (including the Pre-Manufactured Metal Shelter [710-C]);
- Potential Release from C-Area Reactor CWS (186/190-C);
- ECODS C-1; and
- Outfall C-03.

No Action is proposed for the following subunits that have been determined to pose no threat to HH (residential and industrial) or the environment:

- Building 904-89G, Retention Basin for 100-C Containment (including Containment Tank C803-7-1 [NBN]); and
- Outfall C-01.

Groundwater is not part of the CAOU. Groundwater is being addressed separately under the CAGW OU.

V. OPERABLE UNIT CHARACTERISTICS

Conceptual Site Model (CSM) for the CAOU

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 (ECO) receptors.

Exposure pathways describe the course a chemical or physical agent takes from the source to the exposed receptor. The following five (5) components comprise an exposure pathway:

- Source (facility operations, spill, etc.)
- Exposure media (concrete, soil, groundwater, etc.)
- Exposure point (slab surface, drinking water well, etc.)
- Exposure route (external radiation, ingestion, dermal contact, inhalation, etc.)
- Receptor (resident, worker, wildlife, etc.)

If any of these elements are missing, the pathway is incomplete and is not considered further in the quantitative risk assessment. A pathway is complete when all five components are present to permit potential exposure of a receptor to a source of contamination. Exposure analysis is conceptually important in terms of identifying all potentially complete exposure routes, understanding the nature and extent (as well as fate and transport) of contamination, and developing preliminary remedial alternatives. In a

complete pathway, exposure occurs at exposure points that may represent only a small portion of the entire exposure route. If there is no exposure point, then there is no exposure, and the pathway is considered incomplete.

The primary sources of contamination at the CAOU are due to the 105-C Reactor facility and other C-Area operations. Spills, leaks, accidental releases, or simply the operation itself resulted in releases of hazardous or radioactive substances. If the primary source were to contact other media, secondary sources of contamination could be created through several release mechanisms. Typically, the potential secondary release mechanisms include release of volatile constituents from the soil (volatilization), generation of fugitive dust by wind or other surface soil disturbance, biotic uptake, radiation emissions, and infiltration/percolation/leaching to groundwater. Contact with contaminated environmental media creates potential pathways for both human and ECO receptors. The following is a brief summary of the potentially complete exposure pathways that were evaluated as part of the CAOU RFI/RI/BRA (SRNS 2014a).

Subunits within the CAOU perimeter fence line that are within the scope of this document include the Building 717-C, Contaminated Maintenance Facility; C-Area PSLs as Abandoned, NBN; C-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN; Potential Release from the C-Area Disassembly Basin, NBN; and Potential Release from the C-Area Reactor CWS (186/190-C). A potentially complete exposure pathway was evaluated for a future industrial worker for surface soil (0 to 0.3 m [0 to 1 ft]) at these subunits in the human health risk assessment (HHRA). All-depth soil (i.e., entire soil column from surface to depth of sampling) offered a potential exposure pathway for a future industrial worker under an excavation scenario. This pathway was evaluated in the PTSM analysis. Leaching of contaminants from the contaminated media (e.g., soil) to groundwater constitutes a secondary contaminant release mechanism. The potential for contaminants to leach from soil to groundwater was evaluated in the CM analysis. In addition to potential surface soil exposure, the following exposure pathways were evaluated:

- At the Building 717-C Contaminated Maintenance Facility Hot Shop subunit, a potentially complete exposure pathway was also evaluated for a future industrial worker for surface concrete.

- At the Cask Car Railroad Tracks as Abandoned subunit, a potentially complete exposure pathway was also evaluated for a future industrial worker for surface gravel (0 to 0.3 m [0 to 1 ft]).

- At the Potential Release from the C-Area Reactor CWS (186/190-C) subunit, a potentially complete exposure pathway was evaluated for a future industrial worker in surface sediment (0 to 0.15 m [0 to 0.5 ft]). In addition, surface water was also evaluated by performing a comparison to the maximum contaminant levels (MCLs).

Subunits outside the CAOU perimeter fence line that are within the scope of this document include the Building 904-89G, Retention Basin for the 100-C Containment; ECODS C-1 (NBN); Outfall C-01 PSA; and Outfall C-03 PSA. For these facilities, a potentially complete exposure pathway was evaluated for a future resident and future industrial worker for surface soil (0 to 0.3 m [0 to 1 ft]) in the HHRA. All-depth soil offered a potential exposure pathway for a future industrial worker under an excavation scenario. This pathway was evaluated in the PTSM analysis. Leaching of contaminants from the contaminated medium (e.g., soil) to groundwater constitutes a secondary contaminant release mechanism. The potential for contaminants to leach from soil to groundwater was evaluated in the CM analysis. In addition, soil (0 to 0.3 m [0 to 1 ft] and 0.3 to 1.2 m [1 to 4 ft]) offers a potential exposure pathway for terrestrial receptors and was evaluated in the ecological risk assessment (ERA).

Media Assessment

The overall approach that was implemented during various facets of the CAOU investigation is described in the *RCRA Facility Investigation / Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment (BRA) and Focused Corrective Measures Study / Feasibility Study (CMS/FS) for the C-Area Operable Unit (U)* (SRNS 2014a).

The sampling methodology for each of the unit assessment media types was developed to allow for data and sampling consistency at all of the subunits. Details of the sampling and analysis can be found in the *Sampling and Analysis Plan for the Pre-Work Plan Characterization of the C-Area Operable Unit (U)* (SRNS 2011c). In addition to the data collected in accordance with the CAOU Sampling and Analysis Plan (SAP) (SRNS 2011c), data collected as part of the SE process was also used to support the assessment as applicable.

The various media of concern were assessed by conducting HHRA and ERA, fate and transport analysis (i.e., CM), and a PTSM evaluation. The purpose of these assessments was to evaluate the potential for adverse effects associated with exposure to constituents present at the CAOU. Details of the media assessment (e.g., sample locations/maps, analytical results, nature and extent of contamination, exposure assumptions, risk calculations, uncertainty evaluations, etc.) can be found in the RFI/RI/BRA/CMS/FS for the CAOU (SRNS 2014a).

Soil / Concrete Investigation

Characterization of the CAOU subunits began in November 2010 and was completed in September 2012 per the *Sampling and Analysis Plan for the Pre-Work Plan Characterization of the C-Area Operable Unit (U)* (SRNS 2011c). A summary of the characterization investigation is provided below.

Building 717-C, Contaminated Maintenance Facility

In 2010, 40 soil samples were collected from five locations adjacent to the Contaminated Maintenance Facility (717-C). Sample depths included the following: surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]) and then 0.6-m (2-ft) intervals every 3 m (10 ft) to a depth of 18 m (60 ft). Soil samples received gross alpha, nonvolatile beta, gamma spectroscopy, and Target Analyte List (TAL)/Target Compound List (TCL) analyses. In 2011, a lanthanum bromide (LaBr) survey was conducted on the concrete slab and soils adjacent to the remaining slab.

C-Area Process Sewer Lines (PSLs) Combined Subunit

The C-Area PSLs were previously characterized in August 2000 by the SE Program (WSRC 2001a). Soil sampling was conducted at 64 locations and six background locations. Fifty-eight (58) sampling locations were distributed along the length of the C-Area PSLs at tees, elbows, and points which were found to have elevated radioactivity by probe sampling. Samples were collected at depths of 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft). Additionally, samples were collected at 0.3-m (1-ft) below the invert of the sewer lines at depths ranging from 1.2- to 7.2-m (4- to 24-ft) bgs. One exception is the 107-C facility, the base of which is 10-m (32.7-ft) deep, but external sampling only went to a depth of 7.3 m (24 ft). Due to the extensive sampling conducted under the SE Program, additional sampling external to the PSLs was not warranted.

However, as identified by the P-Area Operable Unit (PAOU) and R-Area Operable Unit (RAOU) characterizations, and based on C-Area pipeline crawler surveys, the interior of the PSLs, and associated tanks and sumps (Process Water Storage Tank [106-C], Cooling Water Effluent Sump [107-C], and Storage Basin [109-C]) are contaminated with radionuclides. In 2011, water samples were collected from the Process Water Storage Tank (106-C), Cooling Water Effluent Sump (107-C), and Storage Basin (109-C). Samples were analyzed for TAL and TCL analytes, gross alpha, nonvolatile beta, gamma spectroscopy, and tritium.

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit

A SE report was submitted to USEPA and SCDHEC in September 2001 (WSRC 2001b). A total of 72 locations adjacent to the railroad tracks were sampled including five background locations. Soil samples were collected from 0 to 0.3 m (0 to 1 ft) and 0.3- to 1.2-m (1- to 4-ft) intervals. Samples were analyzed for gross alpha, non-volatile beta, and gamma-pulse height analysis radioisotopes. However, the SE soil samples in 2000 were collected from locations situated outside of the rail bed footprint.

A LaBr gamma survey was performed in 2009 for the railroad tracks within the inner C-Reactor Fence and identified a radiological contamination area adjacent to the C-Reactor (105-C) Disassembly Basin Area. Thirty-four (34) soil and gravel samples were collected from eight locations within and outside the contamination area on the railroad tracks from 0- to 0.3-m (0- to1-ft), 0.3- to 0.6-m (1- to 2-ft), 0.6- to 0.9-m (2- to 3-ft), and 0.9- to 1.2-m (3- to 4-ft) intervals. Gravel and soil samples were analyzed for gamma spectroscopy to determine cesium-137 concentrations.

Additional characterization for the C-Area Railroad Tracks was conducted in 2010-2011, which included a LaBr survey of all the railroad tracks within the C-Area Perimeter Fence. Twelve (12) soil and gravel samples were collected from four locations along the railroad tracks in 2010. The gravel samples were analyzed for gamma spectroscopy to verify the LaBr field survey. Surface (0- to 0.3 m [0- to 1 ft]) gravel samples and subsurface (0.3- to 0.6-m [1- to 2-ft] and 0.6- to 1.5-m [2- to 5-ft]) soil samples were analyzed for gross alpha, nonvolatile beta, gamma spectroscopy, and TAL analyses.

Potential Release from the C-Area Reactor Disassembly Basin (105-C)

Previous C-Area characterization activities for the C-Area PSLs and C-Area Reactor Area Cask Car Railroad Tracks subunits collected an extensive number of surface (0 to 0.3 m [0 to 1 ft]) and subsurface (0.3- to 1.2-m [1 to 4-ft]) soil samples located around the periphery of the Disassembly Basin. In 2011, subsurface soil samples were collected at five locations adjacent to the Disassembly Basin from multiple intervals (2.4 to 3.0 m [8 to 10 ft], 5.5 to 6.1 m [18 to 20 ft], 8.5 to 9.1 m [28 to 30 ft], 11.6 to 12.2 m [38 to 40 ft], 14.6 to 15.2 m [48-50 ft], 17.7 to 18.3 m [58 to 60 ft], and 20.7 to 21.3 m [68 to 70 ft]). The soil samples were analyzed for TAL analytes, gross alpha, nonvolatile beta, gamma spectroscopy, and tritium.

Potential Release from the C-Area Reactor Cooling Water System (186/190-C)

As directed in the CAOU SAP (SRNS 2011c), soil sampling adjacent to the basins included the deep subsurface to identify potential releases. Thirty-two (32) soil samples

were collected from four locations at surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and then 0.6-m (2-ft) intervals every 3-m (10-ft) to a depth of 18 m (60 ft). Three sediment and three surface water samples were also collected from within each of the basin sumps, which was the only location surface water was present and fine sediments had accumulated over time. The soil and sediment samples were analyzed for gross alpha, nonvolatile beta, gamma spectroscopy, and TAL constituents. The surface water samples received the same analyses, but were also analyzed for tritium. Due to elevated total chromium levels in the sediment samples collected from the 186-C sumps, three additional sediment samples were collected for hexavalent chromium analyses in 2014.

Building 904-89G, Retention Basin for 100-C Containment

In 2011, samples were collected from nine locations within the Retention Basin. Forty-six (46) soil samples were collected from the nine locations within the Retention Basin (904-89G), which were sampled at the surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and then 0.6-m (2-ft) intervals every 3 m (10 ft) to a depth of 9 m (30 ft). These samples were analyzed for gross alpha, nonvolatile beta, gamma spectroscopy, and TAL analyses. In 2012, after D&D of the Containment Tank (C803-7-1) was complete, four additional soil borings adjacent to the former tank location were also sampled for constituents that were elevated in the tank water: arsenic, chromium, gamma spectroscopy, potassium, potassium-40, and tritium. Samples were collected at the surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and deep (2.4- to 3.0-m [8- to 10-ft]) subsurface depths.

In 2014, six samples at three additional locations were sampled for hexavalent chromium analyses because total chromium was elevated in several of the 2011 samples. Samples were collected immediately adjacent to the three 2011 stations with the highest total chromium levels at the surface (0 to 0.3 m [0 to 1 ft]) and subsurface (0.3 to 1.2 m [1 to 4 ft]) depth intervals.

Early Construction and Disposal Sites (ECODS) C-1

In January 2002 as part of the SE program, composite soil sampling was conducted at 24 locations, including six background locations. Eighteen (18) of the locations were distributed evenly throughout the areas shown in the GPR survey to contain subsurface disturbances. Samples were collected from 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 from 2.4 to 3.6 m (8 to 12 ft) and 3.6 to 4.8 m (12 to 16 ft) which were ~0.3-m (1-ft) below the bottom of the trenches. The soil samples were analyzed for TCL/TAL analytes.

In 2011, a new GPR survey was conducted on the southwest side and southern boundary of the ECODS C-1. Soil samples were collected from nine locations in the southern/southwestern portion of the ECODS C-1. Samples were collected from surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and deep (>1.2-m [>4-ft]) subsurface soils and analyzed for TAL and TCL analytes.

Outfall C-01 Potential Source Area (PSA)

Soil samples were collected from four sampling locations at Outfall C-01. Samples were collected from surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and deep (>1.2-m [>4-ft]) subsurface soils. Samples were analyzed for TAL and TCL analytes, gross alpha, nonvolatile beta, and gamma spectroscopy. Soil samples with radiological indictor analyses exceeding the trigger limits (20 pCi/g for gross alpha and 50 pCi/g for nonvolatile beta) received the appropriate radionuclide-specific analyses for alpha- and/or beta-emitting radionuclides.

Outfall C-03 Potential Source Area (PSA)

In 2011, soil samples were collected from three sampling locations at Outfall C-03. Samples were collected from surface (0 to 0.3 m [0 to 1 ft]), subsurface (0.3 to 1.2 m [1 to 4 ft]), and deep (>1.2-m [>4-ft]) subsurface soils. Samples were analyzed for TAL and TCL analytes, gross alpha, nonvolatile beta, and gamma spectroscopy. Soil samples with radiological indictor analyses exceeding the trigger limits (20 pCi/g for gross alpha

and 50 pCi/g for nonvolatile beta) received the appropriate radionuclide-specific analyses for alpha- and/or beta-emitting radionuclides.

Groundwater Investigation

The collection of groundwater samples aided evaluation of CM constituents of concern (COCs) to the groundwater at selected CAOU subunits. Data collection was conducted in the shallow water table, primarily the Transmissive Zone of the Upper Three Runs Aquifer. Groundwater data collected during the CAOU characterization will also be used in the CAGW OU evaluation.

Media Assessment Results

The data was used to perform HHRA and ERA, a PTSM evaluation, and CM to groundwater analyses (SRNS 2014a). Table 1 summarizes the results of these evaluations and identifies refined constituents of concern (RCOCs) for each subunit that requires remedial action. RCOCs are those constituents that are retained following a weight-of evidence evaluation and require remedial action.

Soil / Concrete Media Results

A summary of the media assessment results for each subunit is provided below.

Building 717-C, Contaminated Maintenance Facility

The assessment was conducted on the remaining building slab surface and surrounding surface soils to determine risk to an industrial worker. No HH RCOCs were identified in the 0- to 0.3-m (0- to 1-ft) surface soil interval. Cesium-137(+D) and strontium-90(+D) were identified as HH RCOCs on the concrete slab. Though unable to verify the cesium-137 and strontium-90 concentrations from the DPFR during the 2011 LaBr survey, it was assumed the concrete slab has a maximum cesium-137 concentration of 0.97 pCi/g and strontium-90 concentration of 26 pCi/g. Figure 3 shows the cesium-137 activities on the concrete slab.

There were no ECO, CM or PTSM RCOCs identified at this subunit.

C-Area Process Sewer Lines (PSLs) Combined Subunit

The assessment was conducted on the surface soils using the SE data from 2000. Based on this evaluation, there were no HH RCOCs identified for the future industrial worker scenario in the 0- to 0.3-m (0- to 1-ft) surface soil interval.

Based on the quantitative PTSM evaluation for the CAOU, no soil constituents were identified as PTSM for the C-Area PSLs combined subunit (including 106-C, 107-C, and 109-C). This conclusion is based on an evaluation of the soil media surrounding the C-Area PSLs.

Based on the 2011 106-C, 107-C, and 109-C water data and process history, residual contamination that exceeds PTSM threshold levels is assumed to be fixed on the inside surfaces of the C-Area PSLs (i.e., within the pores of the concrete) or trapped within the rust and scale on the surface of steel. The C-Area PSL NTCR action addressed the contamination inside the inactive C-Area PSLs, and the final action for the CAOU will address the currently active C-Area PSLs. Radionuclides were qualitatively identified as PTSM due to fixed contamination inside the subunit pipelines.

There were no ECO or CM RCOCs identified at this subunit.

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit

Cesium-137(+D) was identified as a HH RCOC for the future industrial worker scenario. It was detected in 9 of 62 samples, with 2 sample results being estimated values. Activities ranged from non-detect (ND) to 1.5 pCi/g. Figure 4 shows the Cs-137 activities in the surface soil/gravel media.

There were no ECO, CM or PTSM RCOCs identified at this subunit.

Potential Release from the C-Area Reactor Disassembly Basin (105-C)

Surficial soils data collected in the vicinity of the C-Reactor Disassembly Basin were evaluated with the C-Area PSLs as Abandoned and C-Area Reactor Area Cask Car Railroad Tracks subunits. There were no problems warranting action for the future industrial worker from surface soil since there is no surficial pathway for exposure.

There were no ECO, CM or PTSM RCOCs identified at this subunit.

Although this subunit was determined to have no problems warranting action under the industrial land use scenario, it will be managed with LUCs because its location within the perimeter fence line will not support unrestricted land use.

Potential Release from the C-Area Reactor Cooling Water System (186/190-C)

An assessment was conducted on the soils adjacent to the basins, and the surface water and sediments within the basin sumps to determine risk to an industrial worker. There were no HH RCOCs identified. There were no ECO, CM or PTSM RCOCs identified at this subunit.

Although this subunit was determined to have no problems warranting action under the industrial land use scenario, it will be managed with LUCs because its location within the perimeter fence line will not support unrestricted land use.

Building 904-89G, Retention Basin for 100-C Containment

An assessment was conducted on the Retention Basin for 100-C Containment (904-89G) subunit to determine the risk for a future industrial worker and for a future resident. There were no HH RCOCs identified for the either the future resident or future industrial worker exposure scenarios in surface soil at the 100-C Containment Building (904-89G) subunit. There were no ECO, CM or PTSM RCOCs identified at this subunit.

Since this subunit is located outside the C-Area perimeter fence and has no RCOCs identified, it qualifies for unrestricted land use.

Early Construction and Disposal Sites (ECODS) C-1

For the future resident scenario, Aroclor 1254 and polynuclear aromatic hydrocarbons (PAHs, benzo(a)pyrene and benzo(b)fluoranthene specifically) were identified as HH RCOCs in the 0- to 0.3-m (0- to 1-ft) soil interval. For the future industrial worker scenario, Aroclor 1254 was identified as a HH RCOC.

Aroclor 1254 was detected in 13 of 27 samples, with 7 sample results being estimated values. Concentrations ranged from ND to 6.3 mg/kg. Figure 5 shows the concentrations of Aroclor 1254 in soil.

