ARF # 16479

United States Department of Energy

Savannah River Site

Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes (U)

CERCLIS Numbers: 79, 90, 91, and 95

SRNS-RP-2009-00707

Revision 1

September 2009

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

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

DISCLAIMER

Printed in the United States of America
Prepared for
U. S. Department of Energy
and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

EARLY ACTION RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

for the

C-, K-, L-, and R-Reactor Complexes (U)

CERCLIS Numbers: 79, 90, 91, and 95

SRNS-RP-2009-00707
Revision 1

September 2009

Savannah River Site
Aiken, South Carolina

Prepared by:

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

This page was intentionally left blank.

DECLARATION FOR THE EARLY ACTION RECORD OF DECISION

Unit Name and Location

C-, K-, L-, and R-Reactor Complexes

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: 79, 90, 91, and 95

Savannah River Site

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989

Aiken, South Carolina

United States Department of Energy (USDOE)

The C-, K-, L-, and R-Reactor Complexes are listed as CERCLA units in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).[1] Throughout this document, mention of Reactor Complexes, unless otherwise specified, includes the Reactor Building, the Disassembly Basin, Engine Houses, and the Standby Pumphouse for the C-, K-, L-, and R-Reactor Complexes.[2] The Reactor complexes are located in the central portion of the SRS, a minimum of 8 km (5 mi) from the site boundary.

The FFA is a legally binding agreement between regulatory agencies (U.S. 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 these units are metal components, concrete, and sediment. Groundwater is not part of the scope covered by this Early Action Record of Decision (EAROD); any impacts to groundwater from the Reactor Complexes will be addressed separately from this early action.

[1] The P-Reactor Complex was addressed separately and is not included within the scope of this decision.
[2] No standby pumphouse (191) exists for the R-Reactor Complex. It was planned but never constructed as it was at the other facilities.

Statement of Basis and Purpose

This decision document presents the final end state decision (Selected Remedy) for the C-, K-, L-, and R-Reactor Complexes located at the SRS near Aiken, South Carolina. The Reactor Complexes are a subunit within the C-, K-, L-, and R-Area Operable Units (OUs) for which the FFA parties agreed the potential releases of hazardous substances, pollutants, or contaminants needed to be investigated. This early remedial action will be performed under remedial authority and will occur in conjunction with a long-term action at each specific Area OU to ensure the site is cleaned up as quickly and effectively as possible. 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. This decision is based on the Administrative Record File for this site.

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

Assessment of the Site

Conditions at the Reactor Complexes pose a substantial threat of release of hazardous and radioactive substances at the C-, K-, L-, and R-Reactor Complexes to the environment. The response actions selected in this EAROD are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

The selected remedy for the Reactor Complexes is *in situ* decommissioning (ISD) end state with land use controls (LUCs) to maintain industrial land use. This remedy meets the remedial action objectives (RAOs) for the project and effectively balances short-term effectiveness, implementability, and cost criteria, while resulting in a remedy that provides a high level of long-term protection from unacceptable risks to human health and the environment. Agreement on the final end state for the Reactor Complexes will allow subsequent engineering efforts and regulatory decisions to focus only on ISD alternatives that are appropriate for that end state and allow for consideration of consolidation of remediation waste from each specific Area OU inside the respective Reactor Complex.

The Selected Remedy includes the following components:

In Situ Decommissioning with Land Use Controls: The ISD end state of the radiologically contaminated Reactor Complexes would stabilize contamination within the reactor complex to prevent direct human exposure, limit contaminant migration to groundwater, and prevent animal intrusion exposure to radiological and hazardous components. The engineering details of the final actions with regard to ISD for the buildings will be presented in the final Record of Decision (ROD) for each specific Area OU.

The Land Use Control (LUC) objectives necessary to ensure protectiveness of the selected remedy are:

- Restrict unauthorized worker access and prevent unauthorized contact, removal, or excavation of contaminated media;
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds;
- Maintain the integrity of any current or future remedial or monitoring systems;
- Prevent access or use of contaminated groundwater until cleanup levels are met;
- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion.

Implementation and/or maintenance of LUCs will preclude uses other than industrial at the unit. It is important to recognize that operational activities in support of ongoing USDOE missions will continue to occur at the C-, K-, and L-Area facilities after the EAROD is signed and issued. The agreement on the ISD end state will not require that ongoing operational activities cease until the USDOE's mission involving these facilities is complete. CERCLA five-year remedy reviews will be conducted to confirm the presence and effectiveness of the LUCs and the continued appropriateness of the ISD end state. Since LUCs are proposed in conjunction with the end-state decision, an early action Land Use Control Implementation Plan (EALUCIP) will be submitted for the C-, K-, and L-Reactor Complexes. Institutional controls (ICs) (i.e., LUCs) would be implemented as long as necessary to keep the selected remedy fully protective of human health and the environment. However, since LUCs and ICs are already in place for the Reactor Complexes, it is anticipated that no additional LUCs and ICs will be instituted. Because the early action LUCIP is not proposing additional LUCs other than currently used at SRS, an Early Action Remedial Action Implementation Plan will not be submitted. Approval of the early action LUCIP will constitute remedial action start. The LUCs for the R-Reactor Complex will be included as part of the final LUCIP for the R-Area Operable Unit (RAOU).

Statutory Determinations

Based on the *Resource Conservation and Recovery Act Facility Investigation / Remedial Investigation Report with Baseline Risk Assessment and Corrective Measures Study / Feasibility Study for the P-Area Operable Unit* (SRNS 2008), and similarities between the P-Reactor Complex and the C-, K-, L-, and R-Reactor Complexes, the Reactor Complexes pose a threat to human health and the environment. To address this threat, ISD with LUCs has been selected as the final end-state decision for the C-, K-, L-, and R-Reactor Complexes. Both the current and reasonably anticipated future land use is industrial.

The Selected Remedy (1) is protective of human health and the environment, (2) complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, (3) is cost effective, and (4) utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy, once the details of ISD have been designed, will satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is and will continue to be protective of human health and the environment.

The selected remedy for the Reactor Complexes leaves hazardous substances in place that pose a potential future risk; therefore, each Area OU covered by this EAROD will require LUCs as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control Assurance Plan (LUCAP) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The LUCs for the R-Reactor Complex will be addressed in the final RAOU LUCIP, which is being implemented on an accelerated schedule due to the passing of legislation (i.e., American Recovery and Reinvestment Act). Because the remedial actions for C-, K-, and L-Reactor Complexes will be implemented further in the future, an EALUCIP will be submitted for these three Reactor Complexes. The EALUCIP referenced in this EAROD will provide details and the specific measures required to implement and maintain the LUCs selected as part of this remedy for C-, K-, and L-Reactor Complexes. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this EAROD. Upon final approval, the EALUCIP will be appended to the LUCAP and is considered incorporated by reference into this EAROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the SRS FFA. The approved EALUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for these units. The early action LUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in this EAROD upon any and all transfers. 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 ICs. Unit-specific final LUC objectives for the Area OUs will be deferred to the final ROD for each specific Area OU.

Data Certification Checklist

This EAROD provides the following information for each of the units identified for early remedial actions:

- Identified constituents of concern (COCs) and their respective concentrations (Section VII)
- Baseline risk represented by the COCs (Section VII)
- Cleanup levels established for the COCs and the basis for the levels (Section XI)
- Current and reasonably anticipated future land and groundwater use assumptions used in the Baseline Risk Assessment and EAROD (Section VI)
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section XI)
- 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., 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 VII)

ARF # 16479

11/13/09 Karen Guevara for
Date

Helen Belencan
Deputy Assistant Manager for Closure Project
U. S. Department of Energy
Savannah River Operations Office

12-1-09
Date

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

12/3/09 Daphne G. Neel
Date

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

This page intentionally left blank.

ARF # 16479

EARLY ACTION DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

for the

C-, K-, L-, and R-Reactor Complexes

CERCLIS Numbers: 79, 90, 91, and 95

SRNS-RP-2009-00707
Rev. 1

September 2009

Savannah River Site
Aiken, South Carolina

Prepared By:

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

This page was intentionally left blank

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

(+D)	plus daughters
ARAR	applicable or relevant and appropriate requirement
ARF	Administrative Record File
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CAOU	C-Area Operable Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulation
Ci	curie
CM	contaminant migration
COC	constituent of concern
CSM	conceptual site model
D&D	Deactivation and Decommissioning
D_2O	deuterium oxide (moderator); heavy water
DC	direct current
EALUCIP	Early Action Land Use Controls Implementation Plan
EAPP	Early Action Proposed Plan
EAROD	Early Action Record of Decision
EDE	estimated dose equivalent
EE/CA	Engineering Evaluation/Cost Analysis
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
ft^2	square feet
ft^3	cubic feet
FY	fiscal year
HI	hazard index
HH	human health
HQ	hazard quotient
IC	institutional control
IOU	Integrator Operable Unit
ISD	in situ decommissioning
km	kilometer
km^2	square kilometer
LUC	Land Use Controls
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
m	meter
MCL	maximum contaminant level

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

mi	mile
mi^2	square mile
mrem	millirem
msl	mean sea level
MW	Megawatts
N/A	not applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge and Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PRG	preliminary remediation goal
PTSM	principal threat source material
RAIP	Remedial Action Implementation Plan
RAO	remedial action objective
RAOU	R Area Operable Unit
RBC	Risk-based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SHPO	State Historic Preservation Office
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TBD	to be determined
TSCA	Toxic Substance Control Act
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WSRC	Washington Savannah River Company LLC

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

Unit Name, Location, and Brief Description

C-, K-, L-, and R-Reactor Complexes

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Numbers: 79, 90, 91, and 95

Savannah River Site

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989

Aiken, South Carolina

U.S. Department of Energy (USDOE)

Savannah River Site (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. SRS is located approximately 40.2 km (25 mi) southeast of Augusta, Georgia, and 32.1 km (20 mi) south of Aiken, South Carolina (Figure 1).

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 byproducts of nuclear material production processes. Hazardous substances, as defined by the CERCLA, are currently present in the environment at SRS.

This Early Action Record of Decision (EAROD) documents the selected remedy for the C-, K-, L-, and R-Reactor Complexes (Figure 2).[1] Each Reactor Complex is located within an Area Operable Unit (OU). For each specific Area OU, with the exception of the R Area OU (RAOU), there is an associated groundwater OU. The C-Reactor Complex, for example, is located within the C Area OU and any impacts to groundwater from the C-Reactor Complex are addressed under the C-Area Groundwater OU. For R-Reactor Complex, groundwater is included as a subunit within the Area OU and is being

[1] The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the C-, K-, L-, P-, and R-Reactor Complexes as CERCLA units in Appendix C. The P-Reactor Complex has already been addressed and is not included within the scope of this decision.

ARF # 16479

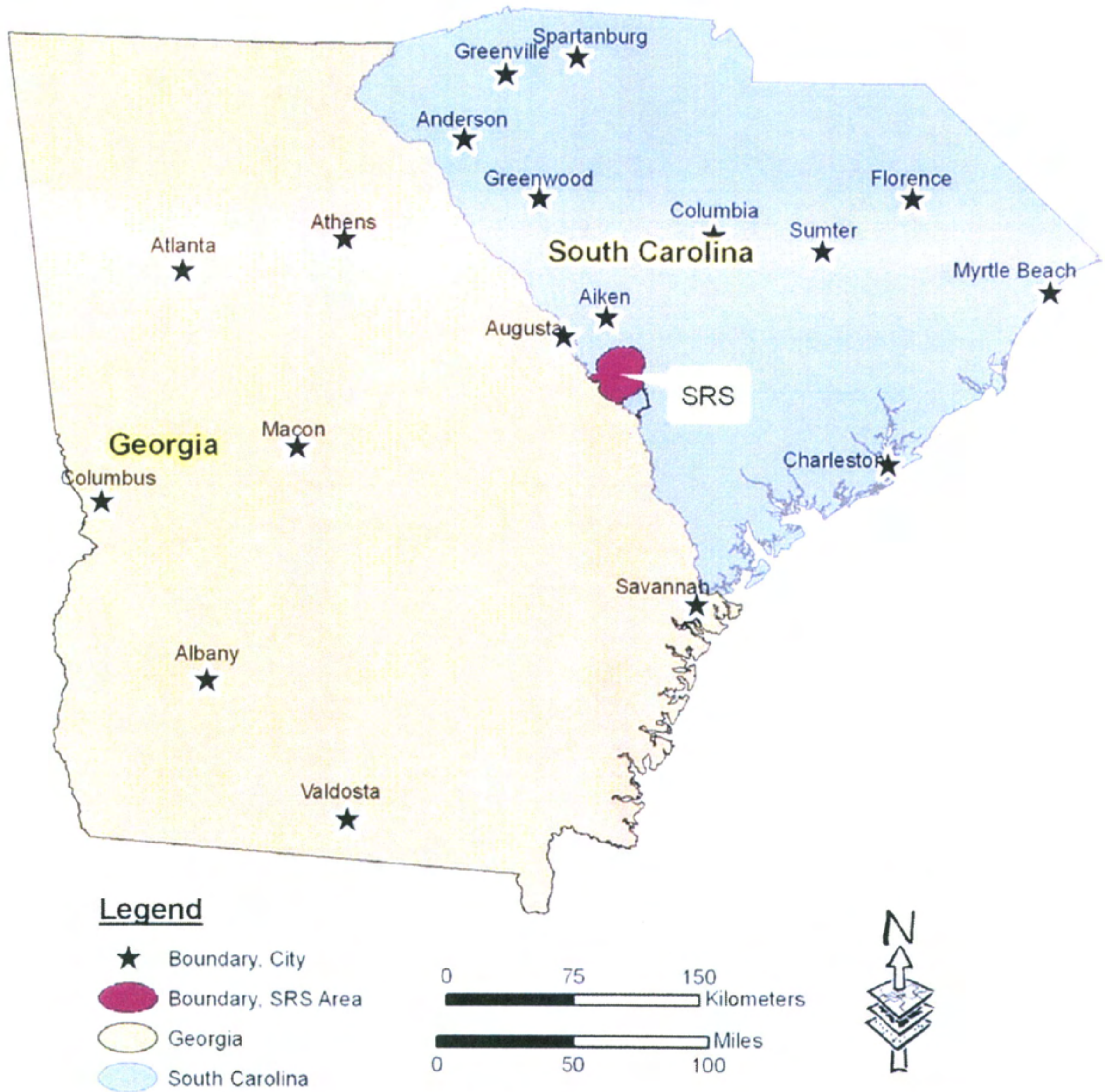


Figure 1. **Regional Setting of the Savannah River Site**

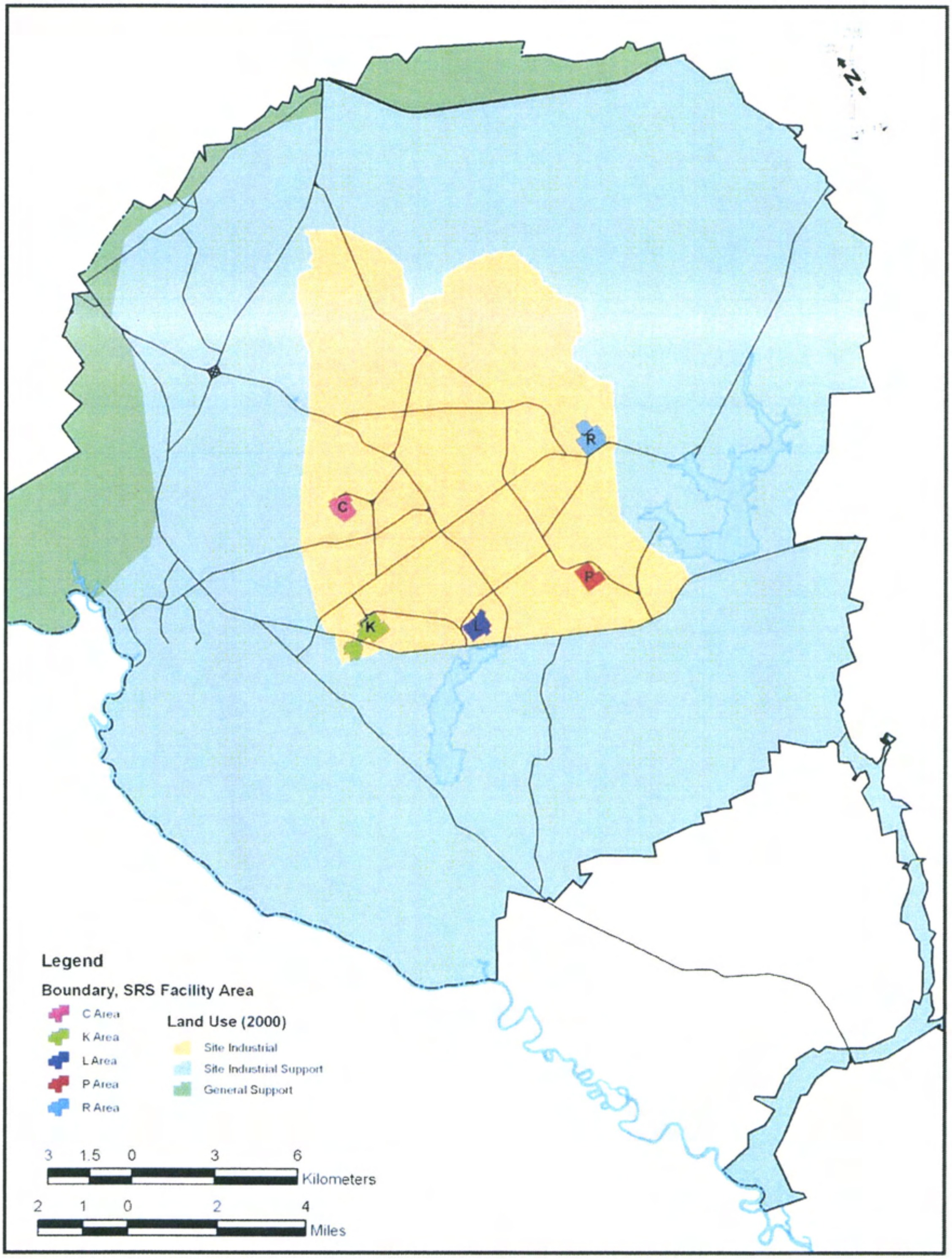


Figure 2. Location of the C-, K-, L-, and R-Reactor Complexes within the Savannah River Site

addressed as part of the specific Area OU Record of Decision (ROD). Each Reactor Complex includes a reactor vessel subunit; a disassembly basin subunit; and a building and attached structures subunit. Additionally, each Reactor Complex is currently access-controlled by a fence.

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 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 byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases disposed of at SRS. Past operational and disposal practices have resulted in soil and groundwater contamination.

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established Resource Conservation and Recovery Act (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 negotiated a Federal Facility Agreement (FFA) (FFA 1993) with U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) to coordinate remedial activities at SRS as one comprehensive strategy, fulfilling the dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by USEPA - Region 4 and the SCDHEC.

Reactor Complex Operational and Compliance History

Operations in the C-, K-, L-, and R-Reactor Complexes resulted in the generation of chemical and radioactive waste that remains primarily within the reactor vessel, Disassembly Basin, and building and attached structures subunits of each Reactor Complex. See Figures 3 to 6 for illustrations of the land use and the location of these Reactor Complexes. Figure 7 illustrates general areas inside the building subunit and includes the Assembly, Process, and Purification Areas.

Nuclear material is no longer being produced at the reactor facilities. C-Reactor began operating in 1955 and was shut down in 1986. K-Reactor began operating in 1954 and was placed in standby in 1988; it was restarted in 1992 for power ascension tests before being shut down in 1993. L-Reactor operated from 1954 to 1968 and again from 1985 to 1988. R-Reactor operated from 1953 to 1964.