Benzo(a)pyrene was detected in 2 of 27 samples, with 1 sample result being an estimated value. Concentrations ranged from ND to 0.128 mg/kg. Benzo(b)fluoranthene was detected in 3 of 27 samples, with 1 sample result being an estimated value. Concentrations ranged from ND to 0.22 mg/kg. Figure 6 shows the concentrations of benzo(a)pyrene and benzo(b)fluoranthene in soil.

There were no ECO, CM or PTSM RCOCs identified at this subunit.

Outfall C-01 Potential Source Area (PSA)

There were no HH RCOCs identified for either the future resident or future industrial worker receptor scenarios in surface soil (0 to 0.3 m [0 to 1 ft]) at the Outfall C-01 subunit. There were no ECO, CM or PTSM RCOCs identified at this subunit. Since this subunit is located outside the C-Area perimeter fence and has no RCOCs identified, it qualifies for unrestricted land use.

Outfall C-03 Potential Source Area (PSA)

Cesium-137(+D) was identified as a HH RCOC in the 0- to 0.3-m (0- to 1-ft) soil interval for both the future resident and the future industrial worker scenarios. It was detected in 1 of 3 samples, with no sample results being estimated values. Activities ranged from ND to 1.19 pCi/g. Figure 7 shows the cesium-137 activities in soil.

There were no ECO, CM or PTSM RCOCs identified at this subunit.

Groundwater

Groundwater media is not included in the scope of the CAOU. Groundwater data collected during the CAOU characterization will be evaluated as part of the CAGW OU.

Site Specific Factors

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

Contaminant Transport Analysis

Given the location and concentrations/activities of residual contamination at the CAOU, there are no known or potential routes of off-Site migration that could impact HH or the environment.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

The CAOU is primarily located in an area currently designated for industrial land use, and is expected to remain industrial in the future. The EAROD for the C-, K- and L-Reactor Complexes (SRNS 2009) selected In-Situ Decommissioning as the preferred end-state, with current LUCs in place for the C-Reactor Complex as specified by the EALUCIP (SRNS 2010a). This decision is consistent with future industrial use. Most of the CAOU subunits discussed in this EAROD are located adjacent to or in the vicinity of the C-Reactor Building (105-C) Complex. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999b) designates the CAOU as being within an industrial area. The future land use is reasonably anticipated to remain industrial with USDOE maintaining control of the land.

Groundwater Uses/Surface Water Uses

No current or future use of the groundwater as a drinking water source is projected. The groundwater media is being addressed in a separate operable unit, the CAGW OU.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment (BRA)

As a component of the RI process, a BRA was performed to evaluate risks associated with the CAOU (SRNS 2014a). The BRA estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The BRA includes HH and ERAs, fate and transport analysis (i.e., CM), and a PTSM evaluation. This section summarizes the results of the RFI/RI/BRA/CMS/FS for the CAOU (SRNS 2014a).

Summary of Human Health Risk Assessment (HHRA)

The CAOU is located in an area currently designated for industrial land use. Therefore, the future industrial worker was chosen as the BRA scenario for quantitative evaluation of human receptors at all of the CAOU subunits. A quantitative evaluation of the future resident scenario was not performed for the subunits located within the C Area perimeter fence line; rather it was qualitatively assessed by recognizing that residential use of the area will be restricted by implementing LUCs to ensure long-term protectiveness. For the subunits located outside of the C Area perimeter fence line, a quantitative evaluation of the residential scenario was performed to determine if any of these subunits qualified for unrestricted land use.

The *USEPA Regional Screening Levels (RSLs)* website (USEPA 2012) was the source of RSLs used in the assessment. The generic table published in November 2012 uses all default parameters for both the residential and industrial worker scenarios. The website was accessed on March 20, 2013.

The *USEPA Preliminary Remediation Goals (PRGs) for Radionuclides* website (USEPA 2010) was the source of the PRGs used in the assessment. The website was also accessed on March 20, 2013. The PRGs for a residential scenario were obtained by using the website calculator function to derive site-specific PRGs. These site-specific PRG values were calculated by eliminating the fruit and vegetable consumption pathways as standard input assumptions and using all other default parameters (SRNS 2012b). The PRGs for an industrial worker scenario were obtained from the generic table that assumes all default parameters.

The *USEPA Surface Preliminary Remediation Goals (SPRGs) for Radionuclides* website (USEPA 2011) was the source of the SPRGs used in the assessment for the evaluation of concrete media. The website was also accessed on March 20, 2013. The SPRGs for a composite worker scenario were obtained from the generic table that assumes all default parameters for two-dimensional direct external exposure.

The standard USEPA future resident exposure scenario evaluates long term risks to individuals expected to have unrestricted use of the unit. It assumes that residents hypothetically live on the unit and are exposed chronically, both indoors and outdoors, to unit contaminants. The exposure assumptions for this scenario are 30 years, 350 days per year, and 24 hours per day.

The future industrial worker exposure scenario is also a standard USEPA scenario which addresses long-term risks to workers who are exposed to unit contaminants within an industrial setting. The exposure assumptions for this scenario are 25 years, 250 days per year, and 8 hours per day.

The potential exposure pathways for evaluation of human receptors included:

- Exposure to surface soil and/or gravel media (0 to 0.3 m [0 to 1 ft]) via incidental ingestion, dermal contact, inhalation, and external exposure from radionuclides.
- Exposure to surface concrete slab media via external exposure from radionuclides.

- Exposure to surface water media via ingestion, dermal contact, inhalation, and external exposure from radionuclides (conservative drinking water standard comparison only).

The first step of the formal HHRA for soil and/or gravel media was a data screening exercise to identify HH constituents of potential concern (COPCs). The maximum detected soil concentration for each constituent was compared to a residential RSL or PRG value and SRS background concentration, if appropriate (i.e., for naturally-occurring constituents only). Constituents that exceeded the soil media screening criteria were identified as COPCs and were carried forward to the quantified risk evaluation.

The quantitative risk assessment was implemented by a streamlined approach which used the RSLs/PRGs to calculate the HH risk estimates for the CAOU. For carcinogens, the risk estimate was calculated using the following equation:

Cancer Risk = (exposure point concentration / RSL or PRG) x 1E-06

The exposure point concentration (EPC) is identified as the lesser of the maximum detected value or the 95% upper confidence limit (UCL) of the mean concentration. Carcinogenic constituents with an individual cancer risk greater than 1E-06 were identified as HH COCs.

For noncarcinogens, the hazard estimate was calculated using the following equation:

Noncancer Hazard Quotient = EPC / RSL

If the total media hazard index (HI) was less than 1, then no COCs were identified. If the total media HI was greater than or equal to 1, then the constituents were segregated, based on relevant target organs. Hazard Quotients (HQs) were summed according to target organs. Constituents were identified as HH COCs if the total organ HQ was greater than or equal to 0.1 and the total organ HI was greater than or equal to 1.

A recommendation of whether or not a HH COC should be carried forward for further remedial evaluation was based on a thorough analysis of each constituent in an uncertainty discussion. COCs that were not eliminated in the refinement process based on a weight-of-evidence evaluation were classified as HH RCOCs.

For concrete slab media (Building 717-C, Contaminated Maintenance Facility), all of the data were carried forward to the risk calculation; no COPC screening was performed. Constituents exceeding 1E-06 risk thresholds were further evaluated in the weight-of-evidence evaluation.

For the surface water media (Potential Release from C-Area Reactor Cooling Water System [186/190C]), the sampling results (maximum concentration) were conservatively compared to MCLs (and tap water RSLs in the absence of a MCL). Constituents that exceed MCL/RSL thresholds were further evaluated in the weight-of-evidence evaluation. No surface water RCOCs were identified.

RCOCs are those constituents that are retained following a weight-of-evidence evaluation and require remedial action. The Risk Assessment Guidance for Superfund Part D tables are presented for the RCOCs in the soil / gravel / concrete media identified in the CAOU BRA to support the HH risk discussion. Tables 2a through 2d lists the RCOCs and their EPCs, Table 3 provides a summary of the cancer toxicity data, and Tables 4a through 4d provide the calculated risk levels for each of the receptor scenarios. Subunits for which RCOCs were determined are discussed below.

Building 717-C, Contaminated Maintenance Facility: surface concrete media, RCOCs identified for the future industrial worker scenario include cesium-137(+D) (risk = 9.3E-06) and strontium-90(+D) (risk = 2.2E-06), with a total cumulative risk (TCR) = 1.2E-05. The primary exposure route of concern is the external radiation pathway. Table 2a lists the RCOCs and their EPCs, and Table 4a provides the calculated risk levels. Figure 3 shows the cesium-137 activities on the concrete slab (maximum = 0.97 pCi/g).

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned: surface soil/gravel media, cesium-137(+D) (risk = 2.8E-06) identified as a RCOC for the future industrial worker scenario. The primary exposure route of concern is the external radiation pathway. Table 2b lists the RCOC and its EPC, and Table 4b provides the calculated risk level. Figure 4 shows the cesium-137 activities in the surface soil/gravel media (maximum = 1.5 pCi/g).

ECODS C-1: surface soil media, RCOCs identified for the future resident scenario include Aroclor 1254 (risk = 1.2E-05), benzo(a)pyrene (risk = 8.5E-06) and benzo(b)fluoranthene (risk = 1.5E-06), with a TCR = 2.2E-05. Aroclor 1254 (risk = 3.6E-06) was identified as a RCOC for the future industrial worker scenario. The primary exposure routes of concern are the ingestion and dermal contact pathways. Table 2c lists the RCOCs and their EPCs, and Table 4c provides the calculated risk levels. Figure 5 shows the concentrations of Aroclor 1254 (maximum = 6.3 mg/kg) and Figure 6 shows the concentrations of benzo(a)pyrene (maximum = 0.128 mg/kg) and benzo(b)fluoranthene (maximum = 0.22 mg/kg) in soil.

Note that the conclusion in the CAOU RFI/RI/BRA/CMS/FS (SRNS 2014a) that asbestos at the ECODS C-1 subunit is a problem warranting action has been re-assessed. The original conclusion was based on investigation results at other ECODS units at SRS where asbestos containing material was encountered in sampling or trenching. However, some ECODS (such as those in B Area) have been shown to not contain any asbestos containing materials. The ECODS C-1 subunit is a set of two trenches that were used to dispose of materials associated with C Area construction from January 1953 to approximately June 1954. The trenches contained trash and construction debris, such as rubble and concrete, as well as broken glass, wire, and nails. These items/materials are documented in the Site Evaluation Report for ECODS C-1 (WSRC 2003). Sections of the trenches were also used as burning pits for combustible waste. There is no history of asbestos disposal at ECODS C-1. In 2002, a total of 96 samples from 24 locations and in 2011, a total of 63 samples from nine locations were taken at ECODS C-1. Asbestos was not encountered in any of the sample materials from the 2002 or the 2011

characterization efforts (e.g., waste transite building material, sometimes associated with ECODS, was not identified). Based on the lack of any samples showing asbestos is present and the lack of any historical records that asbestos was disposed at ECODS C-1, asbestos is not identified as a problem warranting action at the ECODS C-1 subunit.

Outfall C-03: surface soil media, cesium-137(+D) identified as a RCOC for the future resident scenario (risk = 1.9E-05) and future industrial worker scenario (risk = 1.2E-05). The primary exposure route of concern is the external radiation pathway. Table 2d lists the RCOC and its EPC, and Table 4d provides the calculated risk levels. Figure 7 shows the activities of cesium-137(+D) (maximum = 1.19 pCi/g) in soil.

There is no current or projected future use of groundwater as a drinking water source. CAGW has been impacted by previous reactor operations in the area, but the CAGW is a separate FFA OU and not included with the CAOU. Therefore, a HHRA on groundwater was not performed.

Summary of Ecological Risk Assessment (ERA)

The ERA consisted of steps designed to provide a scientifically based and defensible evaluation of exposure and hazard to ecological resources that will support a risk management decision regarding site remediation. Ecological risk is associated with the potential for harmful effects to ecological systems resulting from exposure to an environmental stressor. A stressor is any physical, chemical, or biological entity that induces an environmental response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact.

From an ecological risk perspective, the subunits that are within the industrial area delineated by the C-Area perimeter fence line do not provide any viable habitats that would attract wildlife receptors. Therefore, the exposure pathway for these subunits is incomplete. The subunits outside the C Area perimeter fence do offer marginal resources

(e.g., vegetative cover and/or water) that may attract ecological receptors to some degree. Therefore, these subunits were quantitatively evaluated in the ERA.

Terrestrial receptors evaluated in the ERA include earthworm (soil invertebrate), old-field mouse (herbivorous mammal), short-tailed shrew (insectivorous mammal), raccoon (omnivorous mammal), American robin (insectivorous bird), and red-tailed hawk (carnivorous bird). These receptors were evaluated for the (0 to 0.3 m [0 to 1 ft] and 0.3 to 1.2 m [1 to 4 ft]) soil depth intervals.

There were no ECO RCOCs identified for any of the CAOU subunits.

Summary of the Fate and Transport Analysis

A CM analysis was performed to identify CM COCs. A constituent was identified as a CM COC if leachability modeling predicted the constituent will leach to groundwater and exceed MCLs (or RSLs/PRGs in the absence of a MCL) within 1,000 years. No CM RCOCs were identified at the CAOU as a result of this evaluation.

Discussion of Principal Threat Source Material (PTSM)

Source material are those materials that include or contain hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air that acts as a source for direct exposure. Principal threat waste is defined as those source materials that have a high toxicity or mobility and cannot be reliably contained or present a significant risk to HH or the environment (USEPA 1991). This source material is referred to as PTSM at SRS, and includes liquids or other highly mobile materials having high concentrations of toxic compounds. The identification of PTSM based on mobility is evaluated under the CM analysis. In order to determine whether contaminants in soil at the CAOU should be considered PTSM, a quantitative assessment evaluating the toxicity of the source material was performed. The maximum detected concentration for each constituent in the all media at all depths was used in the evaluation. No PTSM RCOCs were identified at the CAOU as a result of this evaluation.

Radionuclides were qualitatively identified as PTSM due to fixed contamination inside the C-Area PSL as Abandoned pipelines. The NTCR action grouted all openings to the pipelines to prevent direct contact. The potential residual fixed contamination will require LUCs to prevent potential excavation of the pipelines.

Conclusions

Various subunits that are located within the current C-Area perimeter fence line were determined to have no problems warranting action under the industrial land use scenario. However, these subunits will be managed with LUCs to prevent unrestricted use along with the other subunits that are within the perimeter fence that have RCOCs formally identified (i.e., Building 717-C, Contaminated Maintenance Facility; C-Area Reactor Area Cask Car Railroad Tracks as Abandoned: and C-Area PSLs as Abandoned). In addition, the ECODS C-1 and Outfall C-03 subunits have identified RCOCs for both the future resident and future industrial worker scenarios and will also require LUCs.

No HH RCOCs for either the future resident or the future industrial worker scenario were identified for the following subunits located outside the perimeter fence line: Building 904-89G, Retention Basin for 100-C Containment (including Containment Tank C803-7-1 [NBN]) and Outfall C-01. These subunits qualify for unrestricted use.

No ECO or CM RCOCs were identified for any of the subunits that comprise the CAOU.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

This section discusses the remedial action objectives (RAOs) and RGs for the CAOU. The goals of the early remedial action are to protect HH and the environment and mitigate the effects of contamination.

Remedial Action Objectives

RAOs are media- or OU-specific objectives for protecting HH and the environment. RAOs usually specify potential receptors and exposure pathways, and are identified

during project scoping once the CSM 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.

The future land use of the CAOU is assumed to be industrial land use with USDOE maintaining control of the land. The following RAOs have been identified for the CAOU to support the future land use.

- Prevent future resident exposure to contaminated media or structures located within the perimeter fence line.
- Prevent industrial worker exposure to cesium-137(+D) and strontium-90(+D) contaminated concrete that exceed 1E-06 risk levels at Building 717-C, Contaminated Maintenance Facility subunit.
- Prevent industrial worker exposure to fixed radiological contamination in concrete and/or steel inside the inactive C-Area PSLs as Abandoned that exceeds a 1.0E-06 risk or PTSM levels.
- Prevent industrial worker exposure to cesium-137(+D) in rail bed gravels and soils that exceed 1E-06 risk levels at the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned subunit.
- Prevent residential and industrial worker exposure to Aroclor 1254 in soils that exceed the polychlorinated biphenyl (PCB) applicable, or relevant and appropriate requirement (ARAR) and 1E-06 risk at ECODS C-1 subunit.
- Prevent residential exposure to PAHs in surface soil that exceed 1E-06 risk at ECODS C-1 subunit.
- Prevent residential and industrial worker exposure to cesium-137(+D) in surface soil at Outfall C-03 subunit.

Remedial Goals

Remedial goal options (RGOs) serve to provide a range of cleanup goals for each COC and are typically identified along with the RAOs. Following public comment and approval of the EASB/PP, the final cleanup goals or RGs for the selected remedy are chosen from the RGOs and documented in the EAROD.

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 RFI/RI/BRA/CMS/FS presents a range of HH RGOs (SRNS 2014a) corresponding to target cancer risks of 1E-06, 1E-05 and 1E-04 for the future industrial worker and future resident exposure scenarios, as appropriate. Table 5 shows the RGOs for the CAOU and identifies the most likely RG (based on the 1E-06 risk level, background concentration, or ARAR concentration). LUCs will break the exposure pathway to any residual contamination remaining at the CAOU.

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 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.

Key ARARs associated with each alternative are discussed in more detail in the Description of Alternatives section. The complete list of ARARs for the EA remedy is presented in Table 6.

IX. DESCRIPTION OF ALTERNATIVES

This section presents and summarizes the remedial alternatives for the final remedy for the CAOU. Under CERCLA, it is desirable when practical to offer a range of diverse alternatives to compare during the detailed analysis to arrive at the most effective cost-efficient remedial action. The range of alternatives includes options that 1) immobilize chemicals, 2) reduce the contaminant volume, or 3) reduce the need for long-term, onsite management. The alternatives also include an option that involves little or no treatment yet provides protection to HH and the environment by preventing or controlling exposure through LUCs. For the subunits that have NTCR action, a range of alternatives were previously evaluated in the removal action documents (SRNS 2010b, SRNS 2011a, SRNS 2011b). Subsequent to the NTCR actions, residual risks are relatively low as described in Section V and no risk to the environment exists. Thus, for the subunits requiring further action in the CAOU, a No Action and LUC remedial alternative were

determined to be adequate as agreed to in the RFI/RI/BRA/CMS/FS document (SRNS 2014a) and are discussed below.

Remedy Components, Common Elements, and Distinguishing Features of Each Alternative

Alternative 1 – No Action

Alternative 1 consists of performing no action to address contamination at the subunits in the CAOU. Contaminated media would remain in place and no engineered controls, institutional controls, or active remediation would be conducted to control future potential risk to the industrial worker or future resident, to treat or remove contaminated media, or to reduce toxicity, mobility, or volume of the contaminated media. There is no 5-year remedy review for the No Action alternative.

Alternative 2 – Land Use Controls

Alternative 2 involves the use of LUCs to limit access to and the use of the contaminated portions of the CAOU so human exposure to contaminated media is controlled within acceptable limits for the industrial worker and/or future resident. This alternative does not remove or eliminate receptor exposure potential by removal or treatment of hazardous substances – only exposure is controlled. Through administrative and engineering controls, work activities would be limited and controlled by the use of work clearance permits throughout the area of contamination. The LUCs alternative would restrict access to, contact with, and excavation of the contaminated media. Warning signs would be posted informing personnel to contact the waste unit custodian prior to conducting work to prevent contact with hazardous substances. The use of LUCs can prevent the current and future industrial worker from being exposed to hazardous substances in the contaminated media. Deed restrictions would be in place for the future resident scenario.

Because there is no excavation, treatment, or removal of contaminated media in Alternative 2, LUCs will be needed to control access and land use for the entire area where contaminants were found. Figure 8 shows the approximate LUC boundaries that

will cover the entire area inside the perimeter fence line (~35 hectares [86 acres]) and the two (2) subunits outside the perimeter fence line: ECODS C-1, which is 3,600 m^2 (38,750 ft^2), and Outfall C-03, which is 340 linear m (1,115 linear ft). For the purposes of cost estimation, it is assumed that LUCs will need to be in effect for 200 years. The actual time requirement may vary by subunit. For those areas within the fence line, it is expected LUCs will be required for greater than 200 years, as the residual contamination associated with the reactor building complex will be long-lived. For Outfall C-03, LUCs will likely be required for less than 200 years, due to radioactive decay of cesium-137, which has a half-life of ~30 years.

Periodic (annual) inspections will be required and periodic maintenance (e.g., sign repair) will be performed to ensure that the LUCs remain protective.

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 CFR 300.430(e)(9)] requires that potential remedial alternatives undergo detailed analysis using relevant evaluation criteria that will be used to select a final remedy. USEPA has established nine evaluation criteria to address the statutory requirements under CERCLA. The criteria fall into categories of threshold criteria, primary balancing criteria, and modifying criteria. The nine evaluation criteria are detailed in Table 7.

Comparative Analysis of Alternatives

The potential remedial alternatives have been evaluated against the threshold, primary, and modifying balancing criteria. Provided below is a summary of the comparison of the alternatives 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 8.

Overall Protection of Human Health and the Environment

Alternative 1 – No Action: The No Action alternative would not address potential risk to the industrial worker or future resident from exposure to the contaminated media in each subunit of the CAOU. This alternative does not reduce risk to HH.

Alternative 2 – LUCs: The exposure pathway is broken by controlling access to and use of the contaminated areas by preventing exposure of the industrial worker and any other HH receptors (i.e., future residents). This alternative does not remove or treat any contaminants; however, the application of LUCs does prohibit unrestricted use and access to the contaminated subunits unless authorized by the issuance of a valid work clearance permit which establishes safe working conditions and control of the work activities. Deed restrictions would be in place at appropriate subunits for the potential future resident. Even though the contaminated media is not removed or treated under this alternative and the potential risk remains unchanged, LUCs, which include engineering and administrative controls, can be effective to protect HH receptors by breaking the exposure pathway.

Compliance with ARARs

Alternative 1 – No Action: Chemical-Specific ARARs: The No Action alternative does not meet the Chemical-Specific ARAR for PCBs. It is non-protective.

Location-Specific ARARs: No location-specific ARARs are associated with the No Action alternative.

Action-Specific ARARs: The No Action alternative does not meet the Action-Specific ARARs for PCBs. It is non-protective.

Alternative 2 – LUCs: Chemical-Specific ARARs: One chemical-specific ARAR was identified for the ECODS C-1 subunit for the PCB Aroclor 1254. 40 CFR §761.61(a)(4)(i)B)(1) establishes a cleanup level of ≤25 ppm for bulk PCB remediation waste in "low-occupancy areas" (as defined in 40 CFR §761.3). The maximum concentration at which Aroclor 1254 was detected at the ECODS C-1 subunit was

6.3 mg/kg. This ARAR will also be achieved through preventing exposure to PCBs by restricting land uses to low-occupancy uses at the ECODs C-1 subunit.

Location-Specific ARARs: No location-specific ARARs are associated with Alternative A-2.

Action-Specific ARARs: Action-specific ARARs were identified for the ECODS C-1 subunit for the PCB Aroclor 1254. 40 CFR §761.61(a)(8)(i)(A) establishes relevant and appropriate requirements for "low occupancy areas" (as defined in 40 C.F.R. §761.3), such as recording deed restrictions on the property to notify any potential owner that the property contains bulk PCB remediation waste and to restrict uses to low occupancy. These ARARs will be achieved through implementation of the EALUCIP for the CAOU and through deed restrictions as required by CERCLA §120(h)(3)..

The list of ARARs for the EA remedy is presented in Table 6.

Short-Term Effectiveness

Alternative 1 – No Action: Implementation of the No Action alternative would not endanger the surrounding communities or remedial workers or adversely affect the environment. However, exposure to the contaminants present at CAOU would not be prevented.

Alternative 2 – LUCs: This alternative poses no risk to industrial workers or the community because in implementing LUCs no construction work will be performed which disturbs the contaminated media at any subunit within the CAOU. All of the contaminated media are within an area with restricted access (SRS proper); therefore, it is not accessible to members of the public or community. There is no hazard to nearby communities since there are none in proximity. This alternative can be implemented in a timely manner.

Long-Term Effectiveness and Permanence

Alternative 1 – No Action: Residual risk to HH under future conditions at the CAOU subunits would remain unchanged under the No Action alternative. This alternative does not provide for long-term effectiveness or permanence.

Alternative 2 – LUCs: The long-term effectiveness for protecting HH can be achieved under this alternative as long as unit-specific LUCs are maintained. Risks are prevented by controlling access to and use of the contaminated area by preventing exposure of the industrial worker and any other HH receptors. LUCs will be maintained until the concentration of hazardous substances in the media is at such levels to allow for unrestricted use and exposure. An EALUCIP will be prepared by the USDOE that describes the implementation and maintenance actions for the remedial action, including periodic inspections. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs. The EALUCIP will remain in effect unless and until modifications are approved by the USEPA and SCDHEC as needed to be protective of HH. EALUCIP modification will only occur through another CERCLA document.

The timeframe for LUCs is estimated for 200 years of duration as a baseline for a cost estimate. The actual time requirement may vary by subunit as explained earlier. For the purposes of the cost analysis, it was estimated that remedy reviews will be performed every five years for a total of 41 reviews. Periodic inspections will be performed to ensure warning signs are in place and no unauthorized encroachment onto the controlled area is occurring. Signs will be replaced and/or repaired as needed and records for Site Use/Site Control permits will be maintained within the SRS infrastructure.

Since all the subunits of the CAOU are within the SRS boundary, the reliability of access control should be high.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 – No Action: Active treatment or removal of contaminated media to reduce toxicity, mobility, or volume is not associated with the No Action alternative; therefore, there is no reduction in the toxicity, mobility or volume of contaminants in the subunits.

Alternative 2 – LUCs: No active treatment systems are associated with the LUCs alternative that would reduce the toxicity, mobility, or volume of hazardous substances associated with the CAOU subunits. This alternative prevents receptor exposure to the contaminants through controlled access and limiting use. In addition, the toxicity of cesium-137 is also reduced over time through natural decay.

Implementability

Alternative 1 – No Action: Since this alternative requires no action, implementability is not a consideration.

Alternative 2 – LUCs: LUCs are currently active in all areas of SRS. LUCs have been easily implemented at many waste units at SRS (e.g., PAOU and RAOU). The implementation of LUCs presents no technical or administrative impediments.

Cost

Alternative 1 – No Action: There is no present-worth cost estimated for the No Action alternative since there is no action implemented and no 5-year remedy review. A summary of the estimates cost is below.

Total Present-Worth Cost $0

Alternative 2 – LUCs: Costs for LUCs are considered minimal. Costs associated with this alternative include posting warning signs around the perimeter of each of the subunits where the contaminated media is located. SRS will also control access to and prohibit excavation of the subunits through the Site Use/Site Control permit system. For the long term, deed restrictions will be put into place so transfer of the affected properties

will not occur. A review of the remedy will be performed every five years estimated over a 200 year duration. Detail for the cost estimate is provided in Table 9. A summary of the estimated present-worth cost is presented below:

Total Capital Cost	***$131,583***
Total Present-Worth O&M Cost	***$2,136,579***
Total Estimated Cost	***$2,268,162***

Summary of Analysis

Alternative 1, No Action, does not meet the threshold criteria for overall protection of HH and the environment nor compliance with ARARs. Alternative 2, LUCs, does meet the threshold criteria and compares favorably against the No Action alternative using the balancing criteria. Alternative 2 is protective of the industrial worker and the future resident and can meet the RAOs for all the subunits of the CAOU, but leaves contamination in place. However, residual risks are low (less than 1.0E-04) and will be somewhat reduced over time as cesium-137(+D), the primary risk driver at the CAOU (and strontium-90 [+D], to a lesser extent) naturally decays.

Alternative 2 is a relatively low cost alternative to implement and maintain, but leaves hazardous substances in place and residual risk remains greater than 1.0E-06 or SRS background concentrations. Alternative 2 also is the only Likely Response Action agreed to during scoping of the project, is consistent with previous remedial decisions at RAOU and PAOU, complements the early removal actions taken in the CAOU, and is expected to be consistent with the final remedial decision at CAOU upon closure of C Area.

The quantitative ranking is shown in Table 10. Alternative 2 – LUCs scores more favorably than Alternative 1 – No Action.

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

In order to prevent the potential exposure to the industrial worker and/or future resident to the contaminated or potentially contaminated media at CAOU, the preferred alternative for the following CAOU subunits is Alternative 2 – LUCs:

- Building 717-C, Contaminated Maintenance Facility;
- C-Area PSLs as Abandoned (including the Process Water Storage Tank [106-C], Cooling Water Effluent Sump [107-C], and Storage Basin [109-C]);
- C-Area Reactor Area Cask Car Railroad Tracks as Abandoned;
- Potential Release from C-Area Disassembly Basin (including the Pre-Manufactured Metal Shelter [710-C]);
- Potential Release from C-Area Reactor CWS (186/190-C);
- ECODS C-1; and,
- Outfall C-03.

The following LUC objectives are necessary to ensure protectiveness of the selected remedy for the CAOU subunits where residual hazardous substances remain that pose a threat to HH:

- Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media (i.e., soil / gravel / concrete / steel).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

LUCs for the CAOU are presented in Table 11 and include the following:

- Signage will be located at the boundaries shown in Figure 8 to alert on-Site workers to the presence of hazardous substances and to require contacting the waste unit

custodian prior to conducting any work to prevent contact with hazardous substances. The date for installation of the signs will be stated in the unit-specific EALUCIP referenced in EAROD.

- Institutional Controls (i.e., administrative measures) and use restrictions for on-Site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements.

- SRS access controls to prevent exposure to trespassers, as described in the 2013 RCRA Permit Renewal Application, Volume I, 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.

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 EAROD 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 EA remedy for the CAOU 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 HH 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) (WSRC 1999b) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific EALUCIP referenced in this EAROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy, and will be subject to review and approval by USEPA and SCDHEC. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this EAROD. The EALUCIP, 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 EALUCIP will be appended to the LUCAP and is considered incorporated by reference into the EAROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the *Federal Facility Agreement for the Savannah River Site*. The approved EALUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The EALUCIP will remain in effect unless and until modifications are approved as needed to be protective of HH 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 USEPA 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 CAOU to future industrial use and will prohibit residential use of the area. 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

The estimated present-worth cost to implement Alternative 2 - LUCs is $2,268,162 (Table 9). The information in this cost estimate summary 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 ARF, an explanation of significant difference, or an EAROD 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

Based on information currently available, only Alternative 2 – LUCs, meets the threshold criteria of protection of HH and complies with ARARs. Baseline risks identified in the BRA will be reduced through control of the pathway to exposure. Figure 9 is a generic CSM for the CAOU subunits that illustrates how the primary exposure pathways of concern will be broken/rendered incomplete upon implementation of the selected EA remedy. The USDOE expects the Selected Remedy to satisfy the statutory requirements in CERCLA Section 121(b) to: be protective of HH and the environment, comply with

ARARs, and be cost-effective. Alternative 2 is protective of the industrial worker and the future resident and can meet the RAOs for all the subunits of the CAOU, but leaves contamination in place. However, residual risks are low (less than 1.0E-04) and will be somewhat reduced over time as cesium-137(+D), the primary risk driver at the CAOU (and strontium-90[+D], to a lesser extent) naturally decays. In addition, Alternative 2 is a relatively low cost alternative to implement and maintain and is consistent with previous remedial decisions at RAOU and PAOU, complements the early removal actions taken in the CAOU, and is expected to be consistent with the final remedial decision at CAOU upon closure of C Area.

The following CAOU subunits have no final RCOCs; thus No Action is the appropriate response and the subunits are available for unrestricted land use:

- Building 904-89G, Retention Basin for 100-C Containment (including Containment Tank C803-7-1 [NBN]; and
- Outfall C-01.

The administrative path for two of the initially-evaluated CAOU subunits in the RFI/RI/BRA/CMS/FS has been altered as follows:

- Building 108-3C, Fuel Unloading Facilities Power – Area Supervisor subunit has been moved to the CAGW OU and was not evaluated in the EASB/PP or this EAROD.

- CADC subunit was not evaluated in the EASBPP or this EAROD. Existing data and analysis presented in the RFI/RI/BRA/CMS/FS will be used for the final CAOU SB/PP provided no new missions begin operations within CAOU.

Waste Disposal and Transport

There will be no waste generated as a result of implementing the selected remedy.

XII. STATUTORY DETERMINATIONS

Based on the unit RFI/RI/BRA report, portions of the CAOU pose a threat to HH and the environment. Therefore, Alternative 2 - LUCs has been selected as the EA remedy for the CAOU. As part of the selected EA remedy, the future land use for these portions of the CAOU 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 five years of initiation of the early remedial action, and every five years thereafter, to ensure that the remedy continues to be protective of HH and the environment.

The selected EA remedy is protective of HH and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The EA remedy in this OU does not satisfy the statutory preference for treatment as a principal element of the remedy since LUCs are not a form of treatment.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy/remedies selected in this EAROD do not contain any significant changes from the preferred alternative(s) presented in the EASB/PP. No comments were received during the public comment period.

XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary is included as Appendix A of this document.

XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

A summary of the key deliverables and submittal dates for the CAOU is shown in Figure 10 and is summarized below:

- Submit Revision 0, Early Action Record of Decision — January 2015
- Submit Revision 0, Early Action Land Use Control Implementation Plan — May 2015
- Early Action Remedial Action Start — January 2016
- Submit Revision 0, Early Action Corrective Measures Implementation Report / Remedial Action Completion Report — March 2016

XVI. REFERENCES

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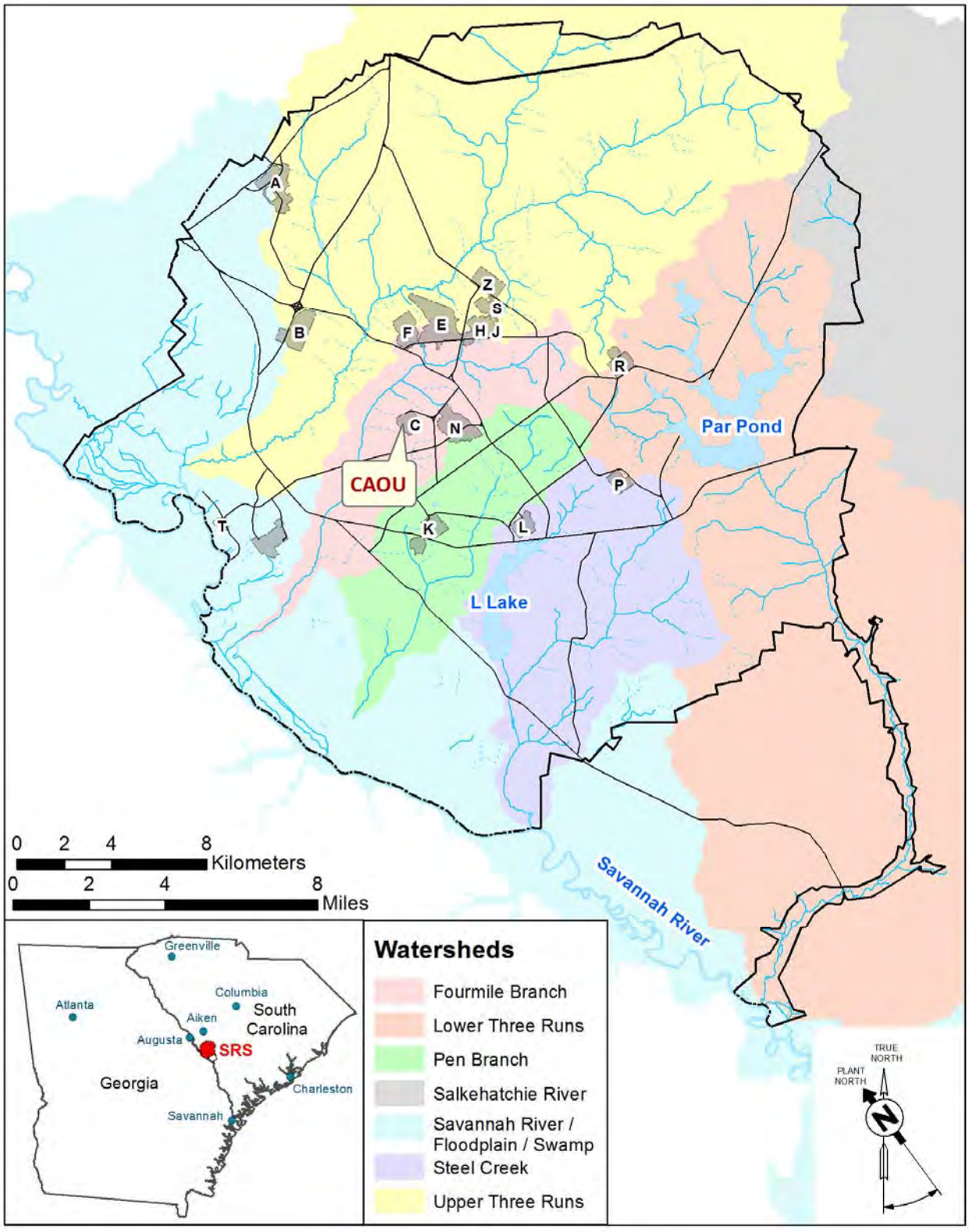