Although the Reactor Complexes are no longer producing nuclear material, the C-, K-, and L-Reactor Complexes have continuing USDOE missions. The C-Reactor Complex is used for cask car refurbishment; the K-Reactor Complex is used for nuclear materials disposition activities; and the L-Reactor Complex is used for nuclear materials storage. These missions will cease prior to implementation of the *in situ* decommissioning (ISD) end state. The R-Reactor Complex status is considered to be 'cold shutdown with no capability of restart'.

A description of the history and operational purpose, as well as similarities in site characteristics, for each of the four Reactor Complex subunits is presented below.

Reactor Vessel Subunit Operational History

In each reactor vessel subunit, embedded in the floor of the process room, is a low-pressure and low-temperature reactor with deuterium oxide (D_2O [moderator]) cooling of the core. The nuclear fission process took place within the reactor tank, a cylinder composed of stainless steel containing a lattice of fuel and target assemblies, control rods, and instrumentation submerged in the primary heavy water moderator/coolant. The vessel is primarily composed of these parts:

- D_2O plenum constructed primarily with stainless steel;
- top shield constructed primarily with stainless steel;

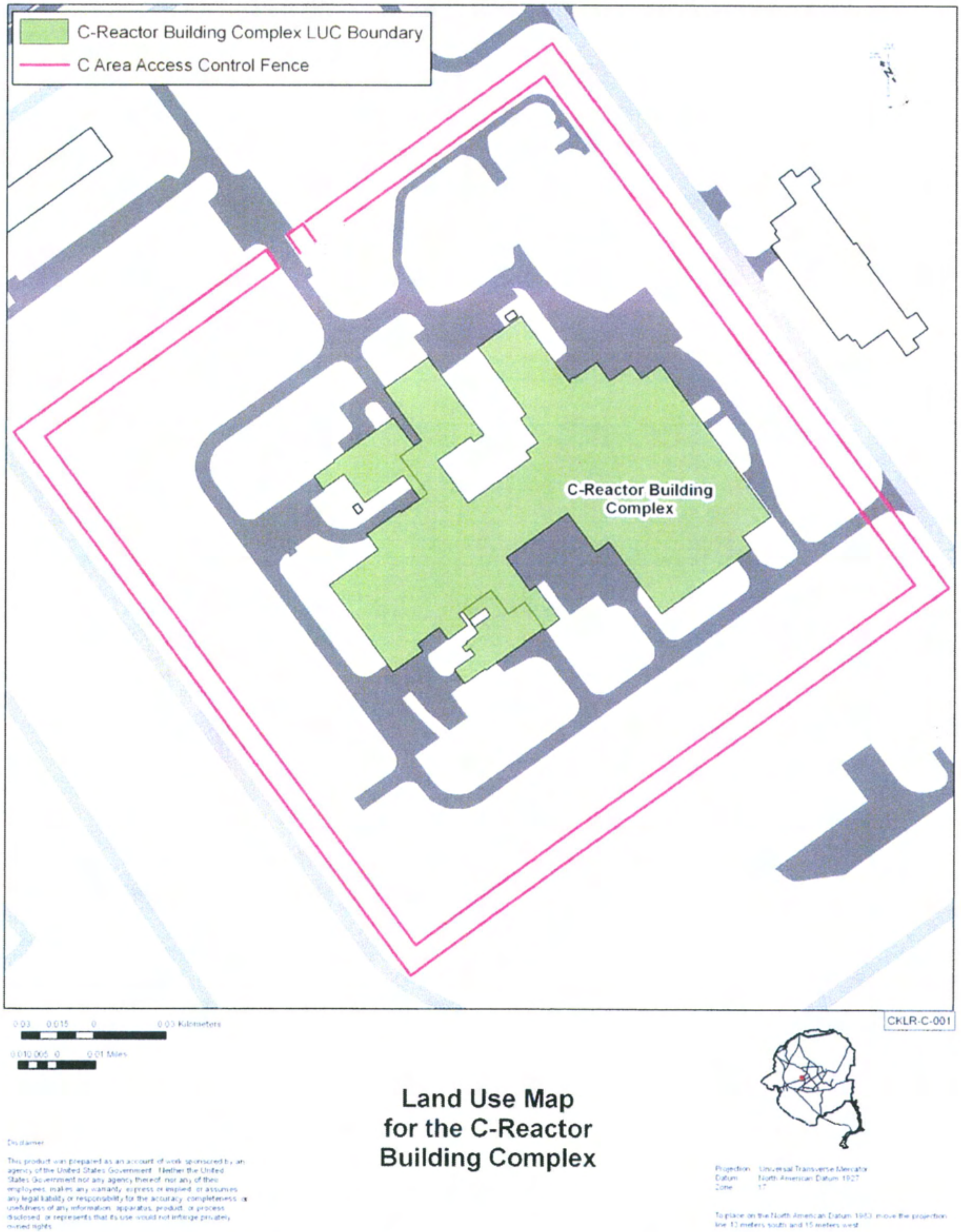


Figure 3. Land Use Map for the C-Reactor Building Complex

ARF # 16479

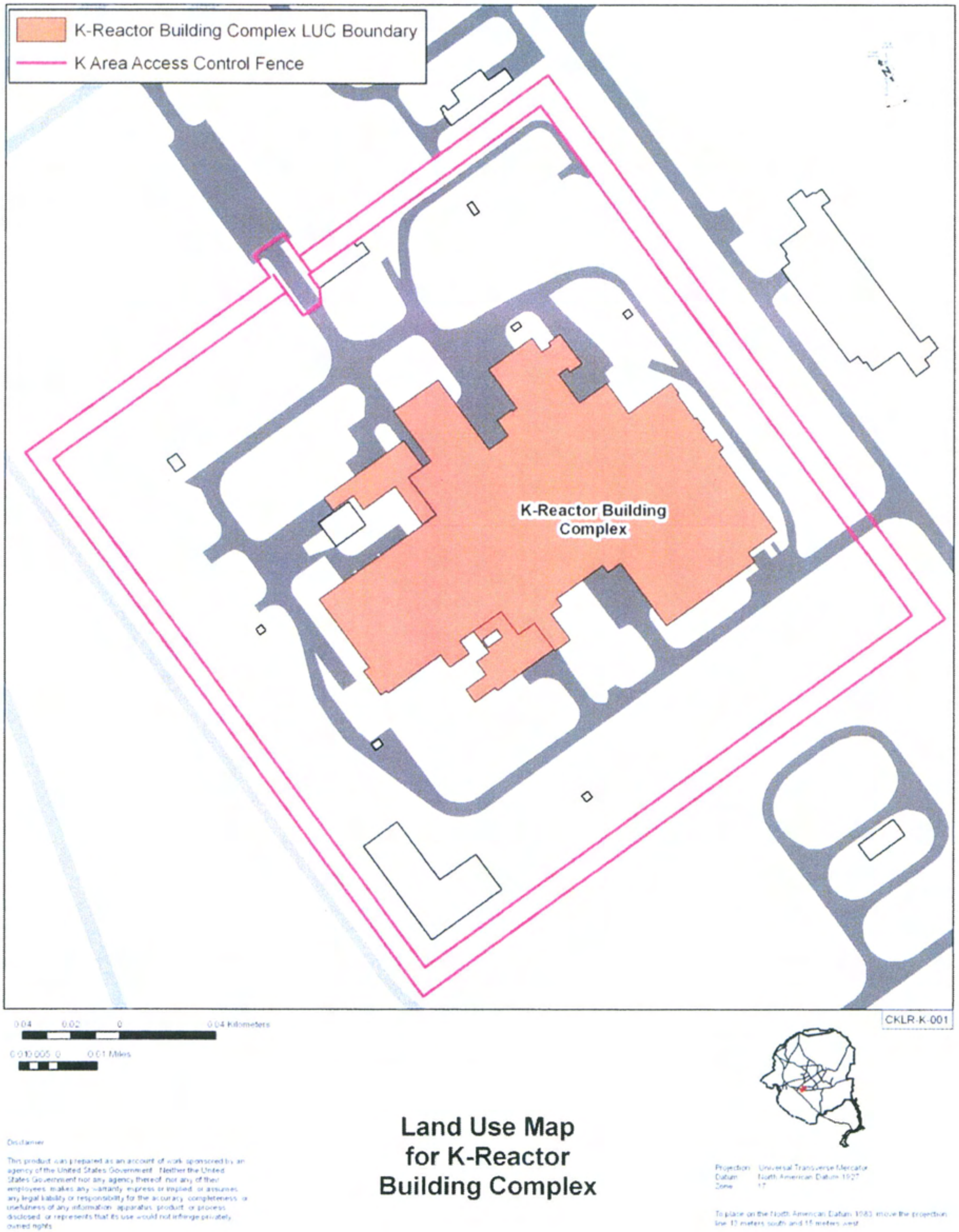


Figure 4. Land Use Map for the K-Reactor Building Complex

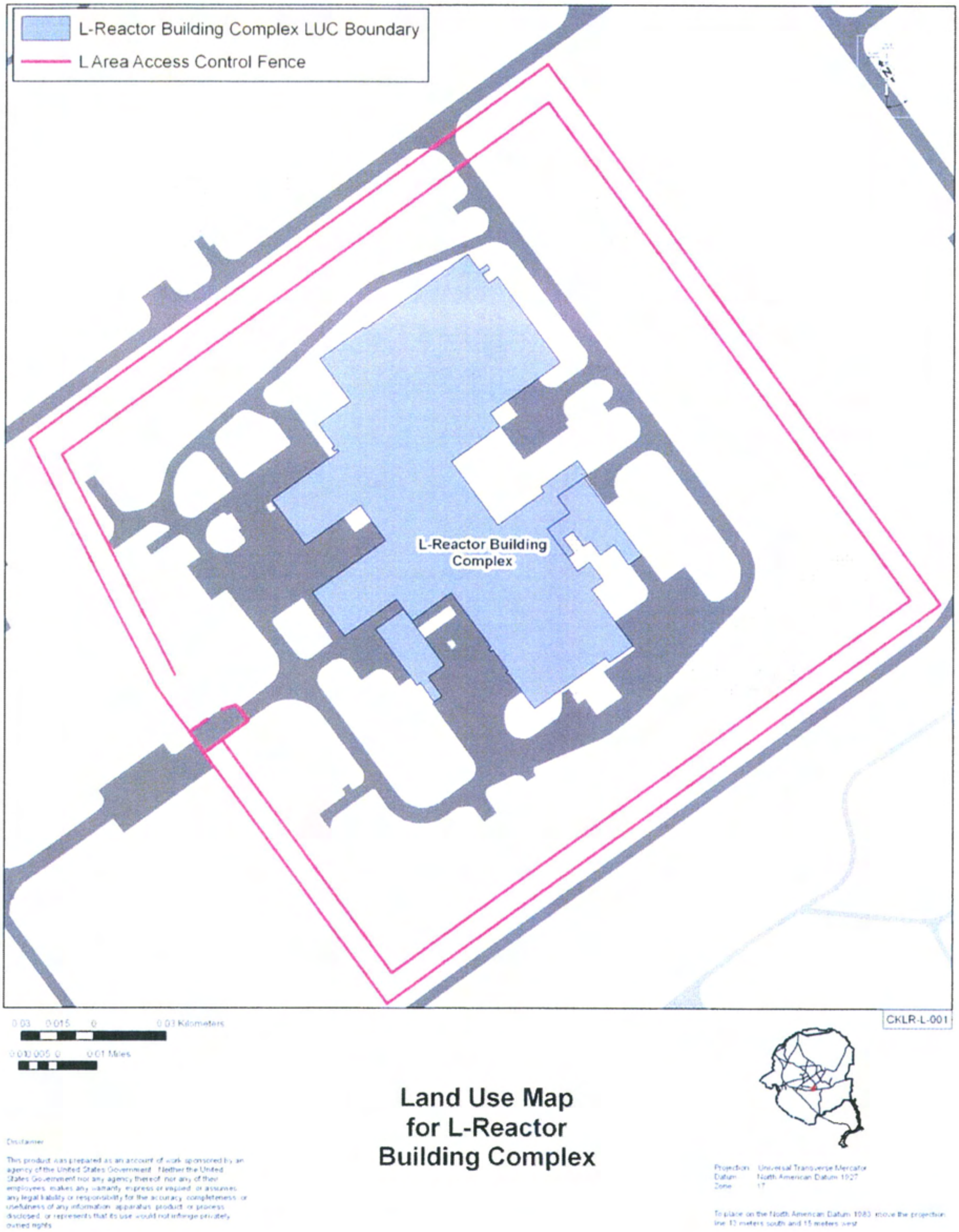


Figure 5. Land Use Map for the L-Reactor Building Complex

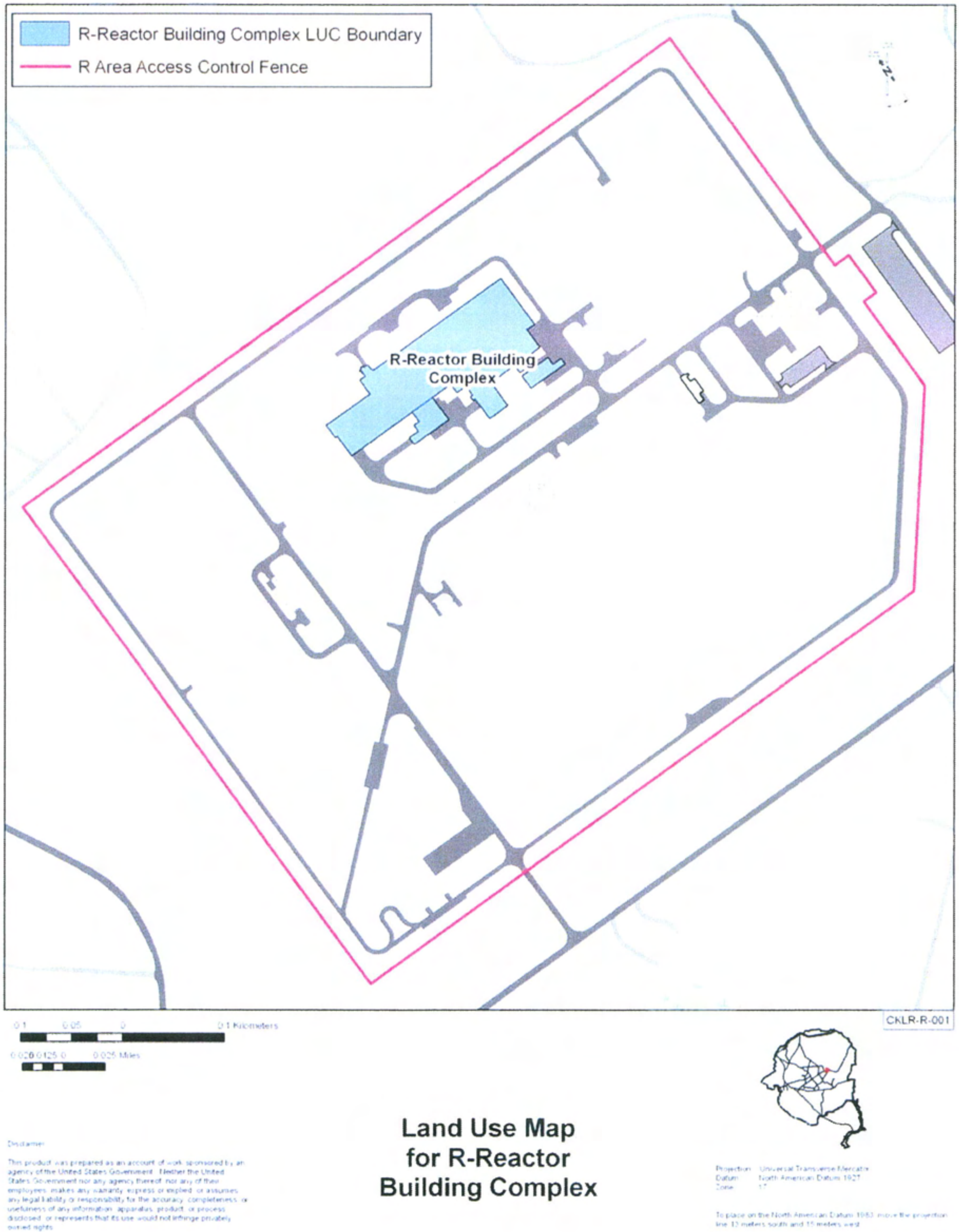


Figure 6. Land Use Map for the R-Reactor Building Complex

ARF # 16479

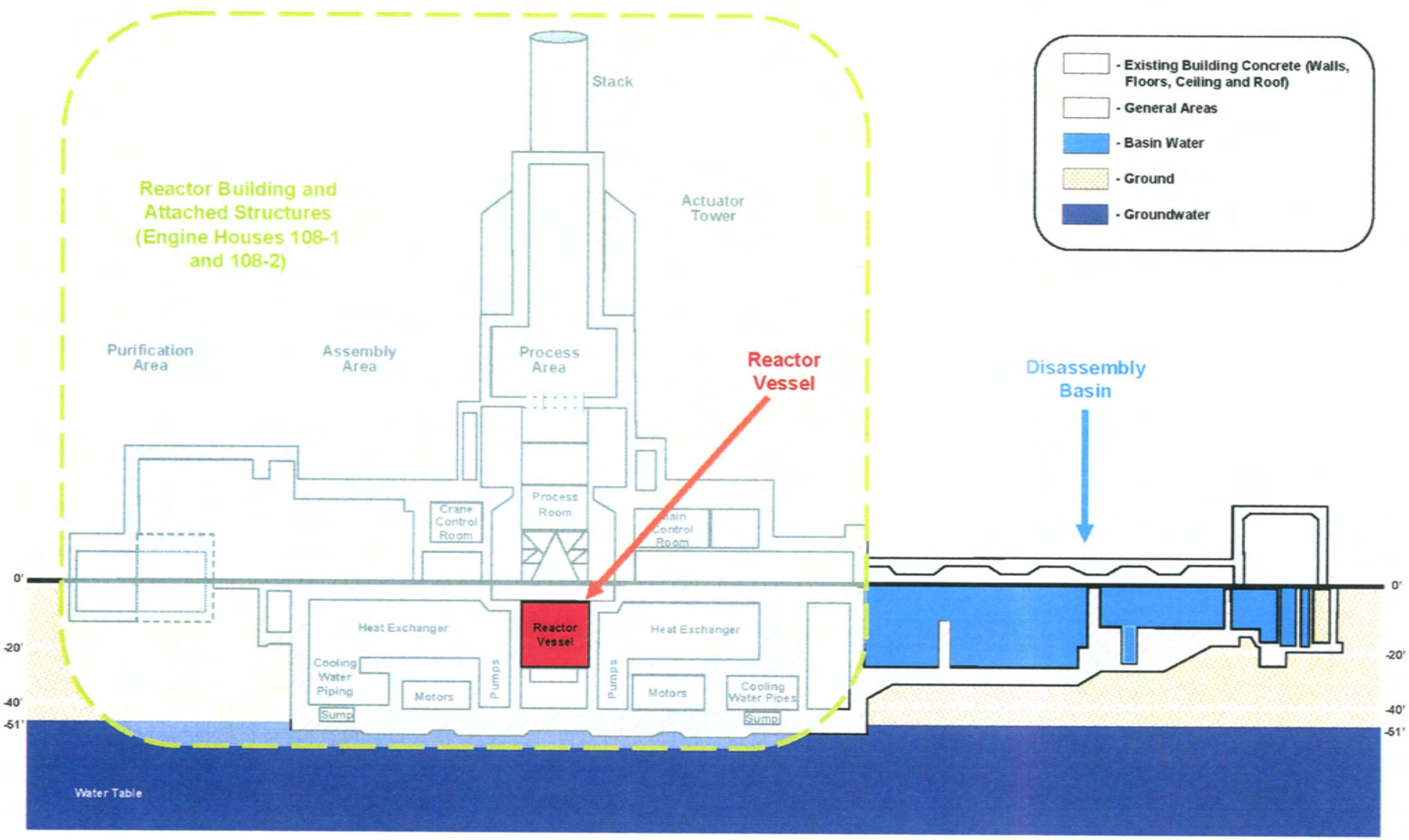


Figure 7. Generic Layout of the Reactor Complexes Subunit

- bottom shield constructed primarily with stainless steel;
- thermal shield constructed primarily with an iron alloy and stainless steel; and
- biological shield constructed of approximately 1.5-m (5-ft) thick concrete with ancillary stainless steel piping and components that traverse it.