Figure 1. Location of the CAOU within the Savannah River Site

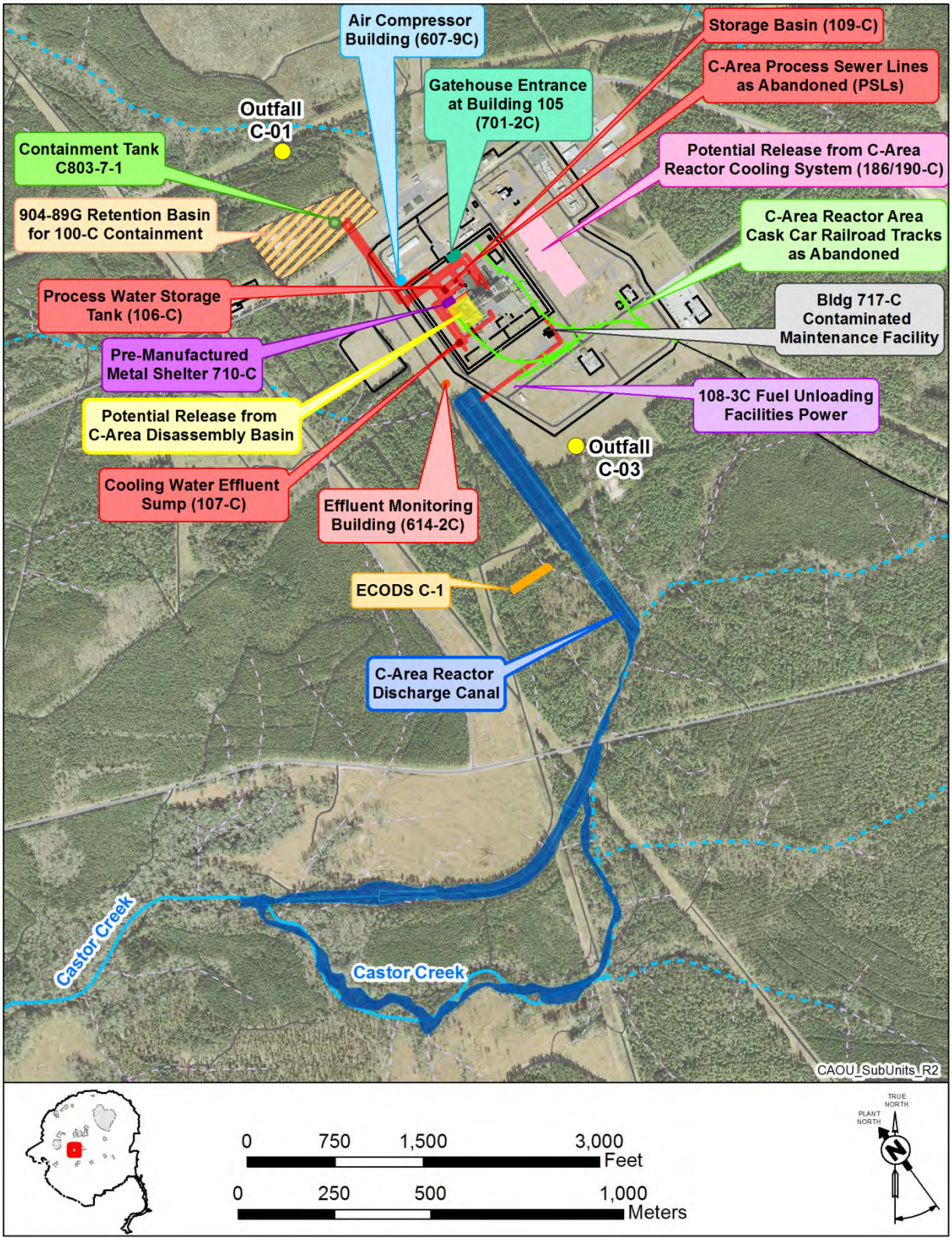


Figure 2. Layout of the CAOU

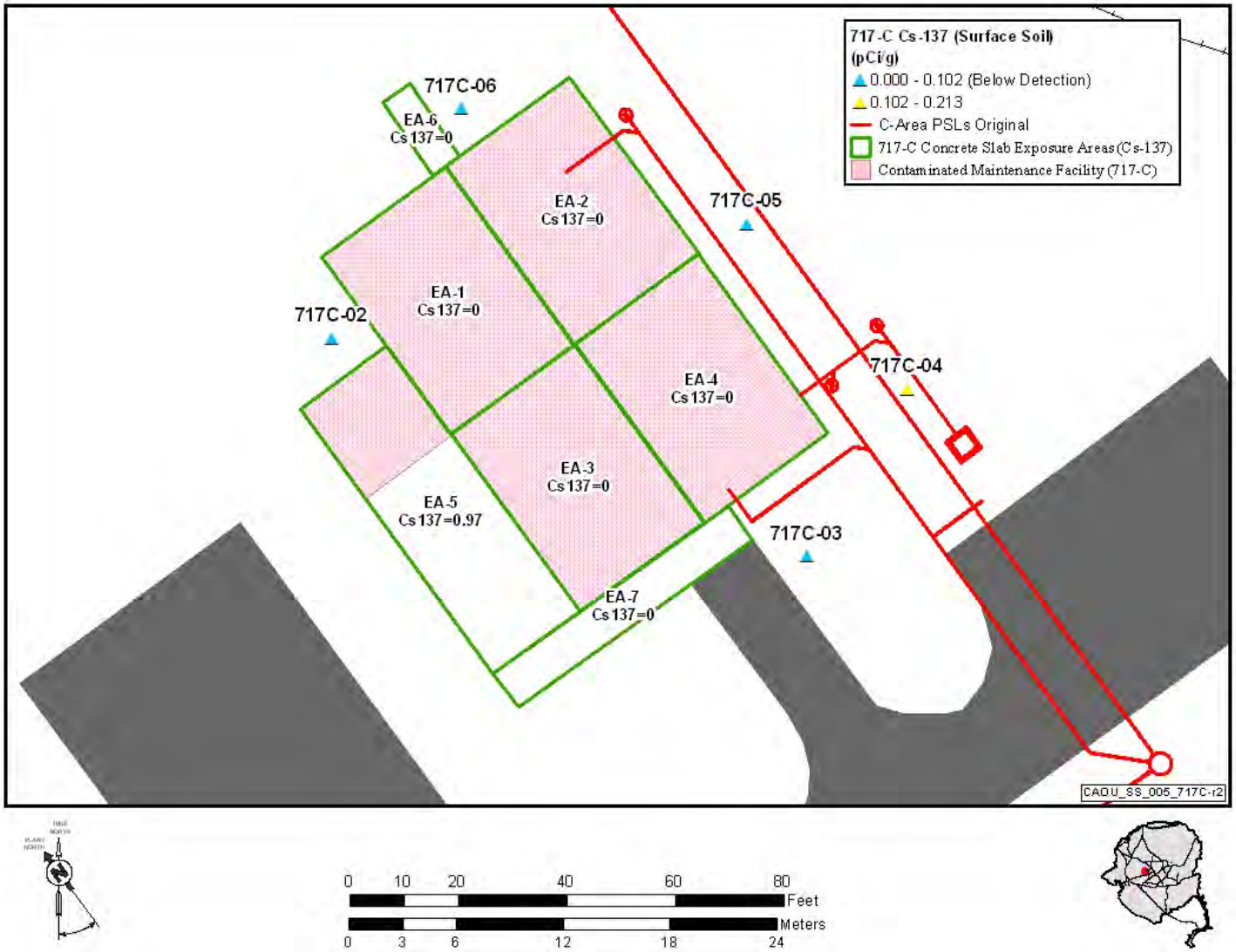


Figure 3. Contaminated Maintenance Facility (717-C) Cesium-137 Activities

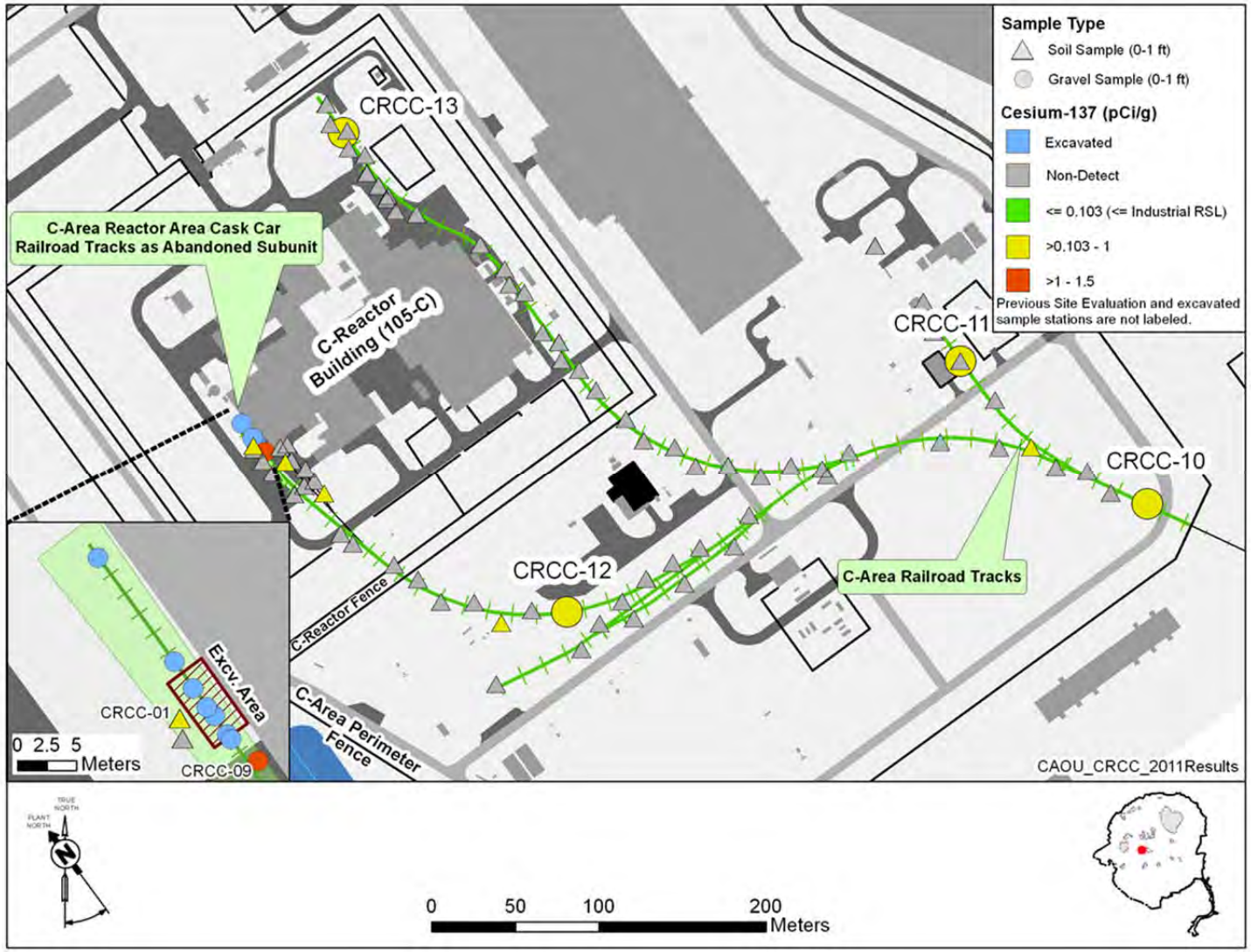


Figure 4. C-Area Reactor Area Cask Car Railroad Tracks Cesium-137 Activities

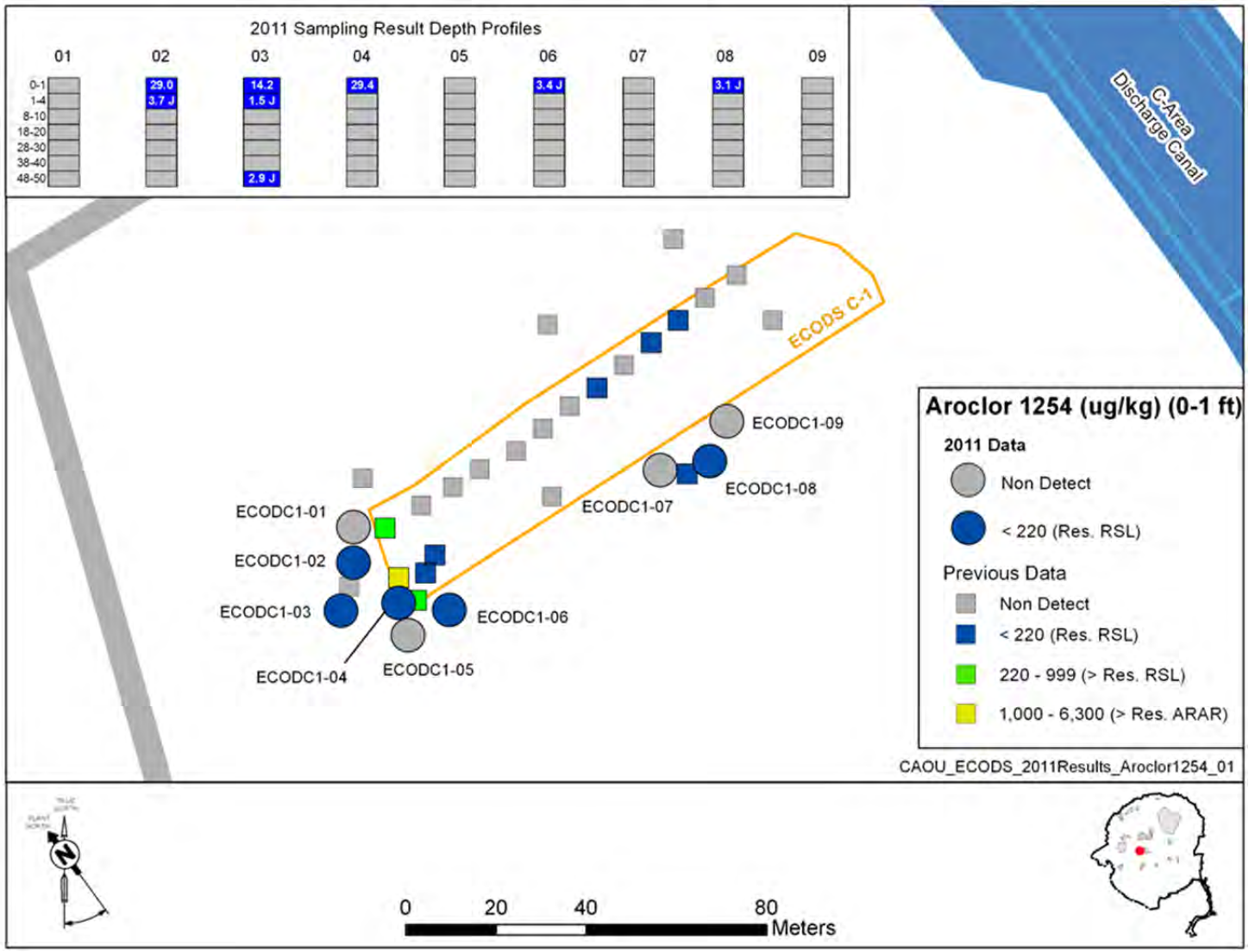


Figure 5. ECODS C-1 Aroclor 1254 (PCB) Soil Data

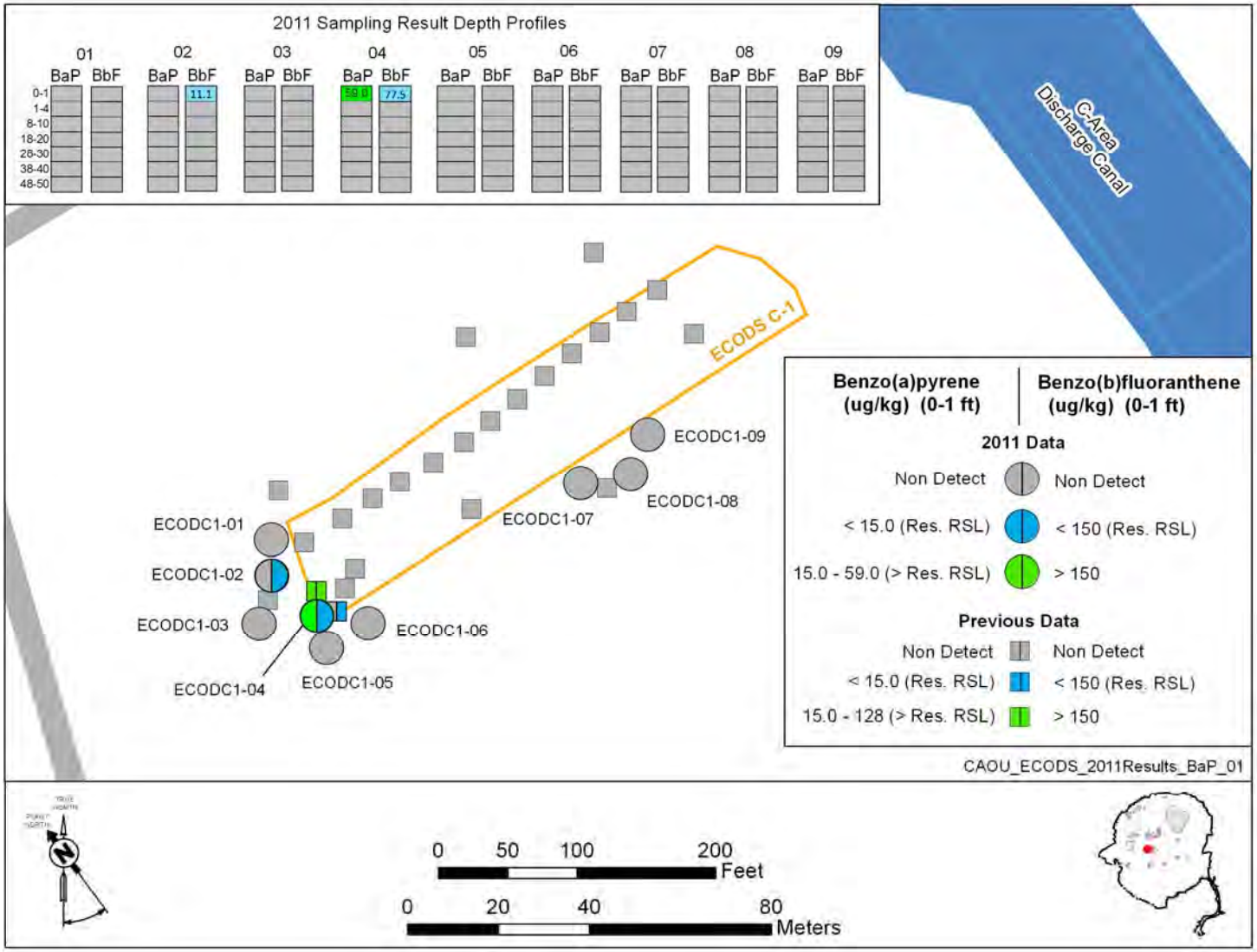


Figure 6. ECODS C-1 Benzo(a)pyrene and Benzo(b)fluoranthene Soil Data

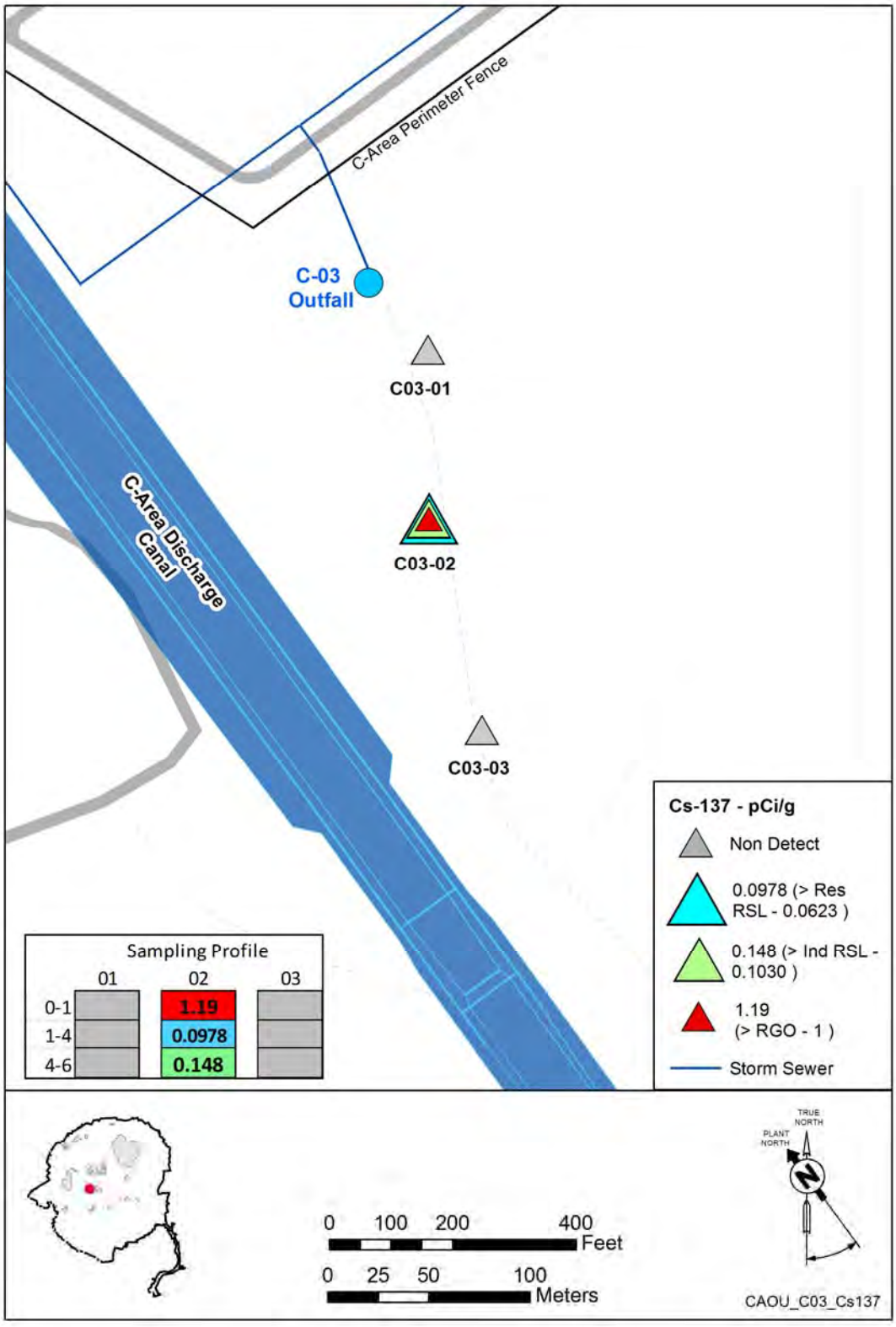


Figure 7. Outfall C-03 Cesium-137 Activities

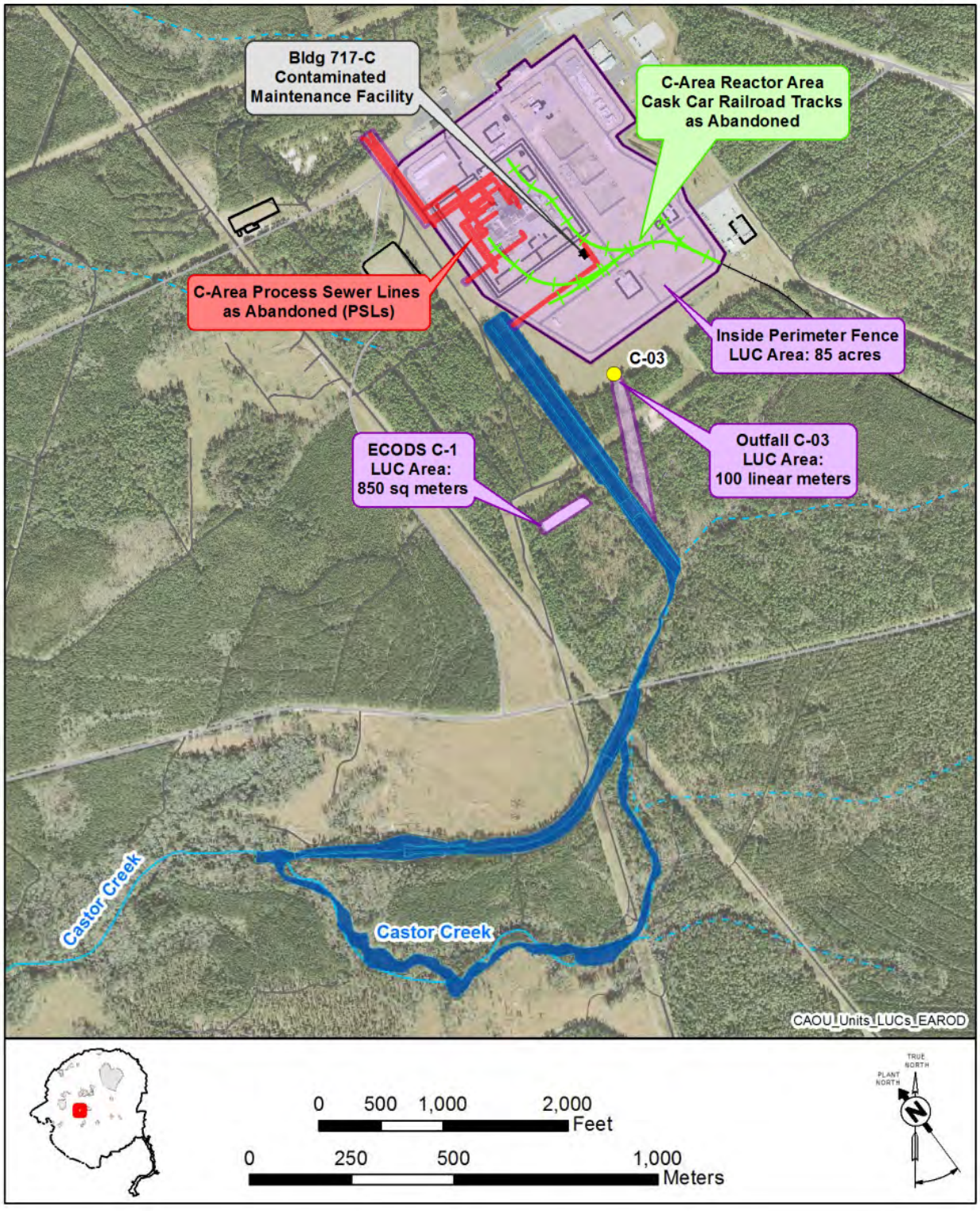
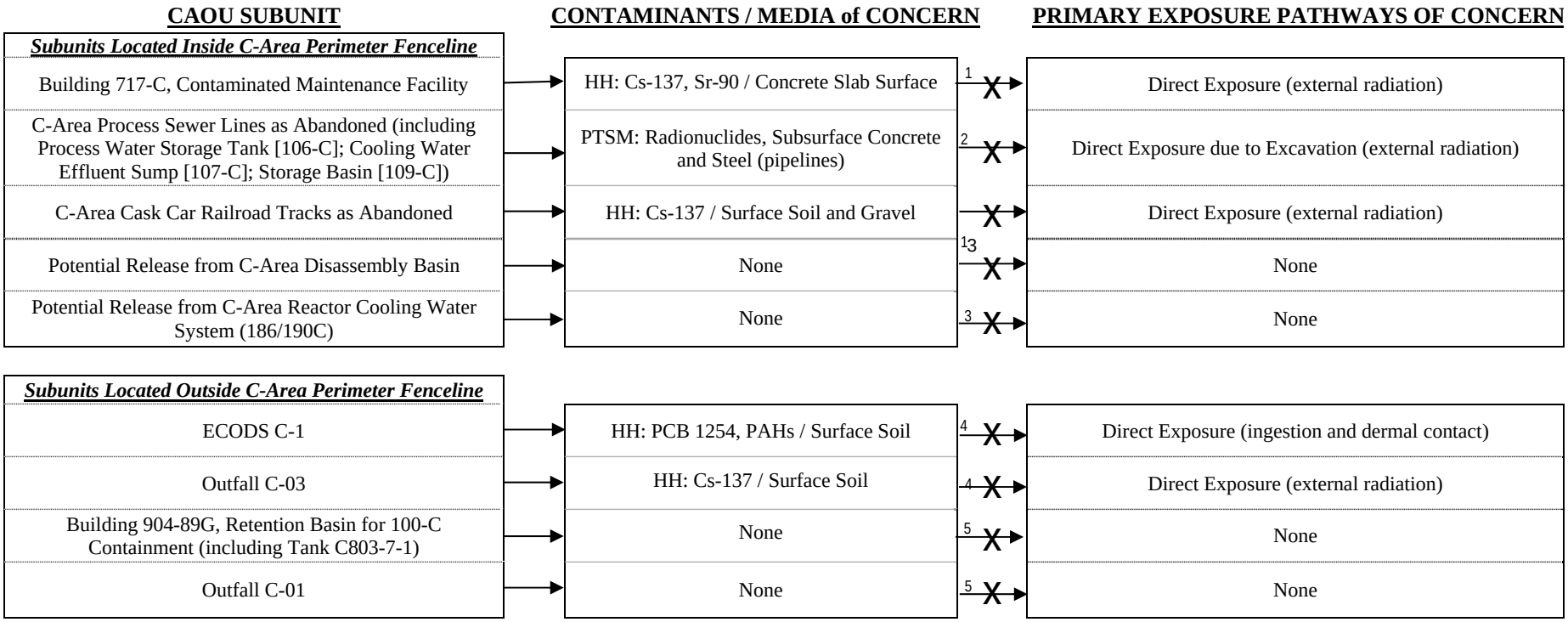


Figure 8. Estimated Area of LUCs

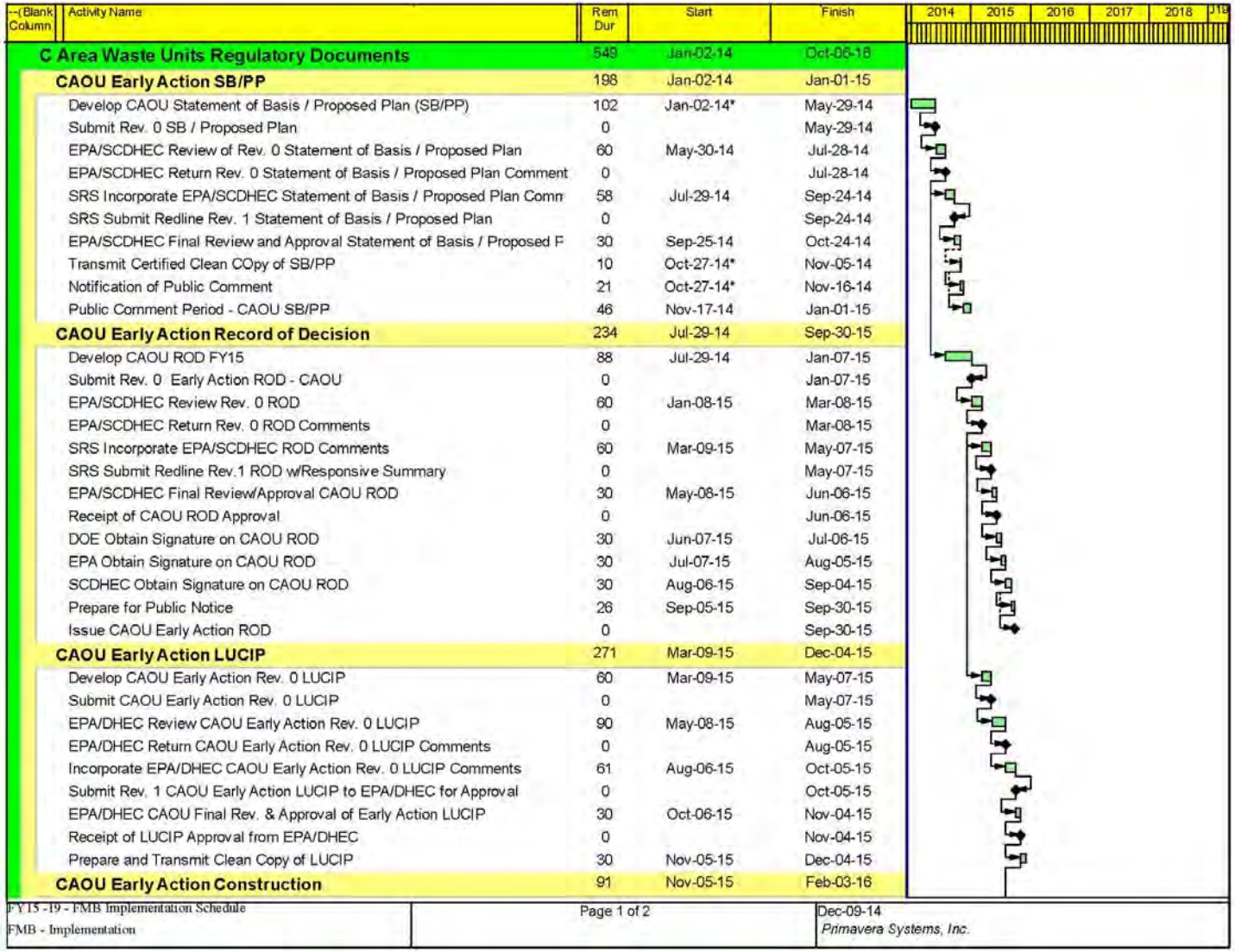


LEGEND

→ Complete exposure pathway —X→ Incomplete exposure pathway due to early remedial action HH = human health risk assessment PTSM = principal threat source material

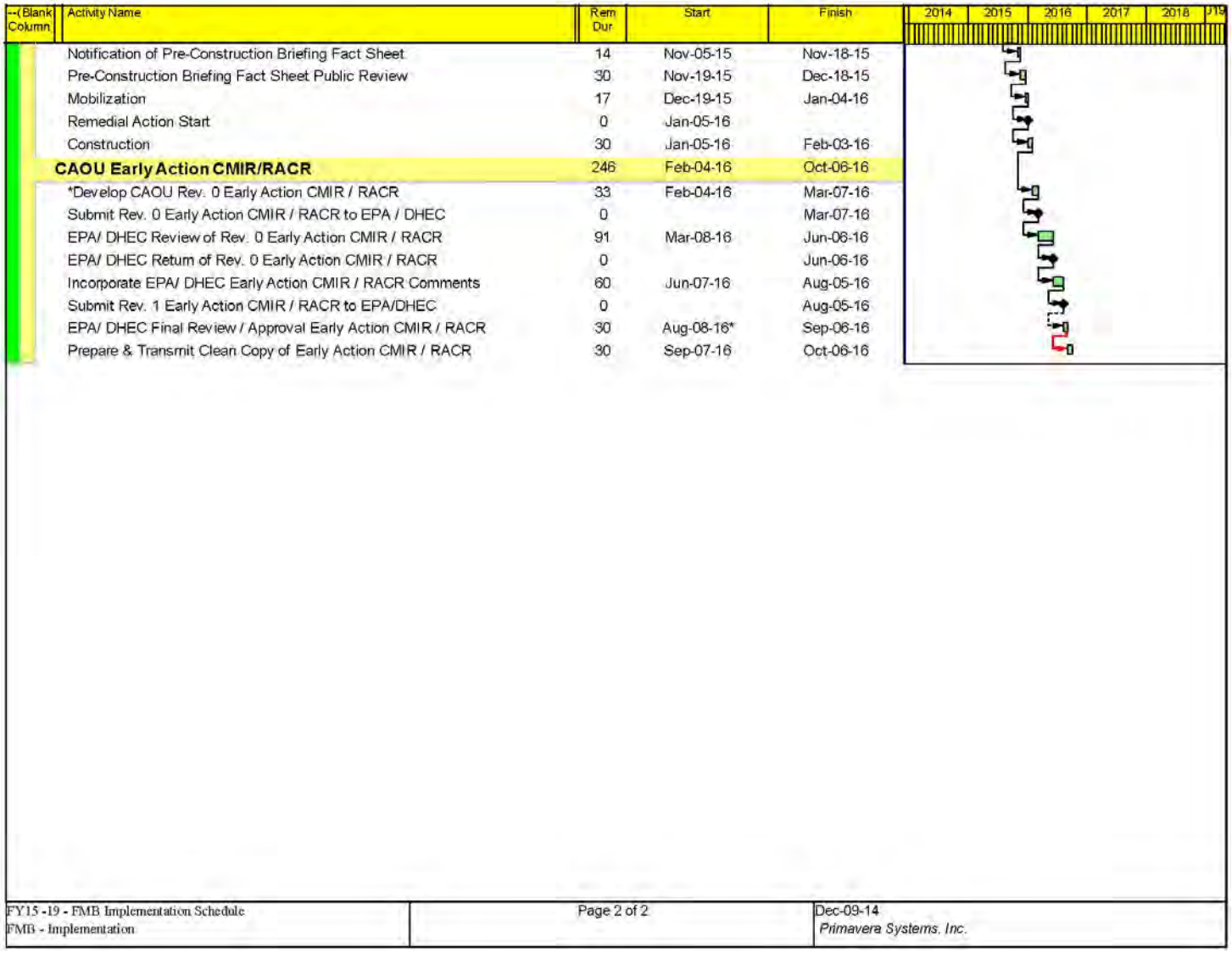
1 - COCs identified based on an evaluation of the industrial land use scenario; CAOU Land Use Controls required to prevent land disturbance activities and unrestricted land use.
2 - Radionuclides qualitatively identified as PTSM due to fixed contamination inside buried pipelines; CAOU Land Use Controls required to prevent land disturbance activities and unrestricted land use.
3 - No COCs identified based on an evaluation of the industrial land use scenario; CAOU Land Use Controls required to prevent unrestricted land use.
4 - COCs identified based on an evaluation of the residential and industrial land use scenarios; CAOU Land Use Controls required to prevent land disturbance activities and unrestricted land use.
5 - No COCs identified based on either the residential or industrial land use scenario; Land Use Controls are not required and unrestricted use is permitted (No Action).

Figure 9. CAOU Generic Conceptual Site Model after Completion of Early Remedial Action



--(Blank Column	Activity Name	Rem Dur	Start	Finish
	C Area Waste Units Regulatory Documents	549	Jan-02-14	Oct-06-16
	CAOU Early Action SB/PP	198	Jan-02-14	Jan-01-15
	Develop CAOU Statement of Basis / Proposed Plan (SB/PP)	102	Jan-02-14*	May-29-14
	Submit Rev. 0 SB / Proposed Plan	0		May-29-14
	EPA/SCDHEC Review of Rev. 0 Statement of Basis / Proposed Plan	60	May-30-14	Jul-28-14
	EPA/SCDHEC Return Rev. 0 Statement of Basis / Proposed Plan Comment	0		Jul-28-14
	SRS Incorporate EPA/SCDHEC Statement of Basis / Proposed Plan Comn	58	Jul-29-14	Sep-24-14
	SRS Submit Redline Rev. 1 Statement of Basis / Proposed Plan	0		Sep-24-14
	EPA/SCDHEC Final Review and Approval Statement of Basis / Proposed F	30	Sep-25-14	Oct-24-14