There are no fuel or target assemblies within the reactor vessel. The components of the reactor vessel are in solid form and contain activated products that are part of and within the matrix material of the reactor vessel.

As a result of the operations of the reactor vessel subunits, the reactor vessels contain activated components with radionuclides at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 principal threat source material (PTSM) risk threshold. Additionally, the reactor vessels are impacted with radionuclides at concentrations that are above regulatory standards (i.e., maximum contaminant levels [MCLs]) and that may have a potential to migrate to groundwater.

Disassembly Basin Subunit Operational History

Each disassembly basin subunit was used to cool (both thermally and radiologically) and process fuel and target assemblies for transfer to the separations facilities. The disassembly basins hold aqueous and solid (sludge) media that contain fission and activation products. In addition, the disassembly basins contain activated scrap metal and failed assembly storage containers.

As a result of historical operations, contaminated water, equipment, and sludge within the disassembly basins contain contamination with concentrations exceeding 1E-06 industrial worker risk threshold. Contaminants in sludge and equipment at the bottom of the disassembly basin exceed the 1E-03 PTSM risk threshold. In addition, the presence of contamination contained in water, equipment, and sludge within the disassembly basin has the potential to migrate to groundwater at levels that exceed regulatory standards (i.e., MCLs).

Of the four reactor disassembly basins presented in this EAROD, only the water in the R-Reactor disassembly basin has been removed to date. This action was conducted using a non-time critical removal action to remove contaminated water from the basin by forced evaporation and supplemented by treatment by the SRS Effluent Treatment Facility (USDOE 2002). Water in the C-, K-, and L-Reactor Complexes will be addressed with their specific Area OU. The Engineering Evaluation and Cost Analysis (EE/CA) for R-Reactor disassembly basin also includes grouting of the disassembly basin, which will be consistent with the final end-state decision.

Building and Attached Structures Subunit Operational History

Each building subunit is a reinforced-concrete structure with walls and floors several feet thick in some areas for blast resistance. The exterior wall thicknesses above grade were dictated by shielding design while reinforcement provided for flexure during blast loads. The buildings extend from -15.2 m (-50 ft) to +45.4 m (+149 ft). Most of the processing equipment and components are located below grade.

The building is subdivided into areas based on activities performed in support of operations. These areas are 1) Assembly Area; 2) Process Area; and 3) Purification Area (Figure 7). The Assembly Area received and prepared fuel and target rods from another area of SRS (M Area). The fuel and target rods were then sent to the Process Area. The Process Area houses the reactor vessel subunit, which is embedded in the floor of the process room. The Process Area also contains the shield water system, control and safety rod-actuating mechanisms, heat exchangers, primary coolant circuit pumps, helium blanket gas system, and the main control room. The Purification Area was used to remove fission and activation products from moderator water and blanket gas. In the Purification Area, moderator water passed through filters, ion exchange resin, and then through distillation columns before being returned to the primary cooling water circuit. This process resulted in the accumulation of radionuclides in process vessels contained within shielded cells.

Attached structures are outside of the main building, but physically connected to the main building. These attached structures include the Engine Houses (108-1 and 108-2) and the Standby Pumphouse (191), with the exception of the R-Reactor Complex, where no standby pumphouse was constructed. The Engine Houses are two-level facilities that provided emergency backup power for operations. These facilities contained diesel generators, direct current (DC) generators, and air compressors. The exhaust pipes for these facilities used asbestos insulation. The basement for these facilities contained support equipment including diesel tanks, coolant tanks, and pumps.

As a result of activities conducted in the building and attached structures subunits, structural concrete and components may be impacted with fixed contamination at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 PTSM thresholds in portions of the building (i.e., sumps, Purification Area). The building concrete and components could also be impacted with contaminants at concentrations that may have the potential to migrate to groundwater at levels exceeding regulatory standards (i.e., MCLs).

Basis of Expected Conditions for C-, K-, L-, and R-Reactor Complexes

The P-Reactor Complex was the subject of numerous investigations to determine conditions of the reactor vessel subunit, disassembly basin subunit, and buildings and attached structures subunits (SRNS 2008). The evaluations performed for the three subunits at the P-Reactor Complex were used as a basis of expected conditions within the C-, K-, L-, and R-Reactor Complexes to provide comparative analysis of the proposed early action alternatives for these areas and to reduce or eliminate redundant analysis. Additionally, investigations conducted for the R-Reactor Complex provide additional characterization support (SRNS 2009b). The findings of those investigations provide a range of expected conditions for the C-, K-, L-, and R-Reactor Complexes due to similar designs and operational histories. For information supporting the applicability of the results of P-Reactor and R-Reactor investigations to the other Reactor Complexes, see Appendix B.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in 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 and allows for public review and comment regarding those alternatives. The ARF must be established at or near the facility at issue.

The SRS FFA Community Involvement Plan (WSRC 2006a) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS FFA Community Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). Section 117(a) of CERCLA, as amended, requires notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action. The *Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes (U)* (WSRC 2008a), a part of the ARF, highlights key aspects of the investigation and identifies the preferred early action for addressing the Reactor Complexes.

The FFA ARF, which contains the information pertaining to the selection of the early response action, is available at the following locations:

U.S. 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 public was notified of the public comment period through 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 45-day public comment period for the Early Action Proposed Plan (EAPP) (WSRC 2008a) began on June 18, 2009 and ended on August 03, 2009. A public workshop was held in North Augusta, SC on July 28, 2009. The workshop was well publicized and included representatives from the USEPA-Region 4, SCDHEC, and the South Carolina State Historic Preservation Office (SHPO).

During the public workshop, USDOE and Savannah River Nuclear Solutions, LLC (SRNS) presented information on the C-, K-, L-, and R-Reactor Complexes. This information included the following: 1) an explanation of the administrative approach (early action documents) in presenting the decommissioning end-state alternatives for the reactor complexes; 2) a description of the reactor complexes; and 3) description and comparison of the end-state alternatives for the reactor complexes decommissioning. The public was notified that a streamlined approach, which relied on existing information and the end-state decision for the P-Reactor Complex, was used to expedite the selection of the end-state for C-, K-, L-, and R-Reactor Complexes. The USEPA and the SCDHEC provided their perspective and support of the early action approach for the Reactor Complexes. Lessons learned from the P-Reactor Complex and a path forward for C-, K-, L-, and R-Reactor Complexes were presented. The path forward included development and issuance of this EAROD, development and issuance of the R-Reactor Complex Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for public comment, and development of area-specific documents which will provide the ISD details for C-, K-, and L-Reactor Complexes at some time in the future. The public was then given an opportunity to provide questions, comments, or concerns.

The Responsiveness Summary, which includes responses to public comments received during the public comment period and the public workshop, is included as Appendix A of this document.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT

As with many large federal facilities on the NPL, the problems at SRS are complex. To further expedite completion of work at SRS, USDOE developed an area completion strategy in 2003 for environmental restoration at SRS. This strategy results in accelerated risk reduction to workers, the public, and the environment by combining and streamlining the documentation process so that remedial actions within an Area OU can be implemented sooner and more efficiently. SCDHEC and USEPA are supporting the accelerated cleanup.

In order to manage the potential impact of multiple contaminant areas on receiving streams, the SRS is divided into six integrator operable units (IOUs). IOUs are defined as surface water bodies (e.g., site streams and the Savannah River) and associated wetlands, including the water, sediment, and related biota. The term IOU is used because these surface water bodies are the "integrator" of potential contamination that could be released from SRS activities to onsite and offsite receptors and the environment. Waste units within an IOU are evaluated and remediated individually or as part of an Area OU. The C-, K-, L-, and R-Reactor Complexes are located in four different IOUs: C-Reactor Complex (Fourmile Branch IOU); K-Reactor Complex (Pen Branch IOU); L-Reactor Complex (Steel Creek IOU); and R-Reactor Complex (Lower Three Runs IOU). A final comprehensive ROD for the respective IOUs will be issued when disposition of all individual OUs within the IOU have been completed.

This EAROD documents and proposes an end-state decision to implement ISD for the C-, K-, L-, and R-Reactor Complexes, including the building and attached structures subunit, the reactor vessel subunit, and the disassembly basin subunit. This end state leverages the evaluations and analyses that were conducted for the P-Reactor Complex and to some extent the R-Reactor Complex since the other Reactor Complexes are expected to exhibit similar site conditions due to operational history and construction. This strategy will streamline the end-state decision making process and reduce or eliminate redundant data collection and evaluation. Additionally, during the C-, K-, and L-Area OU RFI/Remedial Investigations (RIs), the assumptions gathered from investigations of the P- and R-

Reactor Complexes will be validated. This data will be used to substantiate the similarities between reactors and, as necessary, to refine problem statements, remedial action objectives (RAOs), and the likely response actions.

- The principal sources of contamination for the Reactor Complexes subunits that require remedial action include radiological and hazardous constituents associated with the Reactor Complexes that present a risk/hazard to future human receptors.
- The response action for the Reactor Complexes will stabilize contamination within the building facility to prevent direct human exposure, limit contaminant migration to groundwater, and prevent animal intrusion exposure to radiological and hazardous constituents that are or may be present within the Reactor Complexes. It should be noted that this final end-state decision for the Reactor Complexes would not require ongoing operational activities to cease until USDOE's mission involving these facilities has been completed.

Groundwater contamination in the vicinity of the Reactor Complexes will be addressed in the specific groundwater OUs with the exception of the R-Reactor Complex. For the R-Reactor Complex, groundwater is included as a subunit within the RAOU.

V. OPERABLE UNIT CHARACTERISTICS

This section presents a generic conceptual site model (CSM), provides an overview of site features, provides a summary of investigation activities, and presents the characterization results and constituents of concern (COCs) present in the Reactor Complexes.

Conceptual Site Model for the Reactor Complexes

The CSM identifies suspected (and evaluated) sources of contamination, contaminant release mechanisms, potentially affected media (secondary sources of contamination), potential exposure pathways, and potential human and ecological receptors. A graphic illustration of the CSM for the Reactor Complexes is provided in Figure 8.

Spills, leaks, accidental releases, or simply the operation of the reactors may have resulted in a release of hazardous and/or radioactive substances. If the primary source were to contact other media, secondary sources of contamination could be created through several release mechanisms. The future industrial worker was chosen as the exposure scenario for the evaluation of human receptors at this site. Although a quantitative evaluation of the future resident scenario was not performed, it was qualitatively assessed by recognizing that residential use of the area will be restricted by implementing land use restrictions to ensure long-term protectiveness. A quantitative ecological risk assessment was not performed because the exposure pathway for ecological receptors is considered incomplete due to a lack of quality habitat in an industrial setting.

The following are primary exposure pathways for evaluation relative to the future industrial worker:

- Exposure to concrete surface media via the incidental ingestion and external radiation pathways;
- Exposure to sediment media in the disassembly basins via the incidental ingestion, dermal contact, inhalation, and external radiation pathways; and
- Exposure to metal media via the incidental ingestion and external radiation pathways. These pathways apply to the Reactor Vessel only and are considered conservative evaluations since currently there is not a complete exposure pathway due to access controls and various shielding structures within the facility

Leaching of contaminants from the contaminated media (concrete, sediment, soil) to groundwater constitutes a secondary contaminant release mechanism. The potential to leach to groundwater was evaluated in the contaminant migration (CM) analysis conducted for the P-Reactor and R-Reactor Complexes. Ingestion of groundwater offers a potentially complete pathway for human receptors. However, exposure to the groundwater media is not considered within the scope of the Reactor Area OUs, with the exception of the RAOU, which includes groundwater as an RAOU subunit.

Significant Historical Features

Reactor operations at SRS have a long history in the support of our nation's defense program. In accordance with the Programmatic Agreement among the USDOE, the South Carolina SHPO, and the Advisory Council on Historic Preservation, the USDOE has the responsibility of all historic properties at SRS. As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act.

Furthermore, C Area Operable Unit (CAOU) is of special interest because 13 excess facilities, including the Reactor Building (105-C), have been identified in the *Savannah River Site's Cold War Built Environment Cultural Resources Management Plan* (USDOE 2005). Since the CAOU project has not begun the planning and design phases, some uncertainty exists regarding the extent and details of preservation for the 13 facilities. Consistent with the Area Completion approach, CAOU planning and design efforts will address this uncertainty. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details of ISD to ensure protection of human health and the environment while preserving, to the extent practicable, the historic significance of those C-Area facilities.

Streamlined Approach to Investigation

The P-Reactor Complex was the subject of numerous investigations, including contaminant fate and transport analyses, to determine site conditions of the three subunits (P-Reactor Vessel, P-Disassembly Basin, and P-Reactor Building [105-P]) (SRNS 2008). In addition, investigations that provide additional characterization support have been conducted for the R-Reactor Complex (SRNS 2009b). The findings of those investigations provide a range of expected conditions of the C-, K-, and L-Reactor Complexes due to similar designs and operational histories. As noted previously, the final end-state decision documented in this EAROD leverages the P-Reactor and

ARF # 16479

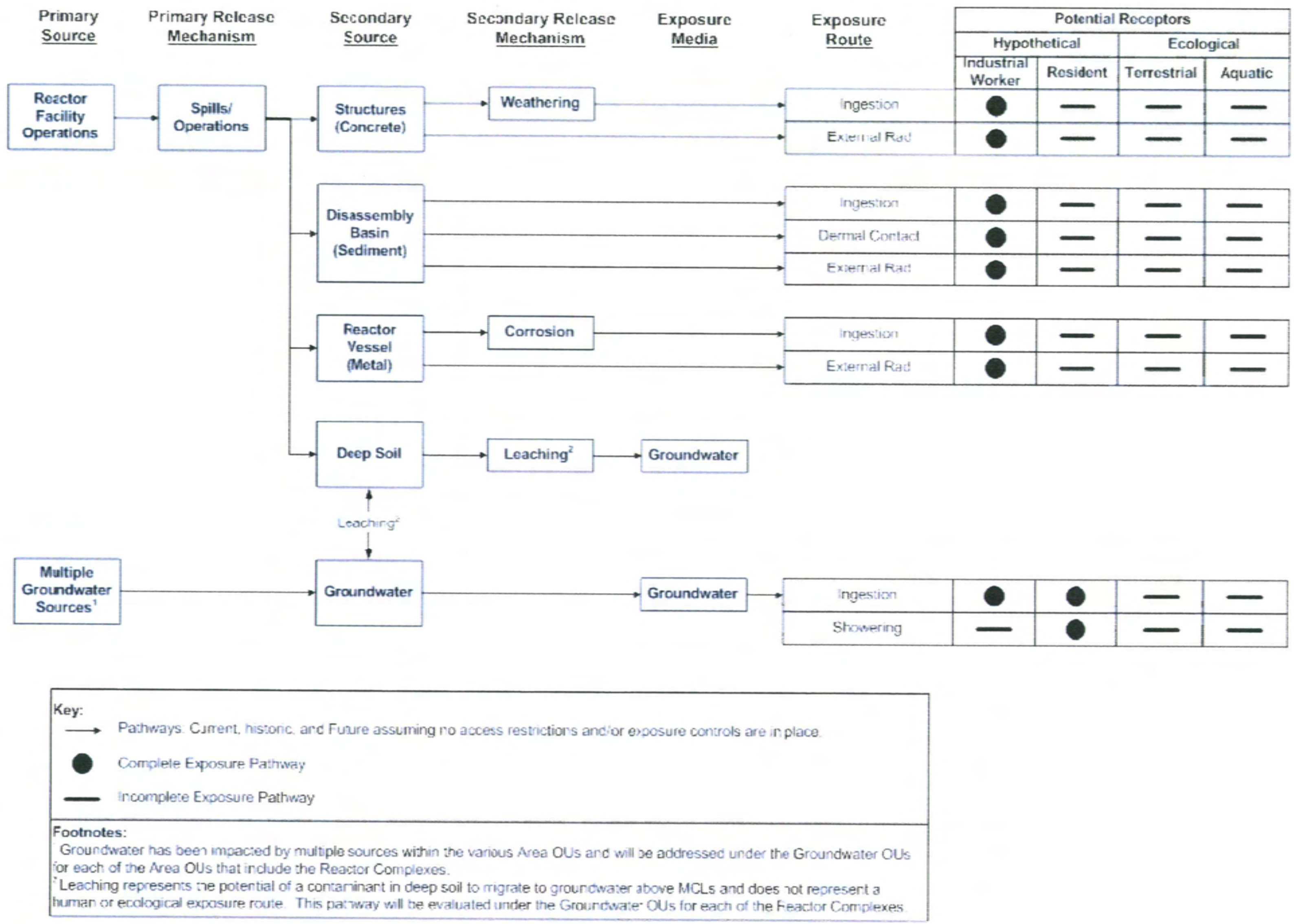


Figure 8. Conceptual Site Model for the C-, K-, L-, and R-Reactor Complexes

R-Reactor evaluations and analyses for the C-, K-, and L-Reactor Complexes. As such, no full-scale investigations for the C-, K-, and L-Reactor Complexes have been conducted. The cumulative results of the investigations of the P-Reactor and R-Reactor Complexes were used to determine the nature and extent of contamination and to identify problems warranting action. For information supporting the applicability of the results of P-Reactor and R-Reactor investigations to the other Reactor Complexes, see Appendix B.

Site-Specific Factors

A site-specific factor that might affect the timing of remedial action for the C-, K-, and L-Reactor Complexes is ongoing USDOE missions. Currently, nuclear material is no longer being produced at the five reactor facilities. However, the C-, K-, and L-Reactor Complexes have continuing USDOE missions. The C-Reactor Complex is used for cask car refurbishment; the K-Reactor Complex is used for nuclear materials disposition activities; and the L-Reactor Complex is used for nuclear materials storage. These missions will be completed prior to beginning reactor closure activities.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

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 1999) designates the C-, K-, L-, and R-Area OUs as being within the site industrial support area (Figure 2). The future land use is reasonably anticipated to remain industrial with USDOE maintaining control of the land.

Although the R-Reactor Complex is idle and awaiting closure, the C-, K-, and L-Reactor Complexes have continuing USDOE missions. The C-Reactor Complex is used for cask car refurbishment; the K-Reactor Complex is used for nuclear materials disposition activities; and the L-Reactor Complex is used for nuclear materials storage. These missions will be completed prior to beginning reactor closure activities. The ongoing missions associated with the C-, K-, and L-Reactor Complexes are estimated to continue until fiscal year (FY) 2012, FY 2021, and FY 2023, respectively.

Groundwater Uses/Surface Water Uses

SRS does not use the shallow water table for drinking water or irrigation purposes and controls any drilling in this area. However, the deeper uncontaminated aquifers may be used for industrial or drinking water use. Groundwater monitoring indicates that the deeper aquifers are uncontaminated. Groundwater monitoring and future investigation will be addressed by each of the specific Area Groundwater OUs, with the exception of the R-Reactor Complex which includes groundwater as an RAOU subunit.

VII. SUMMARY OF OPERABLE UNIT RISKS

Basis for Action

The response action selected in the EAROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of pollutants, hazardous substances, or contaminants from the site to the environment.