	Transmit Certified Clean COpy of SB/PP	10	Oct-27-14*	Nov-05-14
	Notification of Public Comment	21	Oct-27-14*	Nov-16-14
	Public Comment Period - CAOU SB/PP	46	Nov-17-14	Jan-01-15
	CAOU Early Action Record of Decision	234	Jul-29-14	Sep-30-15
	Develop CAOU ROD FY15	88	Jul-29-14	Jan-07-15
	Submit Rev. 0 Early Action ROD - CAOU	0		Jan-07-15
	EPA/SCDHEC Review Rev. 0 ROD	60	Jan-08-15	Mar-08-15
	EPA/SCDHEC Return Rev. 0 ROD Comments	0		Mar-08-15
	SRS Incorporate EPA/SCDHEC ROD Comments	60	Mar-09-15	May-07-15
	SRS Submit Redline Rev.1 ROD w/Responsive Summary	0		May-07-15
	EPA/SCDHEC Final Review/Approval CAOU ROD	30	May-08-15	Jun-06-15
	Receipt of CAOU ROD Approval	0		Jun-06-15
	DOE Obtain Signature on CAOU ROD	30	Jun-07-15	Jul-06-15
	EPA Obtain Signature on CAOU ROD	30	Jul-07-15	Aug-05-15
	SCDHEC Obtain Signature on CAOU ROD	30	Aug-06-15	Sep-04-15
	Prepare for Public Notice	26	Sep-05-15	Sep-30-15
	Issue CAOU Early Action ROD	0		Sep-30-15
	CAOU Early Action LUCIP	271	Mar-09-15	Dec-04-15
	Develop CAOU Early Action Rev. 0 LUCIP	60	Mar-09-15	May-07-15
	Submit CAOU Early Action Rev. 0 LUCIP	0		May-07-15
	EPA/DHEC Review CAOU Early Action Rev. 0 LUCIP	90	May-08-15	Aug-05-15
	EPA/DHEC Return CAOU Early Action Rev. 0 LUCIP Comments	0		Aug-05-15
	Incorporate EPA/DHEC CAOU Early Action Rev. 0 LUCIP Comments	61	Aug-06-15	Oct-05-15
	Submit Rev. 1 CAOU Early Action LUCIP to EPA/DHEC for Approval	0		Oct-05-15
	EPA/DHEC CAOU Final Rev. & Approval of Early Action LUCIP	30	Oct-06-15	Nov-04-15
	Receipt of LUCIP Approval from EPA/DHEC	0		Nov-04-15
	Prepare and Transmit Clean Copy of LUCIP	30	Nov-05-15	Dec-04-15
	CAOU Early Action Construction	91	Nov-05-15	Feb-03-16

Figure 10. Implementation Schedule for the CAOU



--(Blank Column	Activity Name	Rem Dur	Start	Finish
	Notification of Pre-Construction Briefing Fact Sheet	14	Nov-05-15	Nov-18-15
	Pre-Construction Briefing Fact Sheet Public Review	30	Nov-19-15	Dec-18-15
	Mobilization	17	Dec-19-15	Jan-04-16
	Remedial Action Start	0	Jan-05-16	
	Construction	30	Jan-05-16	Feb-03-16
	CAOU Early Action CMIR/RACR	246	Feb-04-16	Oct-06-16
	*Develop CAOU Rev. 0 Early Action CMIR / RACR	33	Feb-04-16	Mar-07-16
	Submit Rev. 0 Early Action CMIR / RACR to EPA / DHEC	0		Mar-07-16
	EPA/ DHEC Review of Rev. 0 Early Action CMIR / RACR	91	Mar-08-16	Jun-06-16
	EPA/ DHEC Return of Rev. 0 Early Action CMIR / RACR	0		Jun-06-16
	Incorporate EPA/ DHEC Early Action CMIR / RACR Comments	60	Jun-07-16	Aug-05-16
	Submit Rev. 1 Early Action CMIR / RACR to EPA/DHEC	0		Aug-05-16
	EPA/ DHEC Final Review / Approval Early Action CMIR / RACR	30	Aug-08-16*	Sep-06-16
	Prepare & Transmit Clean Copy of Early Action CMIR / RACR	30	Sep-07-16	Oct-06-16