Baseline Risk Assessment

As a component of the RFI/RI process, a Baseline Risk Assessment (BRA) was performed to evaluate risks associated with the P-Reactor and R-Reactor Complexes relative to USEPA's target risk range. The BRA estimates what risks the site poses if no action were taken. The findings of these assessments provide for likely conditions that may be expected at the C-, K-, and L-Reactor Complexes.

Summary of Human Health Risk Assessment

The future industrial worker scenario was chosen to document the analysis of the potential for adverse human health effects. This is a standard USEPA scenario that addresses long-term risks to workers who are exposed to unit contaminants within an industrial setting. The future industrial worker is an adult who hypothetically works on-unit for the majority of time. An area is considered to pose adverse health effects to a future industrial worker if the cumulative risk from all COCs exceeds a carcinogenic threshold of greater than 1E-06 or a noncarcinogenic hazard index (HI) greater than 1.

Cancer risk is often expressed as the maximum number of new cases of cancer to occur in a given population of people due to exposure to the cancer causing substance. For example, a cancer risk of 1E-06 means that out of a population of one million people, not more than one additional person would be expected to develop cancer as a result of the exposure to the substance causing the risk.

Noncancer risk is usually determined by comparing the actual level of exposure to chemicals to the level of exposure that is not expected to cause any adverse effects. Strictly speaking, the HI is not a measure of risk. An HI less than one indicates that the exposure is not expected to result in any adverse effects. An HI greater than one does not suggest that adverse effects are expected, but they are possible.

The three components evaluated in the human health (HH) risk assessment included the reactor vessel subunit, the disassembly basin subunit, and the building and attached structures subunit. The HH risk assessment conservatively assumed that there are no access or exposure controls currently in place at this facility. The routes of exposure included in the assessment of the reactor vessel subunit (metal media) and the reactor building and attached structures (concrete media) were incidental ingestion and external radiation pathways. The routes of exposure included in the assessment of the disassembly basin subunit (sediment media) were incidental ingestion, dermal contact, inhalation, and external radiation.

For comparative analysis, the evaluations performed for the three subunits at the P- and R-Reactor Complexes (SRNS 2008, SRNS 2009b) were used as a basis of expected conditions within the C-, K-, and L-Reactor Complexes. In Appendix B, risk summary tables for each subunit at the P- and R-Reactor Complexes are presented to provide a range of expected values for the C-, K-, and L-Reactor Complexes. Table 1 includes a cumulative risk summary for the three subunits at P- and R-Reactor Complexes.

However, characterization data for C-, K-, and L-Reactor Complexes will be collected to support the specific Area Completions.

Reactor Vessel Subunit

P-Area (Table B-5): Eleven radiological constituents are identified as HH COCs. Four of these constituents exceed the PTSM risk threshold of 1E-03 and the remaining seven constituents have a risk estimate greater than 1E-06, but less than 1E-03. The total cumulative risk for the reactor vessel is 1.3E+03; the primary risk driver is cobalt-60 for approximately 100 years followed by nickel-59 as the long-term risk driver beyond 1000 years.

R-Area (Table B-6): Nineteen radiological constituents are identified as HH COCs. Seven of these constituents exceed the PTSM risk threshold of 1E-03 and the remaining twelve constituents have a risk estimate greater than 1E-06, but less than 1E-03. The total cumulative risk for the 105-R Reactor Vessel is 5.5E+01; the primary risk driver is cobalt-60 for approximately 100 years followed by nickel-59 and chlorine-36 as the long-term risk driver beyond 1000 years.

Disassembly Basin Subunit

P-Area (Tables B-7 and B-8): Fifty carcinogenic (49 radiological, one nonradiological) constituents are identified as HH COCs. Eighteen of these constituents exceed the PTSM risk threshold of 1E-03 and the remaining thirty-two constituents have a risk estimate greater than 1E-06, but less than 1E-03. The total cumulative risk for the sediment media is 6.3E+00. The initial primary risk drivers include cobalt-60 (risk = 3.6E+00), cesium-137 plus daughters (+D) (risk = 5.4E-01), and tritium (risk = 2.0E+00). However, long-term risk beyond 1000 years is dominated by nickel-59.

One nonradiological constituent, uranium, exceeds the PTSM threshold value of ten (hazard quotient [HQ] = 19). In addition, three noncarcinogenic constituents have HQs

Table 1. Cumulative Risk Summary for R- and P-Reactor Complexes

Subunit/Medium	Total Cumulative Carcinogenic Risk to Industrial Worker	
	P-Reactor Complex	R-Reactor Complex
Reactor Vessel	1.3E+03	5.5E+01
Disassembly Basin	6.3E+00	1.1E+00
Reactor Building 0-m (0 ft) level	N/A	1.7E-02
Reactor Building minus 6.1-m (-20 ft) level	1.4E-02	8.2E-05
Reactor Building minus 12.2-m (-40 ft) level	1.3E-02	1.4E-02
Reactor Building minus 18.0-m (-49 ft) level	1.7E-04	N/A

N/A = Not Applicable.

greater than 1 and are also identified as HH COCs. These constituents include antimony, iron, and lead.

R-Area (Table B-9): Twenty-four carcinogenic constituents are identified as HH COCs. Four of these constituents exceed the PTSM risk threshold of 1E-03 and the remaining twenty constituents have a risk estimate greater than 1E-06 but less than 1E-03. The total cumulative risk for the sediment media is 1.1E+00. The primary risk drivers include cobalt-60 (risk = 8.0E-01), cesium-137 (+D) (risk = 1.8E-01), and tritium (risk = 9.4E-02).

Reactor Building and Attached Structures Subunit

P-Area (Table B-10): Two radiological constituents exceed the PTSM risk threshold of 1E-03; cesium 137 (+D) (risk = 1.3E-02) and cobalt-60 (risk = 4.2E-03) with a total cumulative risk of 1.7E-02. These risk estimates are conservatively based on the maximum detected concentrations. PTSM is present in the minus 6.1-m (20-ft) and minus 12.2-m (40-ft) levels only. No PTSM is present in the minus 15.1-m (49.5-ft) level.

At the minus 6.1-m (20-ft) level, the following constituents were identified as HH COCs for surface concrete: Aroclor 1254 (risk = 3.2E-05), cesium-137 (+D) (risk = 9.9E-03), cobalt-60 (risk = 4.2E-03), strontium-90 (+D) (risk = 2.6E-05) and uranium-238 (+D) (risk = 6.0E-06): total cumulative risk = 1.4E-02.

At the minus 12.2-m (40-ft) level, the following constituents were identified as HH COCs for surface concrete: Aroclor 1254 (risk = 5.7E-06), cesium-137 (+D) (risk = 1.3E-02) cobalt-60 (risk = 5.7E-05), and strontium-90 (+D) (risk = 6.6E-05): total cumulative risk = 1.3E-02.

At the minus 15.1-m (49.5-ft) level, cesium-137 (+D) was identified as an HH COC for surface concrete (risk = 1.7E-04).

R-Area (Table B-11): Two radiological constituents exceed the PTSM risk threshold of 1E-03; cesium 137 (+D) (risk = 1.7E-02) and cobalt-60 (risk = 1.2E-02) with a total cumulative risk of 2.9E-02. These risk estimates are conservatively based on the maximum detected concentrations. PTSM is present in the ground level and minus 40 ft level. No PTSM is present in the minus 6.1 m (20 ft) level.

At the ground level, the following constituents were identified as HH COCs for surface concrete: arsenic (risk = 2.1E-06), Aroclor 1254 (risk = 2.3E-05), americium-243 (+D) (risk = 3.0E-06), cesium-137 (+D) (risk = 1.7E-02), and strontium-90 (+D) (risk = 2.1E-05): total cumulative risk = 1.7E-02.

At the minus 6.1 m (20 ft) level, the following constituents were identified as HH COCs for surface concrete: americium-243 (+D) (risk = 2.8E-06), cesium-137 (+D) (risk = 6.0E-05) and cobalt-60 (risk = 1.9E-05): total cumulative risk = 8.2E-05.

At the minus 12.2 m (40 ft) level, the following constituents were identified as HH COCs for surface concrete: Aroclor 1254 (risk = 1.2E-05), americium-241 (risk = 9.9E-06), cesium-137 (+D) (risk = 1.5E-03), cobalt-60 (risk = 1.2E-02) and strontium-90 (+D) (risk = 1.1E-05): total cumulative risk = 1.4E-02.

Summary of Ecological Risk Assessment

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 can induce an adverse response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact. Even though the building contains contaminants, it does not provide a suitable habitat for the ecology to thrive and, therefore, no ecological risks are associated with the Reactor Complexes.

Summary of Principal Threat Source Material Assessment

PTSM includes or contains hazardous substance, 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. To determine whether contaminated source material/soils/sediment should be considered PTSM, a simple quantitative assessment evaluating the toxicity of the source was performed. The source material is considered to be PTSM if the cumulative risk exceeds one of the following toxicity threshold criteria:

- Carcinogens - greater than 1E-03 industrial worker risk
- Noncarcinogens – industrial worker HI greater than 10

For the R- and P-Reactor Complexes, the reactor vessel subunit, the disassembly basin subunit, and parts of the building and attached structures subunit can all be considered PTSM. This determination can be deduced from the risk summary presented in Table 1. Details can be found in Tables B-5 through B-11, which present risk characterization summaries from the BRA for both the R- and P-Reactor Complexes. As stated previously, it is assumed that because of similar construction and operational histories the C-, K-, L-, P-, and R-Reactor Complexes will exhibit similar risks.

Summary of Contaminant Migration Assessment

Contaminant migration for the R- and P-Reactor Complexes was modeled using GoldSim, a one-dimensional mass transport software package. For modeling purposes, the Assembly Area, General Areas, Process Area (excluding vessel), and Engine Houses (108-1R and 108-2R) were modeled together as a single source. The Purification Area was modeled separately. A hazardous or radiological constituent is considered to be a CM COC if GoldSim modeling predicts that the constituent concentration in groundwater will exceed its MCL or preliminary remediation goal (PRG) at any time in the future. The groundwater receptor point is considered to be a hypothetical drinking water well screened in the water table aquifer and located at the edge of the reactor building.

Under baseline conditions, nine CM COCs were identified for R-Reactor (SRNS 2009b) and six CM COCs were identified for P-Reactor (SRNS 2008). With the exception of lead, all of the CM COCs were radionuclides. The predicted time frame for groundwater impact was from hundreds to thousands of years.

Conclusions

The following section summarizes the results of the BRA for each subunit at the R- and P-Reactor Complexes as problems warranting action. These provide the basis for the expected problems associated with the C-, K-, and L-Reactor Complexes.

Reactor Vessel Subunit

The following problems warrant action for the reactor vessel subunits:

- The reactor vessel contains activated components with radionuclides at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 PTSM risk threshold.

- The reactor vessel is impacted with radionuclides at concentrations that may have a potential to migrate to groundwater above regulatory standards (i.e., MCLs).

Disassembly Basin Subunit

The following problems warrant action for the disassembly basin subunits:

- Contaminated water, equipment, and sludge contain contamination with concentrations exceeding 1E-06 industrial worker risk threshold.

- Sludge and equipment at the bottom of the disassembly basin exceed the 1E-03 PTSM risk threshold.

- The presence of contamination contained in water, equipment, and sludge within the disassembly basin has the potential to migrate to groundwater at levels that exceed regulatory standards (i.e., MCLs).

Reactor Building and Attached Structures Subunit

The following problems warrant action for the building and attached structures subunits:

- The building structural concrete and components may be impacted with fixed contamination at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 PTSM thresholds in portions of the building (i.e., sumps, Purification Area).

- The building concrete and components could be impacted with contaminants at concentrations that may have the potential to migrate to groundwater at levels exceeding regulatory standards (i.e., MCLs).

- Sand filters on the roof of or near the disassembly basins are contaminated with radionuclides at concentrations exceeding 1E-06 industrial worker risk threshold.[2]

- The building and ancillary structures may contain lead-based or polychlorinated biphenyl (PCB-)-containing paint. If peeling, this type of paint presents a hazard/risk for human exposure.

[2] R-Reactor Complex does not have a sand filter installed; therefore, sand filters not included in R-Reactor Complex scope.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

RAOs are media- or unit-specific objectives for protecting human and the environmental receptors from exposure to contaminated media. The RAOs for the C-, K-, L-, and R-Reactor Complexes reflect the three distinct subunits of each Reactor Complex. RAOs are consistent for all of the reactors, as land use and exposure scenarios are the same.

Remedial goal options (RGOs) are typically identified along with the RAOs and represent the preliminary media-specific goals that provide a measure that the RAO will achieve for a selected remedial action; however, since this EAROD selects an ISD end state for the Reactor Complexes, RGOs will be developed and final remedial goals (RGs) will be selected following subsequent engineering efforts and regulatory decisions documented in the final Area OU Proposed Plans and RODs.

The RAOs developed collaboratively by USDOE, USEPA, and SCDHEC for the Reactor Complexes are presented below.

Reactor Vessel Subunits

The RAOs for the reactor vessel subunits are defined as follows:

- Prevent the migration of radionuclides from the reactor vessel to the groundwater at concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.
- Prevent industrial worker exposure to activated reactor vessel components exceeding 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.

Disassembly Basin Subunits

The RAOs for the disassembly basin subunits are defined as follows:

- Prevent the migration of radionuclides from the disassembly basin structure, water, and/or sludges to the groundwater at concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.

- Prevent industrial worker exposure to disassembly basin water, sludge, and activated metal scrap exceeding 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.

Building and Attached Structures Subunits

The RAOs for the building and attached structures subunits are defined as follows:

- Prevent the migration of radioactive or hazardous contaminants from the building to the groundwater in concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.
- Prevent industrial worker exposure to radioactive or hazardous contamination exceeding 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.

- Prevent animal intruder exposure to radioactive and hazardous contamination.

IX. DESCRIPTION OF ALTERNATIVES

As described in the introduction, the end-state decision for the C-, K-, L-, and R-Reactor Complexes is being supported by information gathered to support the end-state decision for the P-Reactor Complex. As such, the following alternatives developed for the P-Reactor Complex have been considered for the C-, K-, L-, and R-Reactor Complexes:

- ***no action***, where the facility would remain in its current condition indefinitely;
- ***in situ decommissioning with land use controls***, which would stabilize/isolate contamination remaining within the facility, limit the contaminant migration of radioactive or hazardous contaminants to groundwater, prevent radioactive or hazardous contaminant exposure to the industrial worker or animal intruder; and
- ***complete removal***, which would return the Reactor Complex footprint to a greenfield condition.

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

No Action

A No Action alternative for decommissioning is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to serve as a baseline for comparison with other remediation alternatives.

Under this alternative, no efforts would be made to control access, limit exposure, or reduce contaminant toxicity, mobility, or volume. The no action alternative would leave all three subunits in their current condition, with no additional controls.

No action would consist of the building subunit remaining in place indefinitely, containing the current inventory of radionuclides and hazardous materials. No planned on-going building maintenance would be performed and no additional measures would be taken to preclude water ingress or egress or human and ecological access. The building structure would be allowed to deteriorate.

There are no capital, construction, or operation and maintenance (O&M) costs for the No Action alternative. This alternative does not entail five-year remedy reviews. This alternative can be implemented immediately.

The cost estimate associated with the No Action alternative is as follows:

- Capital: $0
- O&M: $0
- Present-Worth: $0

In Situ Decommissioning with Land Use Controls

The basic premise of ISD is that the most cost-effective approach to isolating and containing residual radioactivity from past nuclear operations is internment of the radiological contamination in place to allow natural radioactive decay to reduce hazards to manageable levels. This method limits release of radiological contamination to the environment, minimizes radiation exposure to workers, prevents human/animal access into the building, and allows for ongoing monitoring of the decommissioned facility. Under the ISD scenario, the specific end-state configuration will be determined at the time the particular Reactor Complex is addressed. It is likely that a majority of the Reactor Building would remain, with the below-grade equipment and spaces grouted, as well as the Reactor Vessel. The Reactor Vessel would be stabilized in place using a grout with appropriate physical and chemical characteristics. The existing water would be removed from the Disassembly Basin. It is also likely that the stack and the above-grade structure of the Disassembly Basin would be removed due to safety and structural integrity concerns. In addition, the below-grade structure of the Disassembly Basin would be grouted and capped. Land use controls (LUCs) would be implemented and/or maintained to preclude uses other than industrial.

ISD would consist of 1) maintaining the structural integrity of the above-ground portions of each facility for a period of at least 200 years, preventing exposure to receptors from residual short-lived radioisotopes in building structure and preventing tritium migration from the Reactor Building Complex (RBC) due to infiltration; 2) stabilizing contaminants in place as necessary to prevent unacceptable release to the environment; and 3) sealing the building to eliminate routes of human and animal intruder access thereby eliminating unacceptable exposure to radiological or hazardous contamination. In addition, the roofs over portions of the Process Area would be designed, and maintained for 1350 years, to shed water and prevent vegetative growth, thus helping to prevent water infiltration into the Process Room due to roof degradation/collapse. This will help delay water contact with the long-lived isotopes present in the Reactor Vessel. This timeframe is supported by the structural integrity analysis conducted for P- and R-Reactor Complexes (WSRC 2008b, SRNS 2009a). See Alternative B in Table B-4 of Appendix B.

Institutional controls (ICs) (i.e., LUCs) would also be implemented to prevent direct human/animal exposure and to preclude uses other than industrial while operational activities occur at these facilities between signature of this EAROD and the completion of the USDOE's mission involving these facilities. Final LUC objectives would be determined in the final RODs for the specific Area OUs.

A range for costs for ISD of the P-Reactor Complex was developed and the costs for the other Reactor Complexes are expected to be similar. Since the specific design of the ISD end state would not be developed until the Feasibility Study phase of the Area OUs, it is appropriate to look at the range of costs for various ISD configurations. The present value cost ranges from the P-Reactor Complex are listed below:

- Capital: - $31,043,600 - $142,110,000
- O&M: - $21,497,385 - $94,147,875
- Present-Worth: - $52,540,985 - $236,257,875

Complete Removal

Complete removal entails demolition, packaging, transportation, and offsite disposal of all above- and below-grade structures, together with all the contents of the building and disassembly basin.

The Complete Removal alternative requires no surveillance and monitoring costs and has a low implementability. The Complete Removal alternative provides a level of long-term protection for human and ecological receptors and meets the RAOs. However, removal and disposal of the building to another location with no reduction of toxicity results in the problem simply transferred elsewhere and not effectively managed. In addition, the risk to workers during removal activities would either result in potentially exposing workers to direct contamination or require work to be conducted remotely. Likewise, the segregation and reduction of waste into manageable sizes for packaging and transport would also require remote operations or result in worker exposure as well. Finally, selection of an appropriate waste repository for disposition of contaminated building and reactor components is limited and complete removal is the most expensive alternative.

The present value cost estimate associated with the complete removal alternative is as follows:

- Capital: $366,490,000
- O&M: $0 (since no contamination is left behind to manage)
- Present-Worth: $366,490,000

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remedial alternatives was assessed against evaluation criteria to provide the basis for selecting a remedy. The criteria are identified in 40 Code of Federal Regulations (CFR) 300.430(e)(9)(A-I) and are derived from the statutory requirements of CERCLA § 121. Table 2 briefly explains each of the nine criteria.

Comparative Analysis for the Reactor Complex Alternatives

The following sections present a comparative analysis of the three remedial action alternatives considered for the Reactor Complexes. The alternatives are compared based on their relative achievement of NCP threshold and primary balancing criteria. This analysis identifies the trade-offs between alternatives. The comparative analysis of alternatives is summarized in Table 3.

The alternatives are also compared based on their relative achievement of threshold and primary-balancing criteria. Modifying criteria (i.e., state or support agency acceptance and community acceptance) will be evaluated after the public comment period on the EAPP.