Figure 10. Implementation Schedule for the CAOU *(Continued/End)*

Table 1. CAOU Risk Summary

Subunit	Media	ARAR[1]	PTSM[2]	HHRA[3]	ERA[4]	CM[5]
Building 717-C, Contaminated Maintenance Facility	Soil	None	None	*Resident*: NC *Worker:* None	NC	None
	Concrete	None	None	*Resident:* NC *Worker*: **Cs-137 (risk = 9.3E-06); Sr-90 (risk = 2.2E-06); TCR = 1.2E-05**	NC	None
C-Area Process Sewer Lines as Abandoned	Concrete / Steel	None	**Radionuclides**[6]	*Resident:* NC *Worker*: None	NC	None
C-Area Reactor Area Cask Car Railroad Tracks as Abandoned	Soil/Gravel	None	None	*Resident:* NC *Worker:* **Cs-137 (risk = 2.8E-06)**	NC	None
Potential Release from C-Area Disassembly Basin	Soil	None	None	*Resident:* NC *Worker*: None	NC	None
Potential Release from C-Area Reactor Cooling Water System (186/190C)	Soil/Sediment	None	None	*Resident*: NC *Worker:* None	NC	None
	Surface Water	None	None	*Resident:* NC *Worker:* None	NC	NC
Building 904-89G, Retention Basin for 100-C Containment	Soil	None	None	*Resident:* None *Worker:* None	None	None
ECODS C-1	Soil	**PCB 1254**	None	*Resident:* **PCB 1254 (risk = 1.2E-05); Benzo(a) pyrene (risk = 8.5E-06); Benzo(b)fluoranthene (risk = 1.5E-06); TCR = 2.2E-05** *Worker:* **PCB 1254 (risk = 3.6E-06)**	None	None
Outfall C-01	Soil	None	None	*Resident:* None *Worker:* None	None	None
Outfall C-03	Soil	None	None	*Resident:* **Cs-137 (risk = 1.9E-05)** *Worker:* **Cs-137 (risk = 1.2E-05)**	None	None

1 - ARAR = applicable or relevant and appropriate requirement
2 - PTSM = principal threat source material evaluation
3 - HHRA = human health risk assessment
4 - ERA = ecological risk assessment
5 - CM = contaminant migration analysis
6 - radionuclides qualitatively identified as PTSM due to fixed contamination inside the pipelines

NC = not calculated for this receptor or this media- for the HHRA, a quantitative residential evaluation was not required for the subunits inside the fence. For the ERA, a quantitative evaluation was not performed for the subunits located inside the fence because the exposure pathways were considered incomplete for wildlife receptors.
TCR = total cumulative risk

Table 2a. Summary of Constituents of Concern and Medium-Specific Exposure Point Concentrations

Building 717-C, Contaminated Maintenance Facility

Scenario Timeframe: Current/Future
Medium: Building 717-C, Contaminated Maintenance Facility Concrete
Exposure Medium: Concrete Slab Surface

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	*Max*					
Direct Contact Concrete Slab Surface Bldg. 717-C	Cesium-137(+D)	ND	0.97	pCi/g	1/7	0.97	pCi/g	Max
	Strontium-90(+D)	ND	26.0	pCi/g	1/7	26.0	pCi/g	Max

Key
ND = nondetect pCi/g = picocuries per gram Max = maximum concentration (+D) = plus daughters

Table 2b. Summary of Constituents of Concern and Medium-Specific Exposure Point Concentrations

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned

Scenario Timeframe: Current/Future
Medium: C-Area Reactor Area Cask Car Railroad Tracks as Abandoned Soil / Gravel
Exposure Medium: Surface Soil / Gravel (0-1 ft)

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	*Max*					
Direct Contact Surface Soil / Gravel CCRT	Cesium-137(+D)	ND	1.5	pCi/g	9/62	0.293	pCi/g	95% UCL

Key
ND = nondetect pCi/g = picocuries per gram 95% UCL = 95% upper confidence limit of the mean concentration (+D) = plus daughters

Table 2c. Summary of Constituents of Concern and Medium-Specific Exposure Point Concentrations

ECODS C-1

Scenario Timeframe: Current/Future
Medium: ECODS C-1 Soil
Exposure Medium: Surface Soil (0-1 ft)

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	*Max*					
Direct Contact Surface Soil ECODS C-1	Aroclor 1254	ND	6.3	mg/kg	13/27	2.6	mg/kg	95% UCL
	Benzo(a)pyrene	ND	0.128	mg/kg	2/27	0.128	mg/kg	Max
	Benzo(b)fluoranthene	ND	0.22	mg/kg	3/27	0.22	mg/kg	Max

Key
ND = nondetect mg/kg = milligrams per kilogram 95% UCL = 95% upper confidence limit of the mean concentration Max = maximum concentration

Table 2d. Summary of Constituents of Concern and Medium-Specific Exposure Point Concentrations

Outfall C-03

Scenario Timeframe: Current/Future
Medium: Outfall C-03 Soil
Exposure Medium: Surface Soil (0-1 ft)

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	*Max*					
Direct Contact Surface Soil / Outfall C-03	Cesium-137(+D)	ND	1.19	pCi/g	1/3	1.19	pCi/g	Max

Key
ND = nondetect pCi/g = picocuries per gram Max = maximum concentration

Table 3. Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal						
Constituent of Concern	**Oral Cancer Slope Factor**	**Dermal Cancer Slope Factor**	**Slope Factor Units**	**Weight of Evidence/Cancer Guideline Description**	**Source**	**Date (Year)**
Aroclor 1254	2.0E+00	---	$(mg/kg\text{-}day)^{-1}$	B2	USEPA	11/2012
Benzo(a)pyrene	7.3E+00	---	$(mg/kg\text{-}day)^{-1}$	B2	USEPA	11/2012
Benzo(b)fluoranthene	7.3E-01	---	$(mg/kg\text{-}day)^{-1}$	B2	USEPA	11/2012
Cesium-137(+D)	4.33E-11[a] 3.17E-11[b]	---	risk/pCi	A	USEPA	08/2010
Strontium-90(+D)	NA	---	---	---	---	---

Pathway: Inhalation							
Constituent of Concern	**Unit Risk**	**Units**	**Inhalation Cancer Slope Factor**	**Units**	**Weight of Evidence/Cancer Guideline Description**	**Source**	**Date (Year)**
Aroclor 1254	5.7E-04	$(\mu g/m^3)^{-1}$	---	---	B2	USEPA	11/2012
Benzo(a)pyrene	1.1E-03	$(\mu g/m^3)^{-1}$	---	---	B2	USEPA	11/2012
Benzo(b)fluoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	---	---	B2	USEPA	11/2012
Cesium-137(+D)	---	---	1.19E-11	risk/pCi	A	USEPA	08/2010
Strontium-90(+D)	---	---	NA	---	---	---	---

Pathway: External (Radiation)						
Constituent of Concern	**Cancer Slope or Conversion Factor**	**Exposure Route**	**Units**	**Weight of Evidence/Cancer Guideline Description**	**Source**	**Date (Year)**
Aroclor 1254	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---
Cesium-137(+D)	2.54E-06	External Exposure	risk/yr per pCi/g	A	USEPA	08/2010 03/2011
Strontium-90(+D)	1.96E-08	External Exposure	risk/yr per pCi/g	A	USEPA	03/2011

Key
--- = no information available
A = Human carcinogen
B2 = Probable human carcinogen – indicates sufficient evidence in animals and adequate or no evidence in humans
NA = not applicable – oral and inhalation cancer slope factors for strontium-90 are not applicable for concrete media (incomplete pathways)
mg/kg = milligram per kilogram $\mu g/m^3$ = micrograms per cubic meter risk/pCi = risk per picocurie

a = resident (child + adult) slope factor
b = industrial worker (adult) slope factor

USEPA, November 2012. *USEPA Regional Screening Levels* website, United States Environmental Protection Agency http://epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. Website accessed March 20, 2013.

USEPA, August 2010. *USEPA Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-prg-ornl.gov/radionuclides/. Website accessed March 20, 2013.

USEPA, March 2011. *USEPA Surface Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-sprg-ornl.gov/sprg. Website accessed March 20, 2013.

Table 4a. Risk Characterization Summary – Carcinogens

Building 717-C, Contaminated Maintenance Facility

Scenario Timeframe: Current/Future
Medium: Industrial Worker
Exposure Medium: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Concrete Slab Bldg. 717-C	Concrete Slab Surface	External Exposure	Cesium-137(+D)	NA	NA	NA	9.3E-06	9.3E-06
			Strontium-90(+D)	NA	NA	NA	2.2E-06	2.2E-06
								Industrial Worker Total Cumulative Risk (concrete) = 1.2E-05

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The surface preliminary remediation goals (SPRGs) for radionuclides that were used to calculate risk are risk-based activities that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the SPRG provides an exposure routes total risk estimate for each constituent. For concrete media, only the external pathway is evaluated (two-dimensional direct exposure).
USEPA, March 2011. *Surface Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-sprg-ornl.gov/sprg. Website accessed March 20, 2013.

Table 4b. Risk Characterization Summary – Carcinogens

C-Area Reactor Area Cask Car Railroad Tracks as Abandoned

Scenario Timeframe: Current/Future
Medium: Industrial Worker
Exposure Medium: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil / Gravel CCRT	Surface Soil/ Gravel (0-1 ft)	External Exposure	Cesium-137(+D)	NC	NC	NA	NC	2.8E -06
								Industrial Worker Total Cumulative Risk (soil/gravel) = 2.8E-06

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The USEPA preliminary remediation goals (PRGs) for radionuclides that were used to calculate risk are risk-based activities that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the PRG provides an exposure routes total risk estimate for each constituent.
USEPA, August 2010. *Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-prg-ornl.gov/radionuclides/. Website accessed March 20, 2013.

Table 4c. Risk Characterization Summary – Carcinogens

ECODS C-1

Scenario Timeframe: Current/Future
Medium: Industrial Worker
Exposure Medium: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil ECODS C-1	Surface Soil (0-1 ft)	Direct Contact	Aroclor 1254	NC	NC	NC	NA	3.6E -06
							Industrial Worker Total Cumulative Risk (soil) = 3.6E-06	

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The USEPA regional screening levels (RSLs) that were used to calculate risk are risk-based concentrations that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the RSL provides an exposure routes total risk estimate for each constituent.

USEPA, November 2012. *Regional Screening Levels* website, United States Environmental Protection Agency http://epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. Website accessed March 20, 2013.

Scenario Timeframe: Future
Medium: Resident
Exposure Medium: Child/Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil ECODS C-1	Surface Soil (0-1 ft)	Direct Contact	Aroclor 1254	NC	NC	NC	NA	1.2E-05
			Benzo(a)pyrene	NC	NC	NC	NA	8.5E-06
			Benzo(b)fluoranthene	NC	NC	NC	NA	1.5E-06
							Resident Total Cumulative Risk (soil) = 2.2E-05	

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The USEPA regional screening levels (RSLs) that were used to calculate risk are risk-based concentrations that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the RSL provides an exposure routes total risk estimate for each constituent.

USEPA, November 2012. *Regional Screening Levels* website, United States Environmental Protection Agency http://epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. Website accessed March 20, 2013.

Table 4d. Risk Characterization Summary – Carcinogens

Outfall C-03

Scenario Timeframe: Current/Future
Medium: Industrial Worker
Exposure Medium: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil Outfall C-03	Surface Soil (0-1 ft)	External Exposure	Cesium-137(+D)	NC	NC	NA	NC	1.2E-05
								Industrial Worker Total Cumulative Risk (soil) = 1.2E-05

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The USEPA preliminary remediation goals (PRGs) for radionuclides that were used to calculate risk are risk-based activities that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the PRG provides an exposure routes total risk estimate for each constituent.

USEPA, August 2010. *Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-prg-ornl.gov/radionuclides/. Website accessed March 20, 2013.

Scenario Timeframe: Future
Medium: Resident
Exposure Medium: Child/Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil Outfall C-03	Surface Soil (0-1 ft)	External Exposure	Cesium-137(+D)	NC	NC	NA	NC	1.9E-05
								Resident Total Cumulative Risk (soil) 1.9-05

Key
NA = not applicable. Route of exposure is not applicable to this medium.
NC = not calculated. Risk was not calculated separately for each exposure pathway. The USEPA preliminary remediation goals (PRGs) for radionuclides that were used to calculate risk are risk-based activities that are derived from standardized equations which combine all of the exposure pathways and assumptions with USEPA toxicity data. Use of the PRG provides an exposure routes total risk estimate for each constituent.

USEPA, August 2010. *Preliminary Remediation Goals for Radionuclides* website, United States Environmental Protection Agency http://epa-prg-ornl.gov/radionuclides/. Website accessed March 20, 2013.

Table 5. RGOs for the CAOU

Subunit	Media	RCOC[1]	UNITS	ARAR[2]	HHRA Future Resident[3]	HHRA Industrial Worker[4]	PTSM[5]	ERA[6]	CM[7]	Most Restrictive RGO[8]	SRS Background 95th %tile[9]	Other[10]	Most Likely RG[11]
Building 717-C, Contaminated Maintenance Facility	Concrete	Cesium-137(+D)	pCi/g	---	---	*0.104*	---	---	---	0.104	NA[12]	---	0.104
		Strontium-90(+D)	pCi/g	---	---	*11.9*	---	---	---	11.9	NA[12]	---	11.9
C-Area Process Sewer Lines as Abandoned	Concrete/ Steel	Radionuclides[14]	pC/g	---	---	---	NC[14]	---	---	---	---	---	NC[14]
C-Area Reactor Area Cask Car Railroad Tracks as Abandoned	Soil/ Gravel	Cesium-137(+D)	pCi/g	---	---	0.103	---	---	---	0.103	0.34	*1.0*	1.0
ECODS C-1	Soil	Aroclor 1254	mg/kg	*25.0*	0.22	0.74	---	---	---	0.22	---	---	25.0 [13]
		Benzo(a)pyrene	mg/kg	---	*0.015*	0.21	---	---	---	0.015	---	---	0.015
		Benzo(b)fluoranthene	mg/kg	---	*0.15*	2.1	---	---	---	0.15	---	---	0.15
Outfall C-03	Soil	Cesium-137(+D)	pCi/g	---	0.0623	0.103	---	---	---	0.0623	0.34	*1.0*	1.0

1. RCOC = refined constituent of concern
2. ARAR = applicable or relevant and appropriate requirement.
3. HHRA Resident = human health risk assessment. RGOs calculated for the future resident at a target risk of 1E-06.
4. HHRA Industrial Worker = human health risk assessment. RGOs calculated for the future industrial worker at a target risk of 1E-06.
5. PTSM = principal threat source material evaluation. No RCOCs identified.
6. ERA = ecological risk assessment. No RCOCs identified.
7. CM = contaminant migration analysis. No RCOCs identified.
8. Most Restrictive RGO = the lesser of the ARAR, HHRA, PTSM, ERA and CM RGOs.
9. SRS 95th%tile = ninety-fifth percentile from the *SRS Background Soils Statistical Summary Report,* Appendix B-1 (0 to1 ft), dated October 2006 (WSRC 2006c).
10. Other = 95th%tile SRS background concentration may not be technically achievable; a concentration of 1 pCi/g established as RGO based on generally accepted upper bound of typical fallout levels.
11. Most Likely RG = the most restrictive risk-based RGO if it is greater than background concentrations. If the most restrictive risk-based RGO is less than the background concentration, then the RGO defaults to the background value. Sources of the RGOs in this column are highlighted in italics in the table.
12. NA - not applicable = SRS soils background not identified since Cs-137 and Sr-90 were associated with processes within the building (not subject to fallout).
13. ARAR concentration of 25 mg/kg for low occupancy land use chosen as most likely RGO.
14. NC = not calculated; radionuclides generically identified as PTSM based on process history. Therefore, constituent specific RGOs are not available.

Table 6. Potential ARARs for the Selected Remedial Alternative for CAOU

LOCATION-SPECIFIC ARARs/TBC			
Location Characteristics	**Requirements**	**Prerequisite**	**Citation**
NONE IDENTIFIED			

ACTION-SPECIFIC ARARs/TBC			
Action	**Requirements**	**Prerequisite**	**Citation**
Disposal of PCB remediation waste	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found.	Disposal of PCB remediation waste as defined in 40 C.F.R. § 761.3 **— applicable**	40 C.F.R. § 761.61
Bulk PCB remediation waste left in place at cleanup site (self-implementing)	May remain onsite without further conditions (e.g. no fencing or cap requirements).	Bulk PCB remediation waste remaining in a *low occupancy area* (as defined in 40 C.F.R. § 761.3) at concentrations ≤25 — **relevant and appropriate**	40 C.F.R. § 761.61(a)(4)(i)(B)(1)
Deed restrictions for caps, fences and low occupancy areas	Deed Restrictions	Use of procedures and requirements for a low occupancy area **— relevant and appropriate**	40 C.F.R. § 761.61(a)(8)
	Within 60 days of completion of cleanup activity shall record, in accordance with State law, a notation on the deed to the property, or on some other instrument which is normally examined during a title search, that will in perpetuity notify any potential purchaser of the property: NOTE: Any deed restriction ARARs will be met though the implementation of the final Land Use Control Implementation Plan at the time of future property transfers.		40 C.F.R. § 761.61(a)(8)(i)(A)
	• that land has been used for PCB remediation waste disposal and is restricted to use as a low occupancy area as defined in 40 C.F.R. § 761.3.		40 C.F.R. § 761.61(a)(8)(i)(A)(1)
	• the applicable cleanup levels left at the site, inside the fence, and/or under the cap.		40 C.F.R. § 761.61(a)(8)(i)(A)(3)

Table 6. Potential ARARs for the Selected Remedial Alternative for CAOU *(Continued/End)*

CHEMICAL-SPECIFIC ARARs/TBC			
Chemical Characteristics	**Requirements**	**Prerequisite**	**Citation**
PCBs	For purposes of cleaning, decontaminating or removing PCB remediation waste, cleanup levels are based on the kind of material and the potential exposure to PCBs left after cleanup is completed. USEPA has established a ≤25 ppm limit for PCBs in "low occupancy areas".	The cleanup level for bulk PCB remediation waste in low occupancy areas is ≤25 ppm **— relevant and appropriate**	40 CFR Part761.61(a)(4)(i)(B)(1)

Table 7. 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 EA Record of Decision constitutes approval of the selected alternative by the regulatory agencies.
• *Community Acceptance* considers whether the local community agrees with the Preferred Alternative. Comments received on the EA 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 EA Record of Decision.