Overall Protection of Human Health and the Environment

The No Action alternative is not protective of human health or the environment nor does it achieve RAOs because no controls are established to preclude water ingress or egress or human and ecological access. The ISD and complete removal alternatives effectively protect human and ecological receptors and achieve RAOs.

Compliance with ARARs

As shown in Table 3, the No Action alternative would not be compliant with chemical-specific, location-specific, or action-specific ARARs. Both ISD and the complete removal alternative can be implemented in a manner compliant with identified ARARs. See Appendix C, Table C-1 for details on the ARARs for the end-state decision for the Reactor Complexes.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide any long-term effectiveness or permanence since no controls are established to preclude water ingress or egress or human and ecological access. The ISD alternative eliminates receptors' exposure to contaminants from the Reactor Complexes and prevents exposure to groundwater through the use of LUCs to prohibit the use of groundwater. ISD would require long-term monitoring to ensure continued effectiveness and is long term in nature. The complete removal alternative permanently eliminates contaminants from the Reactor Complexes and is also long term in nature. However, the waste and its hazard potential would still persist in another location though the associated risks would be addressed by the design and operations of the accepting disposal facility.

Reduction of Toxicity, Mobility, or Volume through Treatment

The No Action alternative does not reduce the toxicity, mobility, or volume of contaminants. Through the use of ISD, the mobility of contaminants would be greatly reduced. Complete removal permanently eliminates contaminants from the Reactor Complexes, thus reducing the toxicity, mobility, and volume of contaminants at SRS and negating the need for treatment.

Short-Term Effectiveness

The No Action alternative presents no short-term effectiveness and is not protective of human or ecological receptors.

ISD has a high short-term effectiveness and requires only temporary disturbance of contaminated media during construction activities. For example, stabilization of the subsurface components of the Reactor Complexes (i.e., reactor vessels) can be achieved with limited direct contact between workers and activated metal and concrete components. Engineering controls and health/safety procedures would be implemented to protect remedial workers, on-unit workers, animal intruders, the community, and the environment.

Complete removal has low short-term effectiveness. Engineering controls and health/ safety procedures would be implemented to protect remedial workers, on-unit workers, the community, and the environment; however, short-term risks to human health would result from demolition, size reduction, waste management (i.e., handling, packaging, etc.), and transportation associated with the removal and shipment of waste materials offsite.

The No Action alternative does not achieve RAOs while alternatives ISD and Complete Removal would achieve RAOs upon completion of implementation.

Implementability

No construction is required for the No Action alternative so it could be implemented immediately. Implementation of ISD is achieved using construction equipment, materials, and methods that are readily available to complete ISD and conduct ongoing surveillance and monitoring. The complete removal alternative requires no surveillance and monitoring but would be difficult to implement as compared to ISD due to physical work associated with highly activated materials.

Cost

The total present-worth costs of the alternatives addressing the P-Reactor Complex reactor vessel, building, and disassembly basin subunits were estimated to be $0 for the No Action alternative, $52,540,985 - $236,257,875 for alternative ISD, and $366,490,000 for Complete Removal. These P-Reactor Complex costs are presented for comparative

Table 2. Summary 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 ICs, engineering controls, or treatment.
- *Compliance with applicable or relevant and appropriate requirements (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.
- *Community Acceptance* considers whether the local community agrees with the Preferred Alternative. Comments received on the Proposed Plan during the public comment period are an important indicator of community acceptance.

Table 3. Comparison of Alternatives Against the CERCLA Criteria

Alternative	Overall Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, or Volume	Short-Term Effectiveness	Implementability	Cost
No Action	No	No	Poor	Poor	None	N/A	$0
In Situ Decommissioning	Yes	Yes	Good	Medium	High	Easy	$52,540,985 to $236,257,875
Complete Removal	Yes	Yes	Good	High	Low	Difficult	$366,490,000

N/A – Not Applicable.

analysis. The ISD cost for each Reactor Complex will be evaluated during the Area OU Feasibility Studies. Detailed breakdowns of the P-Reactor Complex cost summaries are included in Appendix D.

XI. THE SELECTED REMEDY

The selected alternative is the alternative that provides the greatest level of protection to human and ecological receptors in a comparable time frame as evaluated under the CERCLA criteria. Consistent with the preferred alternative for the P-Reactor Complex, the selected alternative for the C-, K-, L-, and R-Reactor Complexes is ISD with LUCs. ISD meets the RAOs and provides the best balance among the nine criteria, focusing heavily on the short-term effectiveness, implementability, and cost criteria, while resulting in a remedy that provides a high level of long-term protection.

Detailed Description of the Selected Remedy

Based on the earlier evaluation of alternatives and supported by the detailed evaluation of alternatives performed in the Combined Document (SRNS 2008) for the P-Reactor Complex, the selected remedy for final end-state decision for the C-, K-, L-, and R-Reactor Complexes is ISD with LUCs.

Under the ISD scenario, the specific end-state configuration will be determined at the time the particular Reactor Complex is addressed. It is likely that a majority of the Reactor Building would remain, with the below-grade equipment and spaces grouted, as well as the Reactor Vessel. The Reactor Vessel would be stabilized in place using a grout with appropriate physical and chemical characteristics. The existing water would be removed from the Disassembly Basin. It is also likely that the stack and the above-grade structure of the Disassembly Basin would be removed due to safety and structural integrity concerns. In addition, the below-grade structure of the Disassembly Basin would be grouted and capped. LUCs (Table 4) would be implemented and/or maintained to preclude land uses other than industrial.

ISD would consist of 1) maintaining the structural integrity of the above-ground portions of each facility for at least a period of 200 years, preventing exposure to receptors from residual short-lived radioisotopes in building structure and preventing tritium migration from the RBC due to infiltration; 2) stabilizing contaminants in place as necessary to prevent unacceptable release to the environment; and 3) sealing the building to eliminate routes of human and animal intruder access thereby eliminating unacceptable exposure to radiological or hazardous contamination. In addition, the roofs over portions of the Process Area would be designed, and maintained for 1350 years, to shed water and prevent vegetative growth, thus helping to prevent water infiltration into the Process Room due to roof degradation/collapse. This will help delay water contact with the long-lived isotopes present in the Reactor Vessel. This timeframe is supported by the structural integrity analysis conducted for P- and R-Reactor Complexes (WSRC 2008b, SRNS 2009a). See Alternative B in Table B-4 of Appendix B.

USDOE expects the selected alternative to satisfy the statutory requirements in CERCLA Section 121(b), which are to (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants. Additionally, the selected alternative meets the statutory expectation of the NCP that alternatives be considered "that involve little or no treatment, but provide protection of human health and the environment primarily by preventing or controlling exposure to hazardous substances, pollutants, or contaminants, through engineering controls and, as necessary, ICs to protect human health and the environment and to assure continued effectiveness of the response action." [40 CFR 300.430(e)(3)(ii)]. Although this alternative is the preferred end state, details as to the specific nature, extent, and costs associated with the final ISD end state would be included in the final ROD for each specific Area OU.

Institutional controls will be implemented by:

- Access controls to prevent exposure to on-site workers via the Site Use Program, Site Clearance Program, work control, worker training, worker briefing of health and safety requirements.
- Access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B 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 is ever transferred to nonfederal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA Section 120(h). The deed notification shall notify any potential purchaser that the property has been used for the management and disposal of waste. 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 deed shall also include deed restrictions precluding residential use of the property. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in this EAROD upon any and all transfers. However, the need for these deed 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 need for the deed restrictions 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.

The selected remedy for the Reactor Complexes leaves hazardous substances in place that pose a potential future risk and will require land use restrictions as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control Assurance Plan (LUCAP) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The LUCs for the R-Reactor Complex will be addressed in the final RAOU LUCIP, which is being implemented on an accelerated schedule due to the passing of legislation (i.e., American Recovery and Reinvestment Act). Because the remedial actions for C-, K-, and L-Reactor Complexes will be implemented further in the future, an Early Action LUCIP (EALUCIP) will be submitted for these three Reactor Complexes. The EALUCIP referenced in this EAROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy for C-, K-, and L-Reactor Complexes. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this EAROD. Upon final approval, the EALUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the SRS Federal Facility Agreement. The approved EALUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the C-, K-, and L-Reactor Complexes. The EALUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in this EAROD upon any and all transfers. 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 ICs.

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, including institutional controls, will restrict the Reactor Complexes 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. Land use controls selected as part of this action will be maintained for as long as necessary to keep the selected remedy fully protective of human health and the environment and termination of any land use controls will be subject to CERCLA requirements for documenting changes in remedial actions.

The LUC objectives necessary to ensure protectiveness of the selected remedy are:

- Restrict unauthorized worker access and prevent unauthorized contact, removal, or excavation of contaminated media;
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds;
- Maintain the integrity of any current or future remedial or monitoring systems;
- Prevent access or use of contaminated groundwater until cleanup levels are met;
- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion.

It is important to recognize that USDOE operational activities will continue to occur at the C-, K-, and L- facilities after the EAROD is signed and issued. Although CERCLA five-year remedy reviews will be conducted to confirm the presence and effectiveness of the LUCs and the continued appropriateness of the ISD end state, ongoing operational activities will not be included in the reviews. Additionally, the agreement on the ISD end state will not require ongoing operational activities to cease until USDOE's mission involving these facilities is complete.

Because the EALUCIP is not proposing additional LUCs other than those currently used at SRS, an Early Action Remedial Action Implementation Plan (RAIP) will not be submitted. Approval of the EALUCIP would constitute remedial action start.

The current and future land use for the C-, K-, L-, and R-Reactor Complexes is industrial with USDOE maintaining control of the land. In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions required by Section 120(h) of CERCLA.

Cost Estimate for the Selected Remedy

The information in the cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Detailed breakdowns of these cost summaries are included in Appendix D. 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. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost. More refined estimates for ISD cost for each Reactor Complex will be evaluated during the specific Area OU alternative analysis.

Summary of Present Value Costs

Capital:	\$31,043,600 – \$142,110,000
O&M:	\$21,497,385 – \$94,147,875
Present worth:	\$52,540,985 – \$236,257,875

Estimated costs associated with the selected remedy are based on a 3.9% discount rate over a 200-year period and are summarized above.

Estimated Outcomes of Selected Remedy

The expected condition after the selected alternatives have been implemented is that ISD of the Reactor Complexes, in combination with LUCs, including ICs, would eliminate

Table 4. Land Use Controls for the C-, K-, L-, and R-Reactor Complexes.

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

[a]Affected areas – Specific locations identified in the 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.

exposure for human and ecological receptors. After implementation of the remedial actions, the Reactor Complexes will remain industrial areas with land use restrictions.

The Selected Remedy for the Reactor Complexes will meet RAOs through the following means:

- Prevent industrial worker exposure to radioactive or hazardous contamination exceeding 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds from the Reactor Complexes by controlling access to the building and associated structures through engineering controls and LUCs
- Prevent migration of radiological and hazardous contaminants from the Reactor Complexes to groundwater to the extent practicable through infiltration control, stabilization, and isolation of contamination remaining within the Reactor Complex
- Prevent animal intruder exposure to radioactive and hazardous contamination within the Reactor Complexes by controlling access to the building and associated structures through engineering controls.

XII. STATUTORY DETERMINATIONS

Based on the *Resource Conservation and Recovery Act Facility Investigation / Remedial Investigation Report with Baseline Risk Assessment and Corrective Measures Study / Feasibility Study for the P-Area Operable Unit* (SRNS 2008) and similarities between the P-Reactor Complex and the C-, L-, K-, and R-Reactor Complexes, the Reactor Complexes pose a threat to human health and the environment. To address the threat, ISD with LUCs has been selected as the final end-state decision for the C-, K-, L-, and R-Reactor Complexes. Both the current and reasonably anticipated future land use is industrial.

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action (unless justified by a waiver), are cost-effective, and utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. These remedies, once fully designed in specific Area OU documentation and decision documents, also satisfy the statutory preference for treatment as a principal element of the remedies (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is and will continue to be protective of human health and the environment.

The selected remedy for the Reactor Complexes leaves hazardous substances in place that pose a potential future risk; therefore, each Area OU covered by this EAROD will require LUCs as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a LUCAP to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The LUCs for the R-Reactor Complex will be addressed in the final RAOU LUCIP, which is being implemented on an accelerated schedule due to the passing of legislation (i.e., American Recovery and Reinvestment Act). Because the remedial actions for C-, K-, and L-Reactor Complexes will be implemented further in the future, an EALUCIP will be submitted for these three Reactor Complexes. The EALUCIP incorporated by reference into this EAROD will provide details to discuss interim LUCs that are currently used at the site and the specific measures required to implement and maintain the LUCs selected as part of this remedy for C-, K-, and L-Reactor Complexes. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this EAROD. Upon final approval, the EALUCIP will be appended to the LUCAP and is considered incorporated by reference into this EAROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the

SRS FFA. The approved EALUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for C-, K-, and L-Reactor Complexes. The EALUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in this EAROD upon any and all transfers. 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 ICs. As previously stated, unit-specific LUCs objectives for the Area OUs will be deferred to the final ROD for each Area OU.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

Because this EAROD Revision 0 submittal period overlapped with the EAPP public comment period, additional comments received during the 45 day public comment period are included in Appendix A. The remedies selected in this EAROD do not contain any significant changes from the preferred alternatives presented in the EAPP.

XIV. RESPONSIVENESS SUMMARY

A public workshop was held in North Augusta, SC on July 28, 2009. The workshop was well publicized and included representatives from the USEPA Region 4, SCDHEC, and the South Carolina SHPO.

The Responsiveness Summary, which includes responses to public comments received during the public comment period and the public workshop, is included as Appendix A of this document.

XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

In response to accelerated scope under the Recovery Act, removal activities will be implemented at the R-Reactor Complex under a separate post-ROD administrative path

(SRNS 2009b). For this reason, the forecast schedule for the post-ROD documentation provided below is specific to the C-, K-, and L- Reactor Complexes (see Appendix E).

- SRS submittal of Revision 0 EALUCIP is scheduled for January 6, 2010.
- USEPA and SCDHEC will receive 90 calendar days for review and comment on the Revision 0 EALUCIP.
- The SRS revision of the EALUCIP will be completed 60 calendar days after receipt of all regulatory comments.
- USEPA and SCDHEC will receive 30 calendar days for final review and approval of the EALUCIP.
- The projected Early Action Remedial Action start date is January 12, 2011.

XVI. REFERENCES

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

SRNS, 2008. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study (CMS/FS) for P-Area Operable Unit (U),* WSRC-RP-2007-4032, Revision 1.2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009a. *Long Term Assessment of 105-R Structure for in-situ D&D Alternatives,* T-CLC-R-00002, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *RCRA Facility Investigation/ Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment and Corrective Measure Study/Feasibility Study (CMS/FS) for the R-Area Operable Unit (U),* WSRC-RP-2008-4035, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

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

USDOE, 2002. *Engineering Evaluation/Cost Analysis for the Grouting of the R-Reactor Disassembly Basin at the Savannah River Site*, Aiken, SC

USDOE, 2005. *Savannah River Site's Cold War Building Environment Cultural Resources Management Plan*, United States Department of Energy, Savannah River Operations Office, Aiken, SC

USEPA, 2004. *EPA Region IX Preliminary Remediation Goals Table,* United States Environmental Protection Agency, San Francisco, CA

WSRC, 2003. *Preliminary Remediation Goals.* Engineering Calculation, K-CLC-G-00077, Rev 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Radionuclide Preliminary Remediation Goals for Concrete Media.* Engineering Calculation, K-CLC-G-00086, Rev 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006a. *Savannah River Site Federal Facility Agreement Community Involvement Plan (U),* WSRC-RP-96-120, Revision 5, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006b, *Regulatory Document Handbook,* Rev. 16. ERD-AG-003, Washington Savannah River Company, Aiken, SC.

WSRC, 2008a. *Early Action Proposed Plan for the C-, K-, L-, and R- Reactor Complexes (U)*, WSRC-RP-2008-4085, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008b. *Long-Term Assessment of 105-P Structure for in-situ D&D Alternatives,* T-CLC-R-0004, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008c. *105-P Alternative Cost Analysis (U)*, SDD-2008-00003, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

This page was intentionally left blank

APPENDIX A

RESPONSIVENESS SUMMARY

Appendix A.1
Responses to Public Comments from the Public Workshop on July 28, 2009

Appendix A.2
Responses to Public Comments on the Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes

This page was intentionally left blank

RESPONSIVENESS SUMMARY

The 45-day public comment period for the Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes began on June 18, 2009 and ended on August 03, 2009. During the public comment period, a public workshop was held in North Augusta, SC on July 28, 2009. The workshop was well publicized and included representatives from the U.S. Environmental Protection Agency-Region 4 (USEPA), South Carolina Department of Health and Environmental Control (SCDHEC), and the South Carolina State Historic Preservation Office (SHPO).

This Responsiveness Summary includes responses to public comments received during the public workshop (Appendix A.1) and the public comment period (Appendix A.2).

This page was intentionally left blank

APPENDIX A.1

RESPONSES TO PUBLIC COMMENTS FROM THE PUBLIC WORKSHOP ON JULY 28, 2009

This page was intentionally left blank

Comments from the Public Workshop – July 28, 2009 – Held in North Augusta, SC.

1. There is no information regarding P Area risk. Where can we find that information? What problems were encountered and how will/were handled? The public needs to be made aware the risks and progress at various stages of project development. Readable documents that provide the risks, lessons learned, etc. should be provided to the public, suggest an executive summary type document. A lesson learned fact sheet would also be nice as we continue to move toward closing all five reactors.

   ***Response:** Information pertaining to P Area can be found in:*

   - *"RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit" (WSRC-RP-2007-4032, Revision 1.2, December 2008);*
   - *"Early Action Proposed Plan for the P-Area Operable Unit" (WSRC-RP-2007-4064, Revision 1.1, June 2008);*
   - *"Early Action Record of Decision for the P-Area Operable Unit" (WSRC-RP-2008-4037, Revision 1.1, December 2008);*
   - *"Explanation of Significant Difference for the Revision 1.1 Early Action Record of Decision for the P-Area Operable Unit" (SRNS-RP-2009-00704, Revision 1, September 2009).*

   P-Reactor has been undergoing deactivation activities similar to those activities that are occurring at R-Reactor.

   In general, public notices are issued to the public at the following stages of project development:

   - *Public Comment Periods for Proposed Plan documents (e.g., Early Action Proposed Plans, Statement of Basis/Proposed Plans, etc.)*
   - *Public Notices of Availability for three-Party (USDOE, USEPA, and SCDHEC) signed Records of Decision (e.g., Early Action Records of Decision, Explanation of Significant Differences, Records of Decision, etc.)*
   - *Public Notices of Availability of Pre-Construction Briefing Fact Sheets prior to construction starts*

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

U.S. 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

2. What documents i.e., EIS, PAs, etc., are there and what public involvement is there after this Work Shop?

   Response: The documents for the C-, K-, L-, and R-Reactor Complexes which are required under the CERCLA remedial process are as follows:

   - ***Early Action Proposed Plan for C-, K-, L- and R-Reactor Complexes;***
   - ***Early Action Record of Decision for C-, K-, L- and R-Reactor Complexes;***
   - ***Early Action Land Use Control Implementation Plan for C-, K-, and L-Reactor Complexes;***
   - ***In the future, C-, K-, and L-Reactor Complexes will follow the CERCLA remedial documentation pathway when the investigation/characterization phases begin (RCRA Facility Investigation / Remedial Investigation, Baseline Risk Assessment, Corrective Measures Study / Feasibility Study, Statement of Basis / Proposed Plan, Record of Decision, etc.);***

   In addition, the following CERCLA removal process documents are required:
   - ***Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for R-Reactor Building (105-R) Complex and associated Action Memorandum;***
   - ***Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for R-Area Operable Unit Process Sewer Lines and associated Action Memorandum;***
   - ***Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for R-Area Ash Basin and associated Action Memorandum;***
   - ***Statement of Basis / Proposed Plan for R-Area Operable Unit with Public Comment Period;***
   - ***Record of Decision for R-Area Operable Unit;***
   - ***Land Use Control Implementation Plan for R-Area Operable Unit***
   - ***Post Construction Report with Removal Action Reports for R-Area Operable Unit***

   The public will have an opportunity to comment on the preferred alternative in all of the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis documents and the Statement of Basis/Proposed Plans.