Table 8. Comparison of Alternatives Against the CERCLA Evaluation Criteria

Criterion	Alternative 1: No Action	Alternative 2: Land Use Controls
Overall Protection of Human Health	Not protective of the Industrial worker or future resident because there are no controls or remediation	Protective of the Industrial worker because of access controls and the future resident because of deed restrictions
Overall Protection of the Environment	Protective of the environment because no ECO/CM/PTSM RCOCs	Protective of the environment because no ECO/CM/PTSM RCOCs
Compliance with ARARs	Doesn't meet the PCB ARARs	Meets the PCB ARARs
Long-Term Effectiveness and Permanence		
Magnitude of Residual Human Health Risk	Residual human health risk remains above $1x10^{-6}$	Residual human health risk remains above $1x10^{-6}$
Adequacy of Controls	Not adequately protective of human health receptors	Effective in preventing exposure to human receptors and breaking the exposure pathway. Leaves contaminants in place. LUCs required as long as contaminants are present
Permanence	Not permanent. Leaves contaminants in media	Not permanent. Leaves contaminants in media
Treatment		
Treatment type	No active treatment	No active treatment
Degree of Expected Reduction in Toxicity, Mobility, or Volume	No reduction	No reduction
Short-Term Effectiveness		
Amount of Hazardous Material Destroyed or Treated	None	None
Risk to Remedial Worker	None	None
Risk to Community	None	None
Risk to Environment	None	None
Time to Implement and achieve RAO	Never	6 months
Implementability		
Availability of Materials, Equipment, Contractors	Not applicable	Readily available
Ability to Construct and Operate the Technology	Not applicable	Easy to construct
Ability to Obtain Permits/ Approvals from Other Agencies	Not applicable	Easy to obtain approval
Estimated Cost		
Total Estimated Capital Cost	$0	$131,583
Total Estimated Present Worth O&M Cost	$0	$2,136,579
Total Estimated Cost	$0	$2,268,162
Overall Protection of Human Health and the Environment		
State Support/Agency Acceptance	Not acceptable	Both USEPA and SCDHEC support the preferred remedy.
Community Acceptance	Not Acceptable	Acceptable

ECO = ecological O&M = operations and maintenance

Table 9. Summary of the Present Value Costs

Alternative 2:
Land Use Controls
Subunits at CAOU – SRS

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Institutional Controls					
Posting of Warning Signs	90	ea	$100	$9,000	
Land Use Control Implementation Plan	1	ea	$20,000	$20,000	
Deed Restrictions	3	ea	$5,000	$15,000	
Subtotal - Direct Capital Cost				$44,000	*
Mobilization/Demobilization	20%	of subtotal direct capital		$8,800	*
Site Preparation/Site Restoration	15%	of subtotal direct capital		$6,600	*
Total Direct Capital Cost		(sum of * items)		**$59,400**	
Indirect Capital Costs					
Engineering & Design	14%	of direct capital		$8,316	
Project/Construction Management	25%	of direct capital		$14,850	
Health & Safety	3%	of direct capital		$1,782	
Overhead	30%	of direct capital + indirect capital		$25,304	
Contingency	20%	of direct capital + indirect capital		$21,930	
Total Indirect Capital Cost				**$72,183**	
Total Estimated Capital Cost				**$131,583**	
Direct O&M Costs	1.1%	discount rate for costs >30 years duration[1]			
Annual Costs (Existing System during Post-ROD Design & Const)	2	years O&M		*Years 2015 - 2016*	
Access Controls	1	ea	$750	$750	
Subtotal - Annual Costs				$750	
Present Worth Annual Costs (-1.4% Discount Rate)				$1,525	
Annual Costs (Institutional Controls)	200	years O&M		*Years 2017 - 2217*	
Access Controls	1	ea	$750	$750	
Annual Inspections / Maintenance	1	ea	$5,000	$5,000	
Subtotal - Annual Costs				$5,750	
Present Worth Annual Costs (1.1% Discount Rate)				$206,358	
Five Year Costs	41				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$238,467	
Total Present Worth Direct O&M Cost				**$446,350**	
Indirect O&M Costs					
Project/Admin Management	217%	of direct O&M[2]		$967,200	
Health & Safety	5%	of direct O&M		$15,600	
Overhead	30%	of direct O&M + indirect O&M		$428,745	
Contingency	15%	of direct O&M + indirect O&M		$278,684	
Total Present Worth Indirect O&M Cost				**$1,690,229**	
Total Estimated Present Worth O&M Cost				**$2,136,579**	
TOTAL ESTIMATED COST				**$2,268,162**	

[1.] Interest rate for costs with duration <30 years (i.e., before 2043) based on OMB Circular A-94 (Dec 2012).
[2.] Percentage rate based on Full-Time Employee (FTE) involvement until 2217

Table 10. Comparative Analysis of Alternatives for the CAOU Subunit

Alternatives	Overall Protection of Human Health	Overall Protection of Environment	Achieves RAOs	Achieves ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost	Overall Ranking
A-1 – No Action	No	Yes	No	No	1	1	1	5	5	13
A-2 – Land Use Controls	Yes	Yes	Yes	Yes	3	1	5	5	3	17

Scale: 1=Minimum 5=Maximum
Overall Rating = 5 – 25

Table 11. Land Use Controls for the CAOU

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.	Waste management areas/subunits identified in this EAROD where hazardous substances are left in place at levels requiring land use restrictions.
2. Property record restrictions[c]: A. Land Use	Restrict use of property by imposing limitations.	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.	Waste management areas/subunits identified in this EAROD where hazardous substances are left in place at levels requiring land use restrictions.
3. Other Notices[d]	Provide notice to city and/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.	Waste management areas/subunits identified in this EAROD where hazardous substances are left in place at levels requiring land use 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	Waste management areas/subunits identified in this EAROD where hazardous substances are left in place at levels requiring land use 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.	Fencing and security is provided at SRS Site boundaries in accordance with SRS procedures. Additional physical access controls, including fencing, is not required at the affected areas of the CAOU.

Table 11. Land Use Controls for the CAOU *(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 will be posted in accordance with applicable Site procedures and will be placed in appropriate areas at the CAOU.
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 waste management areas/subunits identified in this EAROD, as necessary.

[a]Affected areas – Specific locations identified in the OU-specific EALUCIP or subsequent post-EAROD 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.

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APPENDIX A

Responsiveness Summary

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Responsiveness Summary

The 45-day public comment period for the Early Action Statement of Basis/Proposed Plan for the CAOU began on November 17, 2014, and ended on January 1, 2015. However, the forty-five (45) day public comment period was extended 30 days to January 31, 2015, at the request of the Savannah River Site Citizens Advisory Board. In addition, a public meeting was held to discuss the preferred remedy on January 26, 2015, from 6:30 p.m. to 8:30 p.m. at the DOE Meeting Center, 230 Village Green Blvd., Suite 22, Aiken, SC 29801.

Responses to public comments received through letter during this period along with responses to comments received at the public meeting are as follows:

SAVANNAH RIVER SITE CITIZENS ADVISORY BOARD COMMENTS

The following comments are being submitted by the Savannah River Site Citizens Advisory Board on the "Early Action Statement Basis / Proposed Plan for the C-Area Operable Unit" that was made available for public comment on November 17, 2014, by the U.S. Department of Energy.

The following comments are based upon the assumptions that the human health risks presented in the Plan are scientifically valid, represent cancer risks based upon life-span exposure, and were developed using widely-accepted methods. In other words, validation and a discussion of how the human health risks were developed are beyond the scope of these comments. In addition, the following comments are restricted to the "Early Action Statement Basis / Proposed Plan for the C-Area Operable Unit" and as such do not address the draft Resource Conservation and Recovery Act permit modifications that were also made available for comment on November 17, 2014.

COMMENTS:

Background Information:

According to the Plan identified above:

1. The early remedial action is being taken in specific areas located in the C-Area Operable Unit, because there are refined constituents of concern in the soil, gravel and concrete that may pose a threat to human health.

2. The C-Area Operable Unit is an area of the Savannah River Site that is currently designated for industrial use and due to subsurface radiological contamination will not support unrestricted land use, such as residential.

3. The C-Area Operable Unit and associated subunits are located within the Fourmile Branch Watershed.

4. The refined constituents of concern include cesium-137, strontium-90, Aroclor 1254, and polycyclic aromatic hydrocarbons. Note: refined constituents of concern require remedial action.

5. The subunits located inside the C-Area perimeter fence that have refined constituents of concern are Building 717-C and C-Area Cask Car Railroad Tracks as Abandoned.

6. The subunits located outside the C-Area perimeter fence that have refined constituents of concern are the Early Construction and Operational Disposal Site, and Outfall C-03.

7. In the Early Action Record of Decision for the C-Reactor Complex, published in 2009, in-situ decommissioning was selected at the preferred end-state, so the future site worker was chosen as the baseline risk assessment scenario for human exposure at all of the C-Area Operable Unit subunits. However, a future resident scenario was also considered for subunits outside of the C Area perimeter fence if a subunit qualified for unrestricted land use.

8. The exposure pathways for human to the refined constituents of concern were identified as exposure to surface media to a depth of one foot from incidental ingestion, dermal contact, inhalation of windblown dust, inhalation of volatile constituents, and external exposure from radionuclides. (P. 8 of 40, SRNS-RP-2014-00009, Revision I, September 2014.)

Response to Background Information Comments #1-8: Agree.

9. Based on the exposure pathways identified, the human health risk assessments for the four subunits are as follows: (Page 33 of 40, SRNS-RP-2014-00009, Revision I, September 2014.)

    a. Building 717-C: (contaminated media is concrete)

        i. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is 1 in 9,300,000 (written in the Plan as 9.3E-06);

        ii. For a worker exposed to strontium-90 the risk to get cancer over the span of a lifetime is 1 in 2,200,000 (written in Plan as 2.2E-06); and

        iii. For a worker the total accumulative risk of getting cancer over the span of a lifetime is 1 in 120,000 (written in plan as 1.2E-05).

    b. C-Area Cask Car Railroad Tracks as Abandoned: (contaminated media is soil and gravel)

        i. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is 1 in 2,800,000 (written in the Plan as 2.8E-06).

    c. Early Construction and Operational Disposal Site: (contaminated media is soil):

        i. For a future resident exposed to polychlorinated biphenyl-1254, the risk to get cancer over the span of a lifetime is 1 in 120,000 (written in the Plan as 1.2E-05).

ii. For a resident exposed to benzo(a)pyrene, the risk to get cancer over the span of a lifetime is 1 in 8,500,000 (written in the Plan as 8.5E-06).

iii. For a future resident exposed to benzo(b)fluoranthene, the risk to get cancer over the span of a lifetime is 1 in 1,500,000 (written in the Plan as 1.5E-06).

iv. For a resident the total accumulative risk of getting cancer over the span of a lifetime is 1 in 220,000 (written in the Plan as 2.2E-05).

v. For a worker exposed to polychlorinated biphenyl-1254, the risk to get cancer over the span of a lifetime is 1 in 3,600,000 (written in the Plan as 3.6E-06).

d. Outfall C-03: (contaminated media is soil)

i. For a resident exposed to cesium-137, the risk to get cancer over the span of a lifetime is 1 in 190,000 (written in the Plan as 1.9E-05).

ii. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is 1 in 120,000 (written in the Plan as 1.2E-05).

Response to Background Information Comment #9: Clarification. The commenter identified equivalent risks as those written in the plan using scientific notation. The equivalent risks were incorrectly determined and should be identified as follows (changes in bold font):

a. Building 717-C: (contaminated media is concrete)

i. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is **9.3 in 1,000,000** (written in the Plan as 9.3E-06);

ii. For a worker exposed to strontium-90 the risk to get cancer over the span of a lifetime is **2.2 in 1,000,000** (written in Plan as 2.2E-06); and

iii. For a worker the total accumulative risk of getting cancer over the span of a lifetime is **1.2 in 100,000** (written in plan as 1.2E-05).

b. C-Area Cask Car Railroad Tracks as Abandoned: (contaminated media is soil and gravel)

i. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is **2.8 in 1,000,000** (written in the Plan as 2.8E-06).

c. Early Construction and Operational Disposal Site: (contaminated media is soil):

i. For a future resident exposed to polychlorinated biphenyl-1254, the risk to get cancer over the span of a lifetime is **1.2 in 100,000** (written in the Plan as 1.2E-05).

ii. For a resident exposed to benzo(a)pyrene, the risk to get cancer over the span of a lifetime is **8.5 in 1,000,000** (written in the Plan as 8.5E-06).

iii. For a future resident exposed to benzo(b)fluoranthene, the risk to get cancer over the span of a lifetime is **1.5 in 1,000,000** (written in the Plan as 1.5E-06).

iv. For a resident the total accumulative risk of getting cancer over the span of a lifetime is **2.2 in 100,000** (written in the Plan as 2.2E-05).

v. For a worker exposed to polychlorinated biphenyl-1254, the risk to get cancer over the span of a lifetime is **3.6 in 1,000,000** (written in the Plan as 3.6E-06).

d. Outfall C-03: (contaminated media is soil)

i. For a resident exposed to cesium-137, the risk to get cancer over the span of a lifetime is **1.9 in 100,000** (written in the Plan as 1.9E-05).

ii. For a worker exposed to cesium-137, the risk to get cancer over the span of a lifetime is **1.2 in 100,000** (written in the Plan as 1.2E-05).

10. A contaminate migration analysis was performed; and it was concluded that there was no potential for groundwater contamination of the refined constituents of concern to exceed drinking water standards. (P. 9-10 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

Response to Background Information Comment #10: Agree.

Remedial Action Goals

According to the Plan identified above: (P. 11 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

1. The remedial action goals are:

a. To prevent future resident exposure to contaminated media or structure within the C-Area perimeter fence.

b. To prevent industrial worker exposure to the refined constituents of concern (cesium-137, strontium-90, Aroclor 1254, and polycyclic aromatic hydrocarbon) where the risk to get cancer from exposure exceeds 1 in 1,000,000 in Building 717-C, C-Area Cask Car Railroad Tracks as Abandoned, and the Early Construction and Operational Disposal Site.

c. To prevent industrial worker and future resident exposure to cesium-137 at Outfall C-03.

Response to Remedial Action Goals Comment #1: Clarification. The remedial action should have been accurately summarized as shown below (corrections in bold font):

1. The remedial action goals are:

    a. To prevent future resident exposure to contaminated media or structure within the C-Area perimeter fence.

    b. To prevent industrial worker exposure to the refined constituents of concern (cesium-137, strontium-90, **and** Aroclor 1254**, and polycyclic aromatic hydrocarbon**) where the risk to get cancer from exposure exceeds 1 in 1,000,000 in Building 717-C, C-Area Cask Car Railroad Tracks as Abandoned, and the Early Construction and Operational Disposal Site.

    c. To prevent industrial worker and future resident exposure to cesium-137 at Outfall C-03.

    d**. To prevent future resident exposure to polycyclic aromatic hydrocarbons where the risk to get cancer from exposure exceeds 1 in 1,000,000 at the Early Construction and Operational Disposal Site.**

2. When remedial alternatives are considered, there are three categories of requirements that clarify how remedial actions comply with requirements and standards set forth under Federal and State environmental laws as required by the Superfund Amendments Reauthorization Act. The requirements are referred to as "Applicable or Relevant and Appropriate Requirements", and the three categories are action-specific, location-specific, and chemical-specific.

    a. Action-specific requirements may control the design, performance and other aspects of implementation of specific remedial activities;

    b. Location-specific requirements reflect the physiographic and environmental characteristics of the unit or the immediate area, and may restrict or preclude remedial actions depending of the location or characteristics of the unit; and

    c. Chemical-specific requirements are media-specific concentration limits promulgated under Federal or State Law. (P. 12 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

Response to Remedial Action Goals Comment #2: Agree

Remedial Alternatives

The selection of alternatives per the Comprehensive Environmental Response, Compensation and Liability Act is guided by a desire to develop a list of alternatives that can be compared in order to select the most effective cost-efficient remedial action. The alternatives include options that 1) immobilize chemicals, 2) reduce the contaminant volume, 3) or reduce the need for long-

term, on site management. Other alternatives include little or no treatment to protect human health by controlling exposure through Land Use Controls. For the subunits in the C-Area Operable Unit, addressed in this Plan, a No Action and Land Use Controls remedial alternatives were determined to be adequate as agreed to in the RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment/Corrective Measures Study/Feasibility Study completed in 2014. (P. 12 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

Alternative 1 – No Action

If this alternative were selected, no action would be taken to address the refined constituents of concern in the subunits in the C-Area Operable Unit and the 5-year remedy review would not be conducted.

Response to Remedial Alternatives Alternative 1 – No Action Comment: Agree

Alternative 2 – Land Use Controls (P. 13 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

If this alternative were selected, Land Use Controls would limit only exposure of the industrial worker and future resident to the refined constituents of concern. Exposure for workers would be limited by the use of administrative and engineering controls, limiting work activities by the use of work clearance permits, and posting signs to inform personnel of the presence of hazardous materials. In addition, deed restrictions would prevent residential land use.

1. Perimeter Fencing would be used to surround the 82 acre area of contamination in the C-Area, which includes the two subunits, Building 717-C and C-Area Cask Car Railroad Tracks as Abandoned.

    a. This fencing would need to be in place for greater than 200 years as residual contamination will be long-lived.

2. Additional perimeter fencing would be used to surround the two subunits that are outside of the perimeter fencing, the Early Construction and Operational Disposal Site and Outfall C-03. For the Early Construction and Operational Disposal Site, fencing would surround an area of 38,751 square feet. For Outfall C-03, 1,115 linear feet of fencing would be necessary.

    a. The fencing around Outfall C-03 may be required for less than 200 years due to the radioactive decay of cesium-137, which has a half-life of about 30 years.

Response to Remedial Alternatives Alternative 2 – Land Use Controls Comments #1-2: Clarification. The commenter summarized Alternative 2 – Land Use Controls by indicating that perimeter fencing would be required around the 82 acre area of contamination in C-Area and around two additional subunits, the Early Construction and Operational Disposal Site and Outfall C-03. In fact, no fencing is required at the contaminated subunits that are under land use controls. Administrative controls (work

clearance permits) are the primary mechanism used to prevent inadvertent exposure of workers in C-Area. In addition, warning signs with a contact number are posted in the area to identify the subunits with residual contamination. The Savannah River Site (SRS) site perimeter fence and access points (guard gates) prevent access to the site by the general public and thus prevent potential exposure at the affected waste units. The C-Area perimeter fence was identified in the Early Action Statement of Basis/Proposed Plan as the spatial marker for the partial extent of the land use controls.

3. Annual inspections would be required and maintenance would be performed as needed to keep the Land Use Controls functioning as designed.

4. The 5-year remedy review would be conducted to determine if the Land Use Controls were still protective.

Response to Remedial Alternatives Alternative 2 – Land Use Controls Comments #3-4: Agree.

Evaluation of Alternatives

Potential remedial alternatives are analyzed using nine evaluation criteria to satisfy the requirements of the Comprehensive Environmental Response, Compensation and Liability Act. A comparison of these criteria across the alternatives is shown on P. 38 of 40, SRNS-RP-2014-00009, Revision I, September 2014). The estimated cost is based upon the assumption that the Land Use Controls would be maintained in place for 200 years.

Criterion	Alternative 1: No Action	Alternative 2: Land Use Controls
Overall Protection of Human Health	Not protective of the Industrial worker or future resident because there are no controls or remediation	Protective of the Industrial worker because of access controls and the future resident because of deed restrictions
Overall Protection of the Environment	Protective of the environment because no ECO/CM/PTSM RCOCs	Protective of the environment because no ECO/CM/PTSM RCOCs
Compliance with ARARs	Doesn't meet the PCB ARAR	Meets the PCB ARAR
Long-Term Effectiveness and Permanence		
Magnitude of Residual Human Health Risk	Residual human health risk remains above $1x10^{-6}$	Residual human health risk remains above $1x10^{-6}$
Adequacy of Controls	Not adequately protective of human health receptors	Effective in preventing exposure to human receptors and breaking the exposure pathway. Leaves contaminants in place. LUCs required as long as contaminants are present
Permanence	Not permanent. Leaves contaminants in media	Not permanent. Leaves contaminants in media
Treatment		
Treatment type	No active treatment	No active treatment
Degree of Expected Reduction in Toxicity, Mobility, or Volume	No reduction	No reduction
Short-Term Effectiveness		
Amount of Hazardous Material Destroyed or Treated	None	None
Risk to Remedial Worker	None	None
Risk to Community	None	None
Risk to Environment	None	None
Time to Implement and achieve RAO	Never	6 months
Implementability		
Availability of Materials, Equipment, Contractors	Not Applicable	Readily available
Ability to Construct and Operate the Technology	Not applicable	Easy to construct
Ability to Obtain Permits/ Approvals from Other Agencies	Not Applicable	Easy to obtain approval
Estimated Cost		
Total Estimated Capital Cost	$0	$131,583
Total Estimated Present Worth O&M Cost	$0	$2,136,579
Total Estimated Cost	$0	$2,268,162
Overall Protection of Human Health and the Environment		
State Support/Agency Acceptance	Not acceptable	Both USEPA and SCDHEC support the preferred remedy.
Community Acceptance	This criterion will be completed following public review	This criterion will be completed following public review.

Summary of Analysis:

Alternative 1 – No Action does not meet the threshold criteria for overall protection of human health and is not compliant with the chemical Applicable or Relevant and Appropriate Requirements.