3. How does the public access documents regarding this reactor activity? Can this information and/or documents be placed on line?

Response: CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA (42 United States Code Sections 9613 and 9617). These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternative and allows for public review and comment regarding those alternatives. The Administrative Record File must be established at or near the facility at issue.

The SRS Federal Facility Agreement Community Involvement Plan (WSRC-RP-96-120, Revision 5) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Federal Facility Agreement Community Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). Section 117(a) of CERCLA, as amended, requires notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action.

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

U.S. 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

In general, Statement of Basis/Proposed Plans and Removal Site Evaluation Report/ Engineering Evaluation/Cost Analysis are posted on the external webpage during public comment periods.

4. How is the public aware of these types of public meetings? Is there more planned? How is the general public notified of these meetings? I only saw a newspaper story today and it was in the legal notices, can a better and timelier job of notification be done?

   Response: The public is notified of public comment periods and public workshops through 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. No additional public meetings are planned, but they can be requested by the public during the public comment period for those reactor specific actions that will be proposed in the future.***

5. Can the CAB briefings be placed on line for the public?

   ***Response:** CAB Meeting Summaries can be obtained through the following website: http://www.srs.gov/general/outreach/srs-cab/srs-cab.html*

6. It was stated that all 5 reactors are similar. There appears to be some similarity discrepancies with the data presented such as big differences in the numbers. Can you explain why they are still considered similar?

   ***Response:** The operations at and design of each of the five Reactor Complexes were all similar. Operating conditions in the Reactor Complexes were similar (i.e., temperature, pressure, fuel/target materials, etc), resulting in closely associated types of nuclear materials and contaminants. Further, the construction history/design/materials for each reactor are comparable, resulting in similarities in the type of media impacted (i.e., concrete, metal). The differences in curie content between the media in the difference reactors is largely due to differences in the operation time period for each reactor. P-Reactor operated the longest, whereas R-Reactor operated the shortest, bracketing the periods of operation for the other reactors. In addition, a calorimeter failure at R-Reactor contributed the largest contaminant inventory to the disassembly basin sludge of all the reactors. However, these differences in values are not significant enough to warrant a different remedial approach for any of the reactors.*

7. There are differences in design between Hanford and SRS reactors, did they perform similar functions? Is our reactor like Hanford's? They had the same mission yet they are taking a different approach. Why is the disposition different between the two (SRS and Hanford)? Has a source term evaluation for each reactor been performed?

   ***Response:** Both the Hanford Reactors and the SRS Reactors made nuclear materials for the United States Government. However, the two sets of reactors are very different because they were built to different specifications. The Hanford Reactors were graphite moderated, while the SRS Reactors were heavy-water moderated. The disposition of the Hanford Reactors is different from the SRS Reactors because the Hanford Core Team elected to place their reactors in SafeStor for 75 years, to allow the contaminants to decay for 75 years before taking final remedial actions to close the Hanford Reactors. The SRS Core Team has chosen In Situ Decommissioning which provides for final disposition of the contaminants at this time. Some of the key differences that resulted in these diverse disposition paths are as follows:*

   - *The reactor vessel at SRS is below-grade, whereas the reactor block at Hanford is above-grade which poses a greater exposure risk;*
   - *The SRS moderator (heavy water) can be removed, whereas the Hanford graphite moderator remains in place;*
   - *The SRS reactors are miles from the river, whereas the Hanford reactors are located next to the river, thus increasing the potential for release of contamination to the river.*

   The source term evaluation for P- and R-Reactors has been performed and will be discussed in the documents specific to the particular Reactor.

8. Is it correct that this In Situ decision doesn't preclude other decisions from being made? Is it correct that this EAPP is not a final plan for each individual reactor, but a collective approach? A member of the public used the analogy that all (reactor areas) will have shirts, trousers, shoes but not all same shape/color, this EAPP is broad framework.

   Response: The In Situ Decommissioning (ISD) decision is a collective approach that permits all the reactors to follow a standardized means of decommissioning, specifically grouting the reactor vessel in place, filling the below-grade portions of the building with grout, and leaving most of the above-grade portions of the building in place. Consistent with the Area Completion approach, planning and design efforts for the different Reactor Complexes will address the specific remedial activities. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details to ensure protection of human health and the environment while preserving, to the extent practicable, the historic significance of the specific Reactor Complex.

9. Is the significance being it (reactor vessel) can't go anywhere?

   Response: The reactor vessel would have to be size reduced in order to remove, transport, and dispose of it. Due to the high radiation levels associated with the vessel, size reduction of the vessel would be very difficult and expensive to implement in order to keep worker exposure to safe levels.

10. Is there a schedule for putting out the risk assessment? When will P-Area have a LUCIP developed?

    Response: The baseline risk assessment for P Area and R Area has been completed and can be found in the "RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit" (WSRC-RP-2007-4032, Revision 1.2, December 2008), and in the "RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the R-Area Operable Unit" (WSRC-RP-2008-4035, Revision 1.1, July 2009). The Land Use Control Implementation Plan for P-Area Operable Unit is scheduled for regulatory approval in 2011. The P-Area Operable Unit and the R-Area Operable unit documents that contain the baseline risk assessment are part of the Administrative Record File. In addition, the P-Area Operable Unit Land Use Control Implementation Plan will become part of the Administrative record File.

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

U.S. 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

11. Is there a risk to public in leaving the Reactor at Savannah River?

    Response: No. Grouting the Reactor Vessel in place will provide long-term protectiveness and, as long as the encapsulation remains sound and is maintained, no credible release mechanisms exist for the radionuclide contaminants from the Reactor Vessel. The encapsulation and cover system proposed as part of In Situ Decommissioning will reduce the mobility and toxicity of the contaminants through long-term stabilization and solidification.

12. Clarify the location and function of the engine houses for all reactors?

    Response: Two engine houses are attached externally to each of the Reactor Buildings. The engine houses were constructed with and connected to the Reactor Buildings at the minus 20-ft elevation. The engine houses provided back-up emergency power for reactor operations.

13. Residual activity in the reactor vessel is activated stainless steel. What is the half life in the stainless steel?

    Response: Stainless steel is primarily comprised of the elements iron, chromium, nickel, and manganese, as well as minute quantities of dozens of other trace elements (including niobium, carbon, molybdenum, chlorine, silver, and technetium, etc.). These elements of the stainless steel become radioactive from the nuclear fission occurring in the reactor vessel. Each element has its own individual radiological properties including half-life. Some of the more important radioactive elements of stainless steel (and their half-lives) are: carbon-14 (5,720 yrs); chlorine-36 (301,000 yrs); cobalt-60 (5.3 yrs); iron-55 (2.7 yrs); molydenym-93 (3,500 yrs); niobium-94 (20,000 yrs); nickel-59 (76,000 yrs); nickel-63 (101 yrs); silver-108m (420 yrs); and technetium-99 (213,000 yrs).

14. Is the class of construction of Disassembly Basin different from the remainder of structure, not as robust?

    Response: The class of construction for the Disassembly Basin is not different from the remainder of the Reactor Building. The facility was built to Specification 3019 "Building Materials and Plumbing", Revision 28, E.I. DuPont de Nemours & Company. However, the Process Area portion of the building (where the reactor vessel is located) was designed more robustly, with thicker concrete slabs and spans. This results in a lower expected

lifespan for the structural integrity of the Disassembly Basin as compared to the Process Area.

15. Construction of portions of the C, K and L Complex utilized transite materials that were not utilized in P and R Complex. Will the transite be removed from C, K, and L?

    Response: Yes. The transite will be removed.

16. What are the consequences of No Action?

    Response: The No Action alternative would not offer long-term protection of human health or the environment. Deterioration of the building would allow for exposure to contaminants in the above-grade portion of the building and the possibility of contaminants to be released into the groundwater. Without engineering controls (encapsulation with grout) to restrict access to the below-grade portions of the building, human and animal receptors could come into contact with high radioactivity levels. Without preventing water from contacting the reactor vessel, the probability of contaminant releases into the groundwater significantly increases.

17. Will the Surveillance and Maintenance program at SRS suffice for the No Action?

    Response: No. The USDOE Surveillance and Maintenance program is an action; No Action would eliminate even this activity. Further, this program alone would not significantly reduce the potential impact to groundwater.

18. Regarding groundwater migration, it is stated "prevent migration to extent practicable", is this EPA standard to meet?

    Response: The EPA generally requires that specific groundwater standards (or concentrations) are not exceeded in the future as one of the goals of the remedy. In some cases, EPA recognizes that these standards may not be technically achievable. Thus, the expectation is to "prevent migration to the extent practicable".

19. Are there measures/controls to monitor beyond a certain time period?

    Response: Monitoring will continue as long as necessary to verify that the selected remedy is fully protective of human health and the environment.

20. Does EPA say why or have anything to say it has to last so many years?

    Response: If the selected remedy leaves hazardous substances in place that pose a potential future risk, then the selected remedy will require land use restrictions as long as necessary to ensure that the selected remedy is fully protective of human health and the environment.

21. Could we bring waste from other areas into P or R Areas? (A matter of cost?)

    Response: No. P and R Areas would have to be permitted as a Waste Disposal Facility or receive a waiver in order to receive waste from other areas.

22. Is there an economy of scale to realize by putting other waste in the grout, i.e., waste consolidation?

    ***Response:** Waste from within P Area is being consolidated into the P-Reactor Building, to the extent practicable. The same is true for R Area in that R Area waste is being consolidated into the R-Reactor Building. While some grouting cost-savings can be achieved by filling the voids with waste, access to the below-grade portions of the Reactor Building is limited. Any cost-savings that would be accrued in terms of grout would be significantly offset by the labor required to transport the waste to the below-grade portions of the Reactor Buildings.*

23. What is the scrap metal being removed? What kind of scrap metal is in the Disassembly Basin?

    ***Response:** The scrap metal being removed is the Shield Door Gantry Crane. The Disassembly Basin also contains used reactor components, i.e., scrap metal that is predominately composed of stainless steel and aluminum.*

24. What is the design composition of the roof modifications? What will this cost?

    ***Response:** In preliminary design for P- and R-Reactor Buildings, the composition of the roof will be concrete. The cost for the roof modifications is estimated to be approximately $2,900K for each reactor building.*

25. What is the Class of Construction of the disassembly basin, how is it different from rest of structure?

    ***Response:** The class of construction for the Disassembly Basin is not different from the remainder of the Reactor Building. The facility was built to Specification 3019 "Building Materials and Plumbing", Revision 28, E.I. DuPont de Nemours & Company. However, the Process Area portion of the building (where the reactor vessel is located) was designed more robustly, with thicker concrete slabs and spans. This results in a lower expected lifespan for the structural integrity of the Disassembly Basin as compared to the Process Area.*

26. Is the Disassembly Basin water contaminated?

    ***Response:** Yes. The Disassembly Basins waters in all five Reactor Complexes are contaminated.*

27. Are there any residual radionuclides in the underground concrete?

    ***Response:** Yes. The underground concrete has residual radionuclides in it.*

28. Do you keep track of what goes below grade as source term?

Response: Any above-ground debris that is placed below-grade is accounted for as waste disposal, and along with any associated contamination will be accounted for in the Post-Construction Report.

29. Would you have to open new waste areas to do complete removal?

    Response: Yes. New permitted waste areas at SRS would be required to handle the volume of low-level waste that would be created if the entire Reactor Building was demolished and removed. The reactor vessel would have to be size reduced and shipped to a permitted off-site disposal facility.

30. In actuality, the in-situ option looks like complete removal? Is the risk to workers higher the more you do?

    Response: The In Situ Decommissioning option is significantly different than the complete removal option, as most of the above-grade portions of the reactor buildings are left in place, as well as the reactor vessel. As more removal activities occur, the risk to workers is higher due to the increased time to complete the heavy construction work and the greater potential of exposure to contaminated debris and the reactor vessel.

31. Could you fill all of actuator w/grout (at what cost) and not wait for it to fail? Would it not make it much safer to add grout?

    Response: The actuator tower is a large, vertical void located above the Reactor Vessel. It would be extremely difficult to grout and add a tremendous amount of weight to the top of the Reactor Vessel. Grouting the Reactor Vessel will afford the same level of protectiveness to human health and the environment from the source term as grouting the actuator tower would.

32. You mentioned other missions for the reactor buildings. Is the missions in L or K been lengthened?

    Response: The current timeline for the start and the completion of decommissioning of the individual reactors at SRS is as follows: K-Reactor Complex – fiscal year 2021-2029; and L-Reactor – fiscal year 2023-2031. This does not currently reflect an increase in mission length.

33. Has SRS looked into possible uses for the reactor?

    Response: The USDOE has determined that there are no future missions for these reactors.

34. Has SRS evaluated caving in the structure at the process area?

    Response: Yes. However, the structure is very robust and would be difficult to demolish. Additionally, the source term being left in place (i.e. the Reactor Vessel) would not be

encapsulated by the building, thus increasing the likelihood of potential exposure to human/animal receptors and the environment.

35. There are no words regarding historical preservation in the EAPP, especially regarding C Area. Will there be words incorporated?

    Response: As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act. In C-Area, 13 excess facilities including the Reactor Building (105-C) have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for historical preservation. At the time that a specific ISD decision is made at C-Area, preservation of the facilities to the extent practicable in keeping with the overall need to protect human health and the environment will be assessed. Text regarding the historical preservation of the reactor building complexes will be incorporated into the EAROD for C-, K-, L-, and R-Reactor Complexes.

36. State Historic Preservation Office would like to be included in future meetings, especially regarding C Area.

    Response: The public is notified of public comment periods for documents review and public workshops through 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 SHPO is encouraged to be involved with the public comment periods and the CAB meetings concerning the SRS Reactors.***

37. During presentations EPA made reference to "in the complex", what do you mean by that?

    Response: The words "in the complex" refer to "in the USDOE Complex", which broadly include all the USDOE facilities across the country.

38. No info on risks on P-Area and how work has been done, what worked right, what didn't work? Asking us to make decision based on P w/o info on how P is going w/o public meeting.

    Response: Information pertaining to P Area can be found in

    - ***"RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit" (WSRC-RP-2007-4032, Revision 1.2, December 2008);***
    - ***"Early Action Proposed Plan for the P-Area Operable Unit" (WSRC-RP-2007-4064, Revision 1.1, June 2008);***

- ***"Early Action Record of Decision for the P-Area Operable Unit" (WSRC-RP-2008-4037, Revision 1.1, December 2008);***
- ***"Explanation of Significant Difference for the Revision 1.1 Early Action Record of Decision for the P-Area Operable Unit" (SRNS-RP-2009-00704, Revision 1, September 2009).***

39. P-Reactor has been undergoing deactivation activities similar to those activities that are occurring at R-Reactor; the ISD work is not expected to begin at P- and R-Reactors until 2010.The reactor core is staying in the building in P or R, does it mean we will do the same in K, L, and C?

    Response: Yes. The Reactor Vessels will also be grouted in place for C-, K-, and L-Reactors as part of In Situ Decommissioning.

40. I appreciate the public meeting and opportunity. How many people are not connected with Site? Why is no one here from the newspaper? It feels like no info is given to public – we only hear about Hanford. You did not mention earthquake fault lines in area. What accidents can occur like Graniteville? Why not dig it (reactor building) up? Especially with the windfall (Recovery Act money).

    Response: From the show of hands, about 12-15 individuals of the 40-50 individuals do not have a connection to SRS-past or present. The public is notified of public comment periods for documents review and public workshops through 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** ***newspapers.***

    No damage or injury has ever been associated with any earthquake activity occurring within the 50-mi radius of the SRS. The largest event to have occurred was the magnitude 3.7 Clarks Hill event of November 5, 1974. Additional information concerning seismic activity and fault line at the SRS can be found in the RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit (WSRC-RP-2007-4032, Revision 1.2, December 2008.

    A Graniteville-type incident could not occur at the Reactor Building Complexes. The radioactive contaminants that exist in the Reactor Complexes are present as solids, primarily below the ground surface, and are associated with the reactor vessels. There is no risk of explosion or gas releases to the environment. Additionally, the ISD remedy will help stabilize the contaminants in place.

    The additional long-term benefits of removing the entire reactor building do not outweigh the short-term risks to workers involved in such an action or the additional costs.

41. Historic preservation does not seem to be addressed. National Historic Preservation Act requires the government to do what's necessary. Seems to only allow sympathetic uses and the document tonight does not mention C Area Historical significance. I want to make sure that we don't go home saying we (historical preservation interests) don't care.

    Response: As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act. In C-Area, 13 excess facilities including the Reactor Building (105-C) have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for historical preservation. At the time that a specific ISD decision is made at C-Area, preservation of the facilities to the extent practicable in keeping with the overall need to protect human health and the environment will be assessed. Text regarding the historical significance of the reactor building complexes will be incorporated into the EAROD for C-, K-, L-, and R-Reactor Complexes.

42. Why can't State Historic Preservation Office (SHPO) be involved along with EPA and DHEC? This will make sure we (SHPO) make noise to make sure DOE doesn't forget promises.

    Response: The SHPO is directly notified of all public comment periods, meetings, notices and CAB meetings concerning the SRS Reactors; and is encouraged to be involved and to provide comments.

43. What is goal of NHPA, to celebrate a long sad history?

    Response: The goal of the National Historic Preservation Act (NHPA) is to preserve historical and archaeological sites in the United States of America.

44. A representative from Mayor Cavanaugh office read a letter from the Mayor.

    Response: Please see the attached letter and response in Appendix A.2.

45. I can't concur with EAPP since it ignores C-Area. I would like to see more in plan (EAPP) in case Ray (Hannah) & Chris (Bergren) get replaced.

    Response: As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act. In C-Area, 13 excess facilities including the Reactor Building (105-C) have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for historical preservation. At the time that a specific ISD decision is made at C-Area, preservation of the facilities to the extent practicable in keeping with the overall need to protect human health and the environment will be assessed. Text regarding the

historical significance of the reactor building complexes will be incorporated into the EAROD for C-, K-, L-, and R-Reactor Complexes.

46. Executive Director of Aiken County Historical Museum – As an educational facility, it is extremely important to keep area vibrant.

    Response: SRS recognizes that 13 excess facilities in C-Area Operable Unit (CAOU), including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for preservation. The end-state decision proposed in this document, in situ decommissioning, allows for a range of acceptable end state conditions from which a final design will be determined at the time that the individual reactor complex is closed. A feasibility study for C-Area addressing its' future use will be completed prior to the start of closure activities, which are planned to begin in 2012. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details to ensure protection of human health and the environment while preserving, to the extent practicable, the historic significance of those C-Area facilities.

47. Can Mayor Cavanaugh get Aiken Standard involved?

    Response: The public is notified of public comment periods for documents review and public workshops through 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.***

48. A member of the public suggested that the public be part of the CAB (Citizens Advisory Board).

    Response: The Savannah River Site Citizens Advisory Board (CAB) is composed of 25 individuals from South Carolina and Georgia. The board members are chosen to reflect the cultural diversity of the population affected by SRS.

    For additional information concerning participation in the CAB, please visit: http://www.srs.gov/general/outreach/srs-cab/srs-cab.html

This page was intentionally left blank

APPENDIX A.2

RESPONSES TO PUBLIC COMMENTS ON THE EARLY ACTION PROPOSED PLAN FOR THE C-, K-, L-, AND R-REACTOR COMPLEXES

This page was intentionally left blank

1.

Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Since the actions proposed for these four reactors parallel the previous decision for P- Reactor, the EAPP should describe the expected and certainly the unexpected findings for that reactor. In fact, a public meeting should be held on this EAPP decision. In that meeting devote time to tell the public the differences between P-Reactor on the other four and the status of P cleanup. I look forward to the meeting to get a better understanding of the proposed action and why it is stated to be the proposed action. When I reviewed the P-Reactor actions, they seemed to be justifiable. I am sure this action is also justifiable, just not explained adequately.

Response: SRS feels that the public meeting held July 28, 2009 in North Augusta, SC adequately conveyed information related to the pathforward and preferred end-state remedy for the reactor building complexes to the public. Based on the similarities between P-Reactor, R-Reactor and the other reactor complexes (C, K, and L), the in situ decommissioning (ISD) end-state remedy is the logical choice. The details of ISD for each individual reactor complex will be described in a separate decision document that will be subject to public review and input.

2. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Risks associated with the proposed action needs to be better explained. Readers should be able to understand terms like "soil hazard index" used in Table A-2 and others used in the report. The footnote on Table A-7 says the RPG for this action will be ten times the industrial worker soil value, for the rest of SRS. Is this acceptable? Apparently the recommendation is thought to be so by issue of this report. This document should be revised and reissued for comments before the public meeting.

   Response: Section V of the EAPP provides a text summary of the site risks and problems that need remediation. It also includes an explanation for some of the risk terms in text boxes. Establishing preliminary remediation goals (PRG) for nonradionuclides at ten times the industrial worker soil values only applies to exposure to concrete, because ingestion or inhalation of concrete is much less likely than for soil. The approved risk analysis for PAOU and RAOU can be obtained through the public reading rooms in the documents titled "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for P-Area Operable Unit (U)" (WSRC-RP-2007-4032, Revision 1.2, December 2008) and "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for R-Area Operable Unit (U)" (WSRC-RP-2008-4035, Revision 1.1 July 2009), respectively.

3. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Page 4. At several places in this document you refer to R-reactor Vessel investigation. Add an appendix with the major findings or implications to this report.

   Response: Information regarding the R-Reactor Vessel Investigation is included and discussed in the document titled, "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for R-Area Operable Unit (U)" (WSRC-RP-2008-4035, Revision 1.1 July 2009).

4. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: From Figure 3, page 8, it appears K reactor and P reactor were in operation for the longest time and should have the most induced activity associated with the reactor. I do not see this when I look at Table A-2 from Appendix A. Somewhere the cause of the large curie content of R-Reactor should be discussed.

   ***Response:** The R-Reactor Disassembly Basin contains a smaller area called the Emergency Basin. This area was the location of a rupture of an instrumented fuel element assembly in 1957. Despite cleanup of the assembly components, significantly higher levels of contamination (greater curie content) remained in the sludge at the bottom of the basin, which was subsequently backfilled with clay and covered with a concrete cap. Additional details for the R-Reactor Complex will be provided in the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis that will be subject to public review and input.*

5. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Background on boxes on page 11 and 12 obscure the information contained. Background in boxes is unnecessary.

   ***Response:** The EAPP for the C-, K-, L-, and R-Reactor Complexes was written in a format approved by the USDOE, the USEPA, and the SCDHEC. SRS will continue to try to improve the clarity of information it provides the public.*

6. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Page 14 talks about an unexplained risk term. PTSM needs to be explained.

   ***Response:** Potential Threat Source Material (PTSM) is source materials considered highly toxic which cannot be reliably contained or pose a significant risk to human health or the environment should exposure occur. The text box on Page 13 of the EAPP for the C-, K-, L-, and R-Reactor Complexes provides additional detail.*

7. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Figure 6, page 23, is not clear. The short paragraph about it on page 22 is very little help. In the copy of the EAPP that I received, the figure is very light and small.

   ***Response:** Figure 6 of the EAPP depicts the Implementation Schedule for the C-, K-, L-, and R-Reactor Complexes pertaining to document submittals to USEPA and SCDHEC, review and comment cycles for USEPA and SCDHEC, SRS's incorporation of USEPA and SCDHEC comments, and regulatory approval of the documents. An updated schedule is included in Appendix E of this EAROD. For additional information, please contact Paul Sauerborn (803-952-6658) or paul.sauerborn@srs.gov).*

8. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: When I look at Table A-2 on page A-3, I note a very large difference between R-Reactor sludge content and the other reactors. Differences like that should be explained. The corrective action for this large amount of activity should also be discussed.

***Response:** The R-Reactor Disassembly Basin contains a smaller area called the Emergency Basin. This area was the location of a rupture of an instrumented fuel element assembly in 1957. Despite cleanup of the assembly components, significantly higher levels of contamination (greater curie content) remained in the sludge at the bottom of the basin, which was subsequently backfilled with clay and covered with a concrete cap. ISD is still the most appropriate remedy for the R-Reactor Building Complex. Additional details for the R-Reactor Building Complex will be provided in the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis that will be subject to public review and input.*

9. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Purpose of Tables A-4 through A-6 are not very useful unless explained better.

   ***Response:** The risk information was provided as supplemental material in support of Section V – Summary of Site Risks, and Section VI - Remedial Action Objectives. The total cumulative risks presented in these tables significantly exceed the risk thresholds established by USEPA and SCDHEC, thus providing the basis for action. The detailed risk analyses can be obtained through the public reading rooms for the "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit" (WSRC-RP-2007-4032, Revision 1.2, December 2008) and the "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the R-Area Operable Unit" (WSRC-RP-2008-4035, Revision 1.1, July 2009).*

10. Attachment to Email from Lee Poe, dated July 22, 2009 to Paul Sauerborn: Table A-7, and A-8 have the same problem. SRS must be familiar with all of this but the public is not.

    ***Response:** The risk information was provided as supplemental material in support of Section V – Summary of Site Risks, and Section VI - Remedial Action Objectives. The total cumulative risks presented in these tables significantly exceed the risk thresholds established by USEPA and SCDHEC, thus providing the basis for action. The detailed risk analyses can be obtained through the public reading rooms for the "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the P-Area Operable Unit" (WSRC-RP-2007-4032, Revision 1.2, December 2008) and the "RCRA Facility Investigation/ Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the R-Area Operable Unit" (WSRC-RP-2008-4035, Revision 1.1, July 2009).*

11. Attachment to Email from Walt Joseph, dated July 28, 2009 to Paul Sauerborn: When D&D began at SRS in 2003, the SRS Heritage Foundation and the cities of Aiken, Augusta and New Ellenton became Consulting Parties under the provisions of NHPA and worked with DOE, the National Council on Historic Preservation, the Citizens Advisory Board and the State Historic Preservation Office (SHPO) to help preserve historically important artifacts and structures. Members of these organizations developed the Cultural Resources Management Plan that was signed in December 2004 by all the parties.

The CRMP is a large document containing numerous implementation processes. Most of these processes have been or are being implemented effectively. However, C-Reactor Area is a special case. The CRMP requires a commitment to maintain the integrity of historic buildings in C area until its future use is defined by a Feasibility Study. The required study is to include potential interpretation and access issues in conjunction with heritage tourism objectives and SRS missions. This Feasibility Study has not been completed so the preferred alternative end-state for C Reactor listed in the EAPP does not meet requirements of the CRMP.

The EAPP also omits mention of the CRMP commitment that artifacts from other reactor areas slated for D&D are to be relocated to C Area if these artifacts can contribute to restoration of C Area to its original appearance.

We recognize that the actions planned for C Area will not occur until FY 2012. However, we would like to ask if the above comments pertaining to C-Reactor Area from a public meeting will be included in the Early Action Record of Decision for this project.

Mr. Allison's letter to SHPO, dated July 24, recognizes the significance of C Area and proposes to create the Feasibility Study that will lead to a final decision on C Area. We welcome this letter and look forward to working with DOE, the other agencies and Consulting Parties to reach agreement on the Feasibility Study and to revisit the CRMP.

Response: SRS recognizes that 13 excess facilities in C-Area Operable Unit, including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for preservation. The end-state decision proposed in this document, in situ decommissioning, allows for a range of acceptable end state conditions from which a final design will be determined at the time that the individual reactor complex is closed. A feasibility study for C-Area addressing its' future use will be completed prior to the start of closure activities, which are currently planned to begin in 2012. Without compromising the selected remedy's protection of human health and the environment, SRS will preserve the historical significance of these facilities in accordance with the National Historic Preservation Act to the extent practicable.

The following text will be added to the EAROD for C-, K-, L-, and R-Reactor Complexes:

"In accordance with the Programmatic Agreement among the USDOE, South Carolina State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation, the USDOE has the responsibility for the Cultural Resource Management of all historic properties at SRS. As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act.

Furthermore, C-Area Operable Unit (CAOU) is of special interest because 13 excess facilities, including the Reactor Building (105-C), have been identified in the Savannah

River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005). Since the CAOU project has not begun the planning and design phases, some uncertainty exists regarding the extent and details of preservation for the 13 facilities. Consistent with the Area Completion approach, CAOU planning and design efforts will address this uncertainty. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details of ISD to ensure protection of human health and the environment while preserving, to the extent practicable, the historic significance of those C-Area facilities."

"Under the ISD scenario, the specific end-state configuration will be determined at the time the particular Reactor Complex is addressed. It is likely that a majority of the Reactor Building would remain, with the below-grade equipment and spaces grouted, as well as the Reactor Vessel. The Reactor Vessel would be stabilized in place using a grout with appropriate physical and chemical characteristics. The existing water would be removed from the Disassembly Basin. It is also likely that the stack and the above-grade structure of the Disassembly Basin would be removed due to safety and structural integrity concerns. In addition, the below-grade structure of the Disassembly Basin would be grouted and capped."

As the R-Reactor Building Complex was deactivated, artifacts were retained per a mitigation plan developed to preserve items of historical significance. These items will be moved to the C-Reactor Building (105-C) Facility.

12. Letter from Mayor Fred Cavanaugh, dated July 28, 2009 to Jeffrey Allison:

AIKEN SOUTH CAROLINA

City of Aiken

Post Office Box 1177
Aiken, S.C. 29802

July 28, 2009

Aiken All-America City 1997

Fred B. Cavanaugh
Mayor

Mr. Jeffrey M. Allison, Manager
US Department of Energy-Savannah River Operations Office
PO Box Aiken,
South Carolina 29802

Dear Mr. Allison:

SUBJECT: Comments on the Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes

You may remember that I represented the City of Aiken as a Consulting Party during discussions that led to creation of the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (CRMP). I signed the CRMP on December 6, 2004 to indicate my agreement with the implementation process described therein.

I am unable to concur with the Early Action Proposed Plan as written because it ignores actions that were agreed to in the CRMP. Specifically, the Plan fails to address a commitment to maintain the integrity of C Area until its future use is defined by a feasibility study. The proposed study was specifically to include potential interpretation and access issues in conjunction with heritage tourism objectives and SRS missions. This study has not been completed.

The Plan also omits mention of the CRMP commitment that artifacts from other reactor areas slated for D&D be placed in C Area if these artifacts can contribute to restoration of C Area to its original appearance.

I recommend that the proposed Action Plan be revised to include the earlier CRMP commitments.

Sincerely,

Fred B. Cavanaugh

Fred B. Cavanaugh
Mayor

Response: SRS recognizes that 13 excess facilities in C-Area Operable Unit, including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for preservation. The end-state decision proposed in this document, in situ decommissioning, allows for a range of acceptable end state conditions from which a final design will be determined at the time that the individual reactor complex is closed. A feasibility study for C-Area addressing its' future use will be completed prior to the start of closure activities, which are currently planned to begin in 2012. Without compromising the selected remedy's protection of human health and the environment, SRS will preserve the historical significance of these facilities in accordance with the National Historic Preservation Act (NHPA) to the extent practicable.

The following text will be added to the EAROD for C-, K-, L-, and R-Reactor Complexes:

"In accordance with the Programmatic Agreement among the USDOE, South Carolina State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation, the USDOE has the responsibility for the Cultural Resource Management of all historic properties at SRS. As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act.

Furthermore, C-Area Operable Unit (CAOU) is of special interest because 13 excess facilities, including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005). Since the CAOU project has not begun the planning and design phases, some uncertainty exists regarding the extent and details of preservation for the 13 facilities. Consistent with the Area Completion approach, CAOU planning and design efforts will address this uncertainty. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details of ISD to ensure protection of human health and the environment while preserving, to the extent practicable, the historic significance of those C-Area facilities."

As both the P- and R-Reactor Building Complexes were deactivated, identified artifacts were retained per a mitigation plan developed to preserve items of historical significance. These items will be moved to the C-Reactor Building (105-C) Facility.

13. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: In the cover letter from the Citizen's Advisory Board (CAB) to SRS, the CAB stated "we submit as an attachment the General Comment requesting more support for the preferred alternative and, in addition, other General and Specific Comments to SRS for its consideration in improving and finalizing the EAPP for the SRS Reactor Complexes."

    Response: The Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes that was submitted for public comment was the final version of the document and the information from the responses provided below will be incorporated into the Early Action Record of Decision (EAROD) as noted in the responses.

14. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Provide the public with a better explanation with more convincing details for not considering the 'No Action' alternative.

    ***Response:** The "No Action" alternative was evaluated as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). For an alternative to be selected, it must meet the two primary threshold criteria: (1) overall protection of human health and the environment and (2) compliance with Applicable or Relevant and Appropriate Requirements (ARARs) (e.g., promulgated state and federal regulations). The No Action alternative does not meet either threshold criteria. It is not protective of human health or the environment because no controls are established to prevent human exposure to high radiation levels associated with parts of the reactor complex (such as the reactor vessel) and it does not prevent rainwater from leaching high levels of contaminants into the environment from the reactor building. It would not be compliant with state and federal chemical-specific, or action-specific ARARs.*

15. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Explain the estimated very wide range of costs for the selected option 'In-situ Decommissioning with Land Use Controls' ($52,540,985 - $236,491,010).

    ***Response:** The wide range of costs for In Situ Decommissioning (ISD) is due to whether the Reactor Vessel would be grouted in place or removed, as well as, whether just the above-grade portion of the Disassembly Basin would be removed or all above-grade portions of the Reactor Building would be removed. Four ISD scenarios were identified in the RCRA Facility Investigation/Remedial Investigation (RFI/RI) with Baseline Risk Assessment (BRA) and Corrective Measures Study/Feasibility Study (CMS/FS) for the P-Area Operable Unit (WSRC-RP-2007-4032, Revision 1.2, December 2008) as follows:*

    - *Alternative R-2A: Grout Reactor Vessel; Remove Only the P-Reactor Disassembly Basin Above Grade;*
    - *Alternative R-2B: Grout Reactor Vessel; Remove All Above-Grade Structures;*
    - *Alternative R-2C: Remove Reactor Vessel; Remove Only the P-Reactor Disassembly Basin Above Grade; and*
    - *Alternative R-2D: Remove Reactor Vessel; Remove All Above-Grade Structures.*

    The very high cost associated with Alternative R-2D as compared to Alternative R-2A is due to the high cost of reactor vessel and building removal/disposal, much of which is the high cost of off-site transportation and disposal of the large quantity of contaminated building debris.

16. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Propose an estimated start-to-finish timeline for the start and completion of the decommissioning of the individual reactors at SRS.

    ***Response:** The current estimated timeline for the start and the completion of decommissioning of the individual reactors at SRS is as follows: P- and R-Reactor*

Complexes – ongoing-FY2011; C-Reactor Complex –FY2012-FY2020; K-Reactor Complex – FY2021-FY2029; and L-Reactor – FY2023-FY2031.

17. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Address fully all of the comments herein and below, and report to the CAB on the action taken by SRS on our comments and the other public comments received by SRS by the FD&SR Committee's August meeting.

    Response: SRS provided responses to the CAB comments and the status of the public comment responses received by SRS on August 21, 2009. The Responsiveness Summary that is included as Appendix A of the Early Action Record of Decision for the C-, K-, L-, and R-Reactor Complexes will also contain the responses to all comments, including the CAB comments, received during the public comment period.

18. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Provide a long-term timeline past 200 years for ISD outcomes (ISD assures integrity and protection for only up to 200 years).

    Response: Without maintenance after 200 years, structural analysis of the buildings indicates the building roofs may begin to collapse after 350 years. Roofs over the process areas of the building (where the vast majority of the contamination is) will be designed/maintained to last 1350 years, after which collapse of the remaining building structures in the process area may begin. After 2500 years, only rubble left above grade is expected. At this point, the covers and grout placed as part of the remedy are expected to have physical properties similar to soil. A table with similar timelines will be included in the Early Action Record of Decision for C-, K-, L-, and R-Reactor Complexes.

    CERCLA five-year remedy reviews will be conducted to confirm the presence and effectiveness of the LUCs and the continued appropriateness of the ISD end state.

19. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Provide a plan for signage past 200 years.

    Response: It is expected that signs at the Reactor Building Complexes will be maintained as part of land use controls as long as necessary to keep the selected remedy protective of human health and the environment. A Land Use Control Implementation Plan will be prepared for each reactor area closure after completion of the final Record of Decision for each area, which will contain the details regarding the signage for each area.

    CERCLA five-year remedy reviews will be conducted to confirm the presence and effectiveness of the LUCs and the continued appropriateness of the ISD end state.

20. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: The document has a significant number of acronyms (e.g., ARAR's) which detract for its readability. Although the acronyms are defined, they are not explained with concrete and simple examples (viz., give an example of an ARAR; LUCIP; PTSM; etc.).

Response: Section XII of the Early Action Proposed Plan (EAPP) is a glossary that provides definitions for many of the significant terms and acronyms (such as ARARs) that may be unfamiliar to the general public. The Land Use Control Implementation Plan (LUCIP) describes what administrative land use controls will be used as part of the remedy to prevent unacceptable exposure to wastes left in place at a waste unit. Principal Threat Source Material (PTSM) is hazardous waste or contaminated media (such as soil) that presents an imminent threat to human health or the environment if not remediated (see Principal Threat Source Material insert box on page 13 of the EAPP).

21. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: The discussion on Background (p. 5) was well-written. It reviewed the inclusion of SRS on the National Priority List (NPL), motivating the integration of RCRA Facility Investigations and CERCLA. Subsequently, a Federal Facility Agreement (FFA) was negotiated with EPA and DHEC to coordinate remediation at SRS and to promote comprehensive strategies to fulfill regulatory requirements, including all five RCs.

    Response: SRS appreciates this comment.

22. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 5, provide a brief list of the actions required by CERCLA for the RCs in the unlikely event DOE transfers property title to non-federal ownership.

    Response: The Early Action Record of Decision (EAROD) will include the following text concerning DOE transfer of property:

    "In the long term, if the property is ever transferred to nonfederal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA Section 120(h). The deed notification shall notify any potential purchaser that the property has been used for the management and disposal of waste. 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 deed shall also include deed restrictions precluding residential use of the property. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in this EAROD. However, the need for these deed 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 need for the deed restrictions 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 Reactor Areas will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency."

23. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 6, physical libraries are being used for dissemination of information to the public. Given the importance of public review and acceptance of the preferred alternative, this needs to be supplemented by an online searchable archive or document repository.

    Response: When a document is available for public comment, an electronic version of the document can be obtained during the public comment period through the following website:

    http://www.srs.gov/general/programs/soil/pub/pubinv.html

24. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 8, add a timeline going forward for ongoing operations at C, K, and L-RCs as a figure on this page; e.g., K-Area is being used for nuclear materials disposition, which will continue until (specify the date and cite the relevant document).

    Response: Currently, the ongoing missions associated with the C-, K-, and L-Reactor Complexes are estimated to continue until FY2012, FY2021, and FY2023, respectively. This information will be added to the EAROD.

25. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 11, "streamlining the documentation process" is one that the CAB is familiar with and has been a strong supporter of in the past (e.g., Plug-in-Rods for seepage basin remediation [Ref. 2]).

    Response: SRS appreciates this comment.

26. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 12, explain with a simple illustration the carcinogenic threshold of 1E-06 and non-carcinogenic index of 1 (e.g., for the first term, 1E-06 could mean one additional cancer per 1 million people exposed); also, p. 14, explain similarly the number of 1E-03 for PTSM material (principal threat source material).

    Response: The Glossary (Section XII of the EAPP) includes a definition of the "target risk range". Cancer risk is often expressed as the maximum number of new cases of cancer to occur in a given population of people due to exposure to the cancer causing substance. For example, a cancer risk of 1E-06 means that out of a population of one million people, not more than one additional person would be expected to develop cancer as a result of the exposure to the substance causing the risk.

    A cancer risk of 1E-03 means that not more than one person out of a population of one thousand people would be expected to develop cancer as a result of the exposure to the substance causing the risk.

    Noncancer risk is usually determined by comparing the actual level of exposure to a chemical to the level of exposure that is not expected to cause any adverse effects. Strictly speaking, the hazard quotient is not a measure of risk. A hazard quotient less than one indicates that the exposure is not expected to result in any adverse effects. A hazard

quotient greater than one does not suggest that adverse effects are expected, but they are possible.

Similar text will be added to the EAROD.

27. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 13, in addition to the nuclides of concern for migration from the reactor complexes, please refer to the list of all of the nuclides analyzed that exist at the RCs.

    Response: The list of radionuclides that exist in the Reactor Complexes are included in the risk summary tables found in Appendix A of the EAPP for the C-, K-, L-, and R-Reactor Complexes.

28. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 16, paragraph 2 (Section 121(d) ...), the quotation "any promulgated standard, requirements, criteria, or limitation under a state environmental of facility citing law that is more stringent that any Federal standard, requirement, criteria, or limitation" doesn't make sense and may be misquoted or need explanation.

    Response: The cited text should state "any promulgated standard, requirement, criteria, or limitation under a State environmental or facility citing law that is more stringent than any Federal standard, requirement, criteria, or limitation". This text has been included in the EAPP consistent with other regulator-approved SRS documents (i.e. Proposed Plans, Records of Decisions, Land Use Control Implementation Plans, etc.).

    This means that state regulations that are more stringent or restrictive than the equivalent federal regulation must be followed.

29. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: P. 17, the large range of costs for ISD with LUC's was not sufficiently explained nor justified. Please provide a straightforward explanation for the wide range of \$52-\$236 million in possible costs; same page, change "present-worth" to "present-worth costs".

    Response: The wide range of costs for ISD is due to whether the Reactor Vessel would be grouted in place or removed, as well as, whether just the above-grade portion of the Disassembly Basin would be removed or all above-grade portions of the Reactor Building would be removed. Four ISD scenarios were identified in the RFI/RI with BRA and CMS/FS for the P-Area Operable Unit (WSRC-RP-2007-4032, Revision 1.2, December 2008) as follows:

    - ***Alternative R-2A: Grout Reactor Vessel; Remove Only the P-Reactor Disassembly Basin Above Grade;***
    - ***Alternative R-2B: Grout Reactor Vessel; Remove All Above-Grade Structures;***
    - ***Alternative R-2C: Remove Reactor Vessel; Remove Only the P-Reactor Disassembly Basin Above Grade; and***
    - ***Alternative R-2D: Remove Reactor Vessel; Remove All Above-Grade Structures.***

The very high cost associated with Alternative R-2D as compared to Alternative R-2A is due to the high cost of reactor vessel and building removal/disposal, much of which is the high cost of off-site transportation and disposal of the large quantity of contaminated building debris.

The word "costs" is implied, as the use of the term "Present-Worth" is consistent with "Capital" and "O&M" cost categories discussed in the ISD and Complete Removal subsections.

30. Attachment to Email from the SRS CAB, dated July 28, 2009 to Paul Sauerborn: Pp. 21-22, the Preferred Alternative (pp. 21-22) steps are unclear and should be rewritten, especially in the 3rd paragraph on p. 22, maybe with fewer acronyms and the use of simple language that an ordinary citizen could be engaged by and understand:
    a. "Since LUCs are proposed in conjunction with the end-state decision, a LUCIP would be submitted. Because the LUCIP is not proposing additional LUCs other than currently used at SRS, a RAIP will not be submitted. Approval of the LUCIP would constitute remedial action start.

    Response: Since Land Use Controls (LUCs) are proposed in conjunction with the end-state decision, an Early Action Land Use Control Implementation Plan (EALUCIP) for C-, K-, and L-Reactor Complexes would be submitted specifying LUCs that prevent exposure of site workers or the general public. Because the EALUCIP is not proposing additional LUCs other than currently used at SRS, and given that the EAPP is merely proposing an end state for the C-, K-, L-,and R-Reactor Building Complexes and not describing specific remedial actions, a Remedial Action Implementation Plan (RAIP) will not be submitted. In this case, approval of the EALUCIP would constitute the remedial action start, rather than construction activities typically associated with the remedial action. The LUCs for the R-Reactor Complex will be included as part of the final LUCIP for the R-Area Operable Unit (RAOU).

31. Attachment to Email from Donna Antonucci, dated July 30, 2009 to Paul Sauerborn: Tables A-4, A-5, A-6, A-7, & A-8 (pp. 36- 39) These Risk Characterization summary tables are very dense and need clarification in the form of an executive summary in layman's terms. Particular attention should focus on explanations of risk, exposure pathway, and mathematical scientific notation. The public's acceptance of this radiological inventory in perpetuity, depends upon full knowledge of the scope of this contamination. I am glad to see this included in table form, but think the general public needs a summary with definitions or the meaning may be misconstrued.

    Response: Section V of the EAPP provides a text summary of the site risks and problems that need remediation. It also includes an explanation for some of the risk terms in text boxes. Detailed explanations of risk and exposure pathways are included in the RFI/RI with BRA and CMS/FS for the P-Area Operable Unit (WSRC-RP-2007-4032, Revision 1.2, December 2008) and the RFI/RI with BRA and CMS/FS for the R-Area Operable Unit (WSRC-RP-2008-4035, Revision 1.1, July 2009). These documents are available in the

Administrative Record File. Scientific notation is a standard method used universally by scientists and engineers for reporting the magnitude of value for data.

32. Table B-1 Summary of Preliminary ARAR for ISD, citation USEPA OSWER directive 9200.4-18, (p.45), please explain the "status-To be considered", Requirement Summary, and Reason for Inclusion.

    Response: To-Be-Considered requirements are non-promulgated advisories or guidance issued by Federal or State government that are not legally binding and do not have the status of potential ARARs. Because USEPA OSWER Directive 9200.4-18 is not a federal or state law, it is evaluated as To-Be-Considered.

    OSWER Directive 9200.4-18 establishes a protective cleanup level of 3E-04 risk in support of other USEPA cleanup regulations for radioactive contamination (40 CFR 300 Subpart E). The directive mandates the use of the CERCLA risk number rather than dose limits established under other regulations, in order to be consistent within the Superfund Program.

    In many circumstances, To-Be-Considered requirements will be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of human health and the environment. Since the reactor buildings are primarily contaminated with radionuclides, federal regulations establishing dose limits are applicable. However, OSWER Directive 9200.4-18 is included since the other cleanup levels established in SRS decision documents are risk-based.

33. Table B-1 Summary of Preliminary ARAR for ISD, citation NESHAP 40 CFR subpart H etc. (p.41) please explain "status- Applicable," the requirement summary, and the Reason for Inclusion.

    Response: Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address the hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. USEPA regulates hazardous air pollutants under Section 112 of the Clean Air Act and Subpart H of the NESHAP 40 CFR.

    NESHAP has promulgated standards for a number of hazardous air pollutants. Department of Energy Facilities requires USDOE to monitor and track emissions of radionuclides. The emissions of radionuclides shall not exceed those amounts that would cause any member of the public to receive an annual effective dose equivalent of 10 mrem/yr.

    This regulation was included in Table B-1 because ISD can include such activities as demolishing portions of the Reactor Buildings and/or grouting various areas of the Reactor Buildings. Therefore, the potential to produce airborne emissions of radionuclides exists and must be evaluated during remediation activities.

34. Letter from John Sylvest, dated August 03, 2009 to Jeffrey Allison

The South Carolina Archives & History Center
History & Heritage For All Generations

August 3, 2009

Mr. Jeffrey Allison, Manager
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

RE: *Early Action Proposed Plan for the C-, K-, L-, and R-Reactor Complexes*

Dear Mr. Allison:

Thank you for submitting the above noted document, received electronically by our office on June 17, 2009, for our review and comment. This *Early Action Proposed Plan* (EAPP) describes the final end-state decisions for the C, K, L, and R reactor complexes.

Our office believes end-state solutions proposed in the EAPP conflict with commitments made by DOE in agreements with our office and the consulting parties to these agreements. Specifically, in the *Cold War Built Environment Cultural Resources Management Plan* (CRMP) of 2004 DOE elected to remove thirteen C Area historic properties from the D&D list for preservation and future interpretation of the Site's historic Cold War mission. These thirteen properties include Reactor Building 105-C and the two engine houses, 108-1C and 108-2C, three properties which this EAPP addresses. This EAPP fails to address how these three significant reactor area historic properties can be considered for decommissioning when they are not even supposed to be on the D&D list or schedule, but to be maintained until a future use is defined.

The preservation and interpretation of C Reactor Area forms the basis of DOE's own stated preservation and heritage tourism vision at SRS. DOE has expended much effort over the past five years in collecting artifacts, missing parts, features, and even other replicated historic properties from the Site's other reactor area's historic properties with the purpose of replicating, restoring, and interpreting C Reactor Area's historic properties, including their interiors, to their Cold War period of significance as best as possible. It is therefore difficult to comprehend how proposing the same reactor building-altering, "closed in place" end-state solution that has been determined for P Reactor complex is acceptable for C Reactor complex.

We believe C Reactor complex must be treated differently than the other reactor complexes. We question whether C Reactor complex should be included in this EAPP or in any future Record of Decision document regarding the reactor complexes. Proposed end-state solutions for P Reactor complex, which our office has yet to receive final formal notification on or concur with, can not be supported by our office at C Reactor preservation area. We believe that completion of the C Area historic properties feasibility study and seeking viable ways to preserve, interpret, and make publicly accessible C Area's historic properties should be DOE's priority before any inclusion of C Reactor in environmental planning documents such as this EAPP. We urge DOE to harness the same positive knowledge, ingenuity, and effort utilized in ensuring closure activities are safe and protect human health and the environment for ensuring C Reactor preservation area is protected, maintained, and made safely accessible for future generations to learn from and enjoy.

Technical comments:

While we are pleased to see the National Historic Preservation Act included as an Applicable or Relevant and Appropriate Requirements (ARAR) (in Appendix B) and "historical preservation considerations" language included within the text (p. 4), we believe these applicable references should be clearly defined and based on agreements with our office and on supporting regulatory language. For example, our office is unsure what "historical preservation considerations" (p. 4) DOE is referencing, or how identifying, retaining, or preserving historic items (or artifacts) should even be included language when the National Historic Preservation Act directs federal agencies to consider and to preserve historic properties. "Historic items" or "artifacts" are not by definition historic properties, they are not eligible for listing in the National Register of Historic Places, and they are just one piece of SRS's preservation program. Historic properties such as reactor buildings and ancillary support structures are what should be identified and preserved and what the ARAR language regarding the National Historic Preservation Act should summarize and include.

Appendix B's ARAR table cites the National Historic Preservation Act (NHPA) in addition to three federal regulations: 36CFR800 - Protection of Historic Properties (Section 106 regulations), 36CFR79 - Curation of Federally Owned and Administered Archaeological Collections, and 36CFR65 - Designation of National Historic Landmarks. We believe the NHPA's Section's 106 and 110 and 36CFR800 to be most relevant for inclusion as ARAR's. The CRMP should be considered as an ARAR too, if possible.

This EAPP also fails to take into account each SRS Reactor's eligibility as a DOE Cold War Signature Facility and what impact the proposed end-state solutions will have on a SRS reactor complex achieving this designation.

These comments are provided to assist you with meeting responsibilities pursuant to Sections 106 and 110 of the National Historic Preservation Act, as amended. If you have any questions, please contact me at (803) 896-6129 or sylvest@scdah.state.sc.us.

Sincerely,

John D. Sylvest
DOE-SRS Project Coordinator
State Historic Preservation Office

cc (electronically):

Ray Hannah, DOE-SR
Chris Bergren, DOE-SR
Parodio Maith, DOE-SR

Teresa Hass, SRNS
Paul Sauerborn, SRNS
Skip Gosling, DOE FPO
Tom McCulloch, ACHP
Walt Joseph, SRS Heritage Foundation, Inc.
SRS Citizens Advisory Board
Mayor of Aiken, SC
Mayor of New Ellenton, SC
Mayor of Augusta, GA
Van Keisler, SCDHEC
Shelly Wilson, SCDHEC
Rob Pope, EPA Region IV
Jim Barksdale, EPA Region IV

Response: SRS recognizes that 13 excess facilities in C-Area Operable Unit, including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005) for preservation. The end-state decision proposed in this document, in situ decommissioning, allows for a range of acceptable end state conditions from which a final design will be determined at the time that the individual reactor complex is closed. A feasibility study for C-Area addressing its' future use will be completed prior to the start of closure activities, which are planned to begin in 2012. Without compromising the selected remedy's protection of human health and the environment, SRS will preserve the historical significance of these facilities in accordance with the National Historic Preservation Act (NHPA) to the extent practicable.

The following text will be added to the Early Action Record of Decision (EAROD) for C-, K-, L-, and R-Reactor Complexes, under the section heading "Significant Historical Features":

"In accordance with the Programmatic Agreement among the USDOE, South Carolina State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation, the USDOE has the responsibility for the Cultural Resource Management of all historic properties at SRS. As has been the case with previous SRS decommissioning projects, to the extent practicable and not to impact human health and the environment, efforts will be made to preserve the historical significance of the Reactor Complexes in C-, K-, L-, and R-Reactor Areas in accordance with the National Historic Preservation Act.

Furthermore, C-Area Operable Unit (CAOU) is of special interest because 13 excess facilities, including the Reactor Building (105-C), have been identified in the Savannah River Site's Cold War Built Environment Cultural Resources Management Plan (USDOE 2005). Since the CAOU project has not begun the planning and design phases, some uncertainty exists regarding the extent and details of preservation for the 13 facilities. Consistent with the Area Completion approach, CAOU planning and design efforts will address this uncertainty. At that time, the USDOE will have a better understanding of site characterization and risks, and can better formulate the engineering details to ensure

protection of human health and the environment while preserving, to the extent practicable, the historic significance of those C-Area facilities."

Also in the EAROD, the section of the ARAR table that describes the NHPA will be revised to replace "artifacts" with "historic properties" under reason for inclusion. The CMRP is not an ARAR as it is not a regulation or law; however, it will be referenced in the EAROD.

APPENDIX B

SUMMARY OF REACTOR COMPLEX SIMILARITIES

This page was intentionally left blank

B.0 Summary of Reactor Complex Similarities

As part of the accelerated cleanup strategy underway at the Savannah River Site, the U.S. Department of Energy and its regulators, in the form of a Core Team, have agreed that each of the C-, K-, L-, P-, and R-Reactor Complexes are analogous facilities, and as such, the end-state decision previously reached and data used to support that decision for the P-Reactor Complex can be applied to indicate expected conditions at the C-, K-, L-, and R-Reactor Complexes.

These complexes are considered analogous for a number of reasons, including:

- Operational history (i.e., timeframe of operations and power levels) can inform whether there is expected to be consistency in the nature and magnitude of contaminants. The operations at and design of each of the five Reactor Complexes were all similar, therefore producing the same types of contaminants.

- Operating conditions in the Reactor Complexes were similar (i.e., temperature, pressure, fuel/target materials, etc), resulting in closely associated types of nuclear materials and contaminants. Accordingly, the inventories for P- and R-Reactor vessel subunits have been determined by detailed modeling and are considered representative of the types of contaminants to be expected for C-, K-, and L-Reactor vessel subunit.

- Construction history/design/materials are similar, resulting in similarities in the type of media to be impacted (i.e., concrete, metal).

- Other operational information related to disassembly basin discharges, limited Reactor characterization efforts and evaluations, and maintenance and/or upgrade activities inform what can be expected to be present within the Reactor Complexes.

Tables B-1 through B-4 details the similarities between the three subunits for each of the Reactor Complexes.

B.1 Reactor Complex Carcinogenic Risk Comparison

The conditions at all applicable P- and R-Reactor Complex subunits have been evaluated and Tables B-5 through B-7 and Table B-9 through B-11 present the data from these subunits relative to carcinogenic risk. This information provides a range of expected levels of risk for the reactor vessel, disassembly basin, and building and attached structures subunits at the C-, K-, L-, and R-Reactor Complexes.

B.2 Reactor Complex Noncarcinogenic Risk Considerations

Other potentially hazardous non-radiological contamination is known to be present throughout each of the Reactor Complexes. Examples are asbestos pipe insulation, lead shielding blocks, paint that contains lead, and mercury and some other metals.

The baseline risk assessment for the P-Reactor Complex (SRNS 2008) identified a minor level of risk (i.e., hazard) from noncarcinogenic constituents, presented in Table B-8, which informs the expected conditions for the C-, K-, L-, and R-Reactor Complexes.

Table B-1. Summary of Reactor Vessel Subunit Similarities

	Vessels				
	P-Reactor	R-Reactor	L-Reactor	K-Reactor	C-Reactor
Vessel Tank Construction	4.6 m high x 4.9 m wide (15 ft x 16 ft) cylindrical tank with 1.25 cm (0.5 in) thick stainless steel plate				Same height but 0.7 m (2.2 ft) wider
	Concrete Bioshield				
Operational Duration	34 years 1954 to 1988	11 years 1953 to 1964	14 years 1954 to 1968 1985 to 1988	34 years 1954 to 1988 1992 to 1993	29 years 1955 - 1986
Flux	398 - 2700 megawatts (MW) 17.2 million MW-days	300 - 2400 MW 4.5 million MW-days	378 MW – Not currently available*	Not currently available*	2915 MW - Not currently available *
Vessel Curies	211,000 Ci‡	57,800 Ci‡	Not currently available*	Not currently available*	Not currently available *

* Not currently available: Information will be available when the specific Area Completion documentation is completed.

‡ The curie inventory from modeling performed on the P- and R-Reactor vessels provides a range of expected curies that could be contained within the C-, K-, and L-Area reactor vessels.

Table B-2. Summary of Disassembly Basin Subunit Similarities

	Disassembly Basins (DB)				
	P-Reactor	R-Reactor	L-Reactor	K-Reactor	C-Reactor
Basin Size	31,000 ft^2	48,500 ft^2	26,000 ft^2	38,000 ft^2	37,500 ft^2
Construction	Concrete with 3 ft walls and 5 to 7.5 ft base mat.		Concrete with 3 ft walls and 5 to 7 ft base mat.		
DB Capacity	4.8 million gallons	6.3 million gallons	3.4 million gallons	3.4 million gallons	3.6 million gallons
Current Water Volume	4.18 million gallons	383,100 gallons	3,375,000 gallons	3,375,000 gallons	3.55 million gallons
Sludge Volume	4,380 ft^3	668 ft^3	2,085 ft^3	2,085 ft^3	2,200 ft^3 †
Curie content of sludge	57.4 Ci	1,261 Ci‡	31.6 Ci	31.6 Ci	42.2 Ci
Curie content of water	4,950 Ci	13.3 Ci	96.2 Ci	715.4 Ci	1,530 Ci