Response to Evaluation of Alternatives Alternative 1 – No Action Comment: Agree

Alternative 2 – Land Use Controls is protective of the industrial worker and the future resident, and can meet the Remedial Action Objectives. The refined constituents of concern are left in place and human health is protected by restricting exposure by fencing off the subunits where the refined constituents of concern are. The residual risk is low with a cancer risk of 1 in 10,000. This risk will continue to be reduced overtime as cesium-137, which is the primary risk driver, will decay naturally. The hazardous materials are left in place and the residual risk that remains is greater than 1 in 1,000,000. (P. 16 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

Response to Evaluation of Alternatives Alternative 2 – Land Use Controls: Clarification. The commenter indicated that land use controls are protective through the use of fencing at the subunits. As explained in the Response to Remedial Alternatives 2 – Land Use Controls Comments #1-2, fencing at the subunits is not required; protectiveness is maintained through the use of both administrative and engineering controls (warning signs and SRS boundary fencing).

Preferred Alternative

The preferred alternative is Alternative 2 – Land Use Controls. The preferred remedy for the C-Area Operable Unit "leaves hazardous substances in place that pose a potential future risk and require land use restrictions for an indefinite period of time." (P. 17 of 40, SRNS-RP-2014-00009, Revision I, September 2014) To ensure that land use restrictions are maintained and periodically verified, the Savannah River Site has a "Land Use Control Assurance Plan" that was written in response to the US Environmental Protection Agency's policy, *Assuring Land Use Controls at Federal Facilities.*

The cost for implementation of Alternative 2 – Land Use Controls includes an initial capital cost of $59,400, while the total cost for the 200-year project is estimated to be $2,268,162. (P. 39 of 40, SRNS-RP-2014-00009, Revision I, September 2014).

Alternative 2:
Land Use Controls
Subunits at CAOU – SRS

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Institutional Controls					
Posting of Warning Signs	90	ea	$100	$9,000	
Land Use Control Implementation Plan	1	ea	$20,000	$20,000	
Deed Restrictions	3	ea	$5,000	$15,000	
Subtotal - Direct Capital Cost				$44,000	*
Mobilization/Demobilization	20%	of subtotal direct capital		$8,800	*
Site Preparation/Site Restoration	15%	of subtotal direct capital		$6,600	*
Total Direct Capital Cost		(sum of * items)		**$59,400**	
Indirect Capital Costs					
Engineering & Design	14%	of direct capital		$8,316	
Project/Construction Management	25%	of direct capital		$14,850	
Health & Safety	3%	of direct capital		$1,782	
Overhead	30%	of direct capital + indirect capital		$25,304	
Contingency	20%	of direct capital + indirect capital		$21,930	
Total Indirect Capital Cost				**$72,183**	
Total Estimated Capital Cost				**$131,583**	
Direct O&M Costs	1.1%	discount rate for costs >30 years duration[1]			
Annual Costs (Existing System during Post-ROD Design & Const)	2	years O&M		*Years 2015 - 2016*	
Access Controls	1	ea	$750	$750	
Subtotal - Annual Costs				$750	
Present Worth Annual Costs (-1.4% Discount Rate)				$1,525	
Annual Costs (Institutional Controls)	200	years O&M		*Years 2017 - 2217*	
Access Controls	1	ea	$750	$750	
Annual Inspections / Maintenance	1	ea	$5,000	$5,000	
Subtotal - Annual Costs				$5,750	
Present Worth Annual Costs (1.1% Discount Rate)				$206,358	
Five Year Costs	41				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$238,467	
Total Present Worth Direct O&M Cost				**$446,350**	
Indirect O&M Costs					
Project/Admin Management	217%	of direct O&M[2]		$967,200	
Health & Safety	5%	of direct O&M		$15,600	
Overhead	30%	of direct O&M + indirect O&M		$428,745	
Contingency	15%	of direct O&M + indirect O&M		$278,684	
Total Present Worth Indirect O&M Cost				**$1,690,229**	
Total Estimated Present Worth O&M Cost				**$2,136,579**	
TOTAL ESTIMATED COST				**$2,268,162**	

1. Interest rate for costs with duration <30 years (i.e., before 2043) based on OMB Circular A-94 (Dec 2012).
2. Percentage rate based on Full-Time Employee (FTE) involvement until 2217

Response to Preferred Alternative Comment: Agree

Post-ROD Schedule

The remedial action plan is scheduled to start in January 2016. (P. 18 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

Response to Post-ROD Schedule Comment: Agree

CONCLUSIONS

In conclusion, we agree that Alternative 2 – Land Use Controls is preferred over No Action, but are concerned with the indefinite period of time that the Land Use Controls must be in place to protect the future workers and residents. It is hard to imagine that these controls could be kept in place for 200 years or more. Two hundred years represents eight generations and 50 US Presidential Terms! The United States of America is only 238 years old. The Department of Energy is just 39 years old, and the Office of Environmental Management was established a mere 26 years ago.

It is difficult to believe that the Department of Energy will have control of this land 200 years from now on. In addition, to estimate the cost to maintain the Land Use Controls for 200 years is not a meaningful exercise as it is largely a guess. In addition, the use of deed restrictions to prevent future residents from being exposed to the refined constituents of concern is also flawed, because it again assumes that there is permanency in local government structure to control land use. Even if a deed restriction is in place, it is very difficult for the government to control what happens on private property so far into the future.

As stated at the beginning of this letter, it is beyond the scope of these comments to debate the risk assessments presented in this Plan. Rather, we are basing our opinions on the fact that the US Environmental Protection Agency, the SC Department of Health and Environmental Control, and the Department of Energy believe that four subunits in the C-Area Operable Unit (Building 717-C, C-Area Cask Car Railroad Tracks as Abandoned, Early Construction and Operational Disposal Site, and Outfall C-03) have refined constituents of concern that pose a cancer risk to workers and future residents, if they are exposed to surface media to a depth of one foot from incidental ingestion, dermal contact, inhalation of windblown dust, inhalation of volatile constituents, and external exposure from radionuclides. Not only are these risks present now, but these risks would be present for at least 200 years into the future.

The Savannah River Site should be cleaned up to protect future generations of workers and residents, if it is possible to do so. As a result, installing Land Use Controls that must be in place for 200 years is not an acceptable approach. Unfortunately, there is nothing in the Plan that addresses how difficult or expensive it would be to remove and treat the contaminated soil, gravel and concrete where the contamination resides. However, it is hard to imagine that this is not possible as similar soil excavation projects have been completed at the Savannah River Site in recent years. One project that comes to mind is the cleaning up of contamination in Lower Three Runs where about three acres of contaminated soil was removed and disposed of. The

cost of this excavation and treatment was over 17 million dollars, so we recognize that removal and treatment of soil, gravel and concrete is an expensive endeavor.

Another project that demonstrates the feasibility of removing surface media is the cleanup of ash in the wetlands area at Dunbarton Bay. In this project about 13 acres will be excavated to remove ash. The cost of this cleanup project is over four million dollars. Again, it is recognized that the removal and treatment of soil, gravel and concrete is an expensive endeavor. However, in the long run, it is worth the cost if future generations are protected. From the information presented, it appears that it would be feasible to cleanup of the subunits in the C-Area Operable Unit rather than just preventing access to the areas where refined constituents of concern reside.

It is recognized that these subunits in Area-C Operable Unit do not come close to the risks of the High Level Waste Tanks and strongly agree that the cleanup of these subunits should not take funds away from the High Level Waste Tank cleanup project at this time. Further, the timely completion of the clean out and closure of the High Level Waste Underground storage tanks should continue to be of the highest priority.

However, there is a 3rd Alternative that is appropriate. Thus, Alternative 3 – Temporary Land Use Controls and Final Removal of Refined Constituents of Concern is being proposed. In this scenario, the Land Use Controls as described in Alternative 2 would be put into place per the proposed Plan, but in 2040, when the major work is projected to be completed on the High Level Waste Tanks, excavation and treatment or disposal of the contaminated soil, gravel, and concrete from Building 717-C, C-Area Cask Car Railroad Tracks as Abandoned, Early Construction and Operational Disposal Site, and Outfall C-03 would be evaluated, and if the cancer risk is confirmed, would be initiated. This timeline would delay cleanup of these subunits for one generation, but it is more reasonable to expect that the Land Use Controls would still be in place to protect workers and residents until the excavation could be completed. Importantly, this Alternative is perfectly in line with two of the three options that are used to guide the process to select alternatives under the Comprehensive Environmental Response, Compensation and Liability Act, the desire to reduce contaminant volume and to reduce the need for long-term on site management. (P. 18 of 40, SRNS-RP-2014-00009, Revision I, September 2014)

The cost for this first phase of this alternative would be the same as Alternative 2 – Land Use Controls, with Direct Capital Costs of $59,400 and Indirect Capital Costs of $131,583. Instead of 200 years of Direct Operating and Maintenance costs, there would be 25 years, which would add approximately $56,000 for the first 14 years of the project, until 2040.

We strongly urge you to consider Alternative 3 – Temporary Land Use Controls and Final Removal of Refined Constituents of Concern as proposed here. This alternative would allow protection for another generation of future workers and residents at a modest cost and cleanup of the subunits so that all future generations are protected without question. The cost of cleanup in 25 years will probably escalate from current costs, but there is also a possibility that new methods and equipment could make the project easier.

Response: Clarification/Disagree. SRS believes that maintaining land use controls for 200 years is not an unreasonable assumption. Federal Superfund cleanup law (the

Comprehensive Environmental Response Compensation and Liability Act [CERCLA]) requires that a review of the remedy decision be conducted every five years to ensure that the remedy is and will continue to be protective of human health and the environment. The public is notified of the five-year remedy reviews, which become part of the administrative record. If land use controls cannot be maintained, then the remedy must be re-evaluated for protectiveness.

The rationale for not including a remedial alternative that removes the contamination at the C-Area Operable Unit (CAOU) was largely influenced by a previous remedial decision involving C Area. In accordance with the approved Early Action Record of Decision for the C-, K-, L-, and R-Reactor Complexes (SRNS-RP-2009-00707, Revision 1, September 2009), the in situ decommissioning alternative was chosen for the reactor complexes. The selected alternative will leave high levels of radioactivity in a stabilized form (grouted) beneath the ground surface at the C-Reactor Complex, consistent with completed remedial actions at the P- and R-Reactor Complexes. As part of the in situ decommissioning remedy, land use controls will be required as long as necessary to ensure that the remedy is fully protective of human health and the environment, expected to be greater than 200 years. Because the C-Area waste units identified in the comment are in proximity to the C-Area Reactor complex, it is reasonable to assume that the land use controls could include the adjacent subunits with low levels of residual contamination. Similar final remedial decisions have been implemented at the P- and R-Area Operable Units where closure of the reactor complexes is complete. Other remedial decisions at SRS (for example, M-Area OU) use land use controls to prevent exposure to low levels of surface contamination, to manage the residual risk.

For CAOU, cleanup actions were taken in 2011 and 2012 at four of the subunits to remove or stabilize higher levels of contamination that were present at a cost of approximately $28M. The residual level of contamination and associated risks were significantly reduced as a result. The current cancer risk to the long-term (25 years) on-unit industrial worker over the span of a lifetime is 1 in 100,000 (i.e., 1.0E-05) and is within the United States Environmental Protection Agency's (USEPA) acceptable risk range of 1 in 10,000 to 1 in 1,000,000. However, a remedial action for risk at this level is preferred by the South Carolina Department of Health and Environmental Control (SCDHEC). Because of the previous cleanup action taken and the low level of residual risk, evaluation of a more aggressive remedial alternative in addition to land use controls is not warranted. Land use controls remain the preferred alternative to support the early action decision at CAOU.

CLOSING

A few comments on the public participation process for this comment period are warranted. First, the extension of the comment period for an additional 30 days is appreciated. Second, the online availability of the two documents that were prepared for public review, the "Early Action Statement of Basis / Proposed Plan, Fact Sheet for the C-Operable Unit" and the full document "Early Action Statement of Basis / Proposed Plan for the C-Area Operable Unit, made the review process easier. Third, two sections in the proposed Plan give the impression that the decision to

go with Alternative 2 – Land Use Control is a "done deal" and that the input at this time from the public is an exercise without meaning.

1) In the "Summary of Analysis" section on the third from the last page of the Plan narrative, there is a paragraph about Alternative 2 that includes the following sentence: "Alternative 2 is also the only Likely Response Action agreed to during scoping of the project," (P. 16 of 40, SRNS-RP-2014-00009, Revision I, September 2014). This makes it seem unlikely that new input from the public will make a difference. If this was agreed upon, is there really an opportunity for the public to suggest a new Alternative? 2) In section "VII. Summary of Remedial Alternatives" in the Plan the following is stated: "Thus, for subunits requiring further action in the CAOU, a No Action and LUC remedial alternative were determined to be adequate as agreed to in the RFI/RI/BRA/CMS/FS document (SRNS 2014)." (P. 12 of 40, SRNS-RP-2014-00009, Revision I, September 2014) Again, this makes it seem unlikely that new input from the public will make a difference. If this was agreed upon, is there really an opportunity for the public to suggest a new Alternative?

In addition, there are two issues that should be addressed by the Department of Energy in the future. First and foremost, when documents are prepared for public review and comment, they should be written without the use of acronyms, except those that are understood by the public at large, as described in the "Federal Plain Language Guidelines" revised in May 2011. In the current situation, the Plan contains 65 acronyms, which hinders comprehension and greatly extends reading time.

Second, any fact sheet that is prepared to accompany another document should contain all pertinent information. For example, in the Plan that is being discussed here, a fact sheet was also provided. It was fairly easy to read, even with the abundance of acronyms, but there are two omissions that are pertinent to the decision-making process involving the alternatives. 1) Risks are presented without stating what the risks are, and the risks are stated in an unfamiliar form. If these are cancer risks over the span of a lifetime, then that should be stated. Also, stating risks in scientific notation, such as 2.8E-06, is not readily understood by the public. 2) The explanation of the Alternative 2 does not include the timeframe involved for Land Use Controls. It is very important for the public to understand that the Land Use Controls that are the favored remedy in this Plan are going to have to be in place and maintained for 200 years or more.

In closing, the Citizens Advisory Board appreciates the opportunity to provide input on this proposed Plan and looks forward to working closely with the Department of Energy as cleanup decisions at the Savannah River Site are made in the future.

Response to Closing Comment: Clarification/Agree. The three parties to the SRS Federal Facility Agreement [United States Department of Energy (USDOE), USEPA, and SCDHEC] participate in a scoping process for each waste unit where likely response actions are discussed and the remedial alternatives to be evaluated in the Feasibility Study are agreed to, based on the nature and magnitude of the environmental problem and associated risk to human health and the environment. This agreement on a preferred remedial alternative does not preclude public involvement and input into the decision-making process as required by both CERCLA and the Resource Conservation and

Recovery Act. The preferred alternative identified in a Statement of Basis/Proposed Plan is subject to modification after public comments are considered. However, for CAOU, based on the reasons explained in the response given to the Conclusions above, the additional alternative proposed will not be added to the alternatives evaluation.

SRS recognizes that the use of acronyms may affect the readability of the documents intended for public review and will try to limit their overuse in future documentation. In addition, future fact sheets will include an explanation of lifetime cancer risks (i.e., 1 in 1,000,000 cancer risk) in addition to, or in place of, scientific notation. The timeframe for land use controls will also be clearly communicated in future documentation.

COMMENTS RECEIVED DURING THE PUBLIC MEETING

The following comments were recorded during the public meeting for the Early Action Statement of Basis/Proposed Plan for the C-Area Operable Unit held on January 26, 2015.

> **MR. CHAPUT:** My name is Ernest Chaput. I'm a citizen of Aiken County and a former DOE manager out here at Savannah River and elsewhere.
>
> There's two comments I'd like to make about this latter part of the conversation. One is a lot of discussion of risk, very, very appropriate, very, very necessary. And risk-based decision-making really is ultimately what's in the public's best interest and I totally support it.
>
> But when you talk about risks, you need to talk about risk in a very holistic type of way, and it's not just risks to soil and groundwater at C-Reactor, you need to expand it to talk about the various other risks that exist at Savannah River. And as you look at the cost of remedial actions at C-Reactor, or elsewhere, you need to say is that dollar better spent taking cesium out of a process sewer line in C-Reactor, or is it better spent taking high level waste out of a tank in F-Area. I think most people would say you're probably better off taking the liquid waste out of those tanks because that tends to be more mobile, potentially more mobile, potentially more of an effect on public health and safety and the environment than the relatively immobile materials that are present at C-Reactor and can be effectively -- reasonably effectively managed through land use controls and other types of things.
>
> The situation is -- you know, which we all don't like, is we're dealing with a fixed amount of money and I think the Department of Energy and EPA and DHEC, a part of their responsibility is to take a look at, "I've got an extra dollar here; where do I spend it? What is the -- you know, where do I get the most bang for the buck in risk reduction?"
>
> And I know DOE puts -- you know, they put buckets of money out there and they make it difficult to move money back and forth. On the other hand, smart bureaucrats can figure out how to do reprogrammings and things like that.

And all I would do is encourage the Department and our regulatory partners and the public to say, "Okay, do I really want to make something relatively safe even safer, or do I want to take something which is unsafe and try to make it safe in the first place?"

I think the general consensus is that the liquid waste in the high level tanks is the single largest safety, health and environmental problem at Savannah River and my personal opinion has been, for many years, including when I was with the Department, and I'd advocated since then, is every time you've got another nickel you can spend, you ought to be using it to get that waste out of the tanks. And I would just encourage, you know, this group, the Department and others to look at it in a very -- in a largest holistic way of how do we get the most bang, the most risk reduction bang for that buck.

And that's -- you know, I think what you've done in the case of the C Area units is very appropriate. I think you've taken a measured approach. You tried to deal with, you know, the most obvious and immediate hazards as you put effective controls in place. I support the approach you're taking. I would argue against or urge against trying to do more within those C Area units only because it'll impact something else on the Site which is probably of higher priority from a risk reduction standpoint.

Thank you.

Response to Public Meeting Comment (Mr. Chaput): Agree. Individual remedial decisions are reached on an independent basis considering the nine criteria as required by the National Oil and Hazardous Substances Pollution Contingency Plan. The alternatives analysis considers both risk reduction and costs. In addition, since USDOE, USEPA, and SCDHEC have made many remedial decisions at SRS, and work together to plan future remediation schedules for all operable units at SRS, individual remedial decisions are also made considering the larger program context.

MR. CLEMENTS: Thanks very much. My name is Tom Clements and I'm the director of Savannah River Site Watch and I live in Columbia, South Carolina.

I would agree that the high level waste at Savannah River Site presents the greatest risk, but the fact that this reactor does have rernedial or residual contamination and the fact that it played a key role in the folly of the Cold War, I have two questions about the plan that's presented.

The first is what kind of restrictions to public access are there in case the land use controls are selected for the remedial action that is chosen. In part I ask this because I've heard that there are some people that might want access by the public to one of the reactors so that they could see the reactor that had a key role in producing nuclear materials for the Cold War.

> The second question I have is will any potential new missions for the C-Reactor building impact any land use controls that are put in place. And I ask this question because we have seen that both the K and the L Reactors, even thought they were not built for the current missions that are being -- have been deployed in them, could they have been chosen for long-term missions. So I'm just curious what impact the land use controls might have for any future missions of C-Reactor, particularly given that it has a large floor space inside the building.
>
> That's it. Thank you.

Response to Public Meeting Comment (Mr. Clements): The land use controls presented in the *Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes* do not prevent <u>authorized</u> public access to the area. Exposure to the public would be prevented during any public tours of the reactor area.

Industrial uses of the C-Area reactor building complex and surrounding area are allowed under the land use controls presented in the Proposed Plan and under those established in the *Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes*. Any new activities in the areas of control are reviewed through the site use/clearance permitting process to ensure that those activities will not result in an unacceptable level of exposure or will disturb the integrity of the remedy (e.g., no drilling through abandoned process sewer lines). At the present time, there are no known future missions for the C-Reactor complex. Any future activities that could impact the protectiveness of the land use controls would be evaluated and approval by the USEPA and SCHDEC would be required before any major change in land use occurs.

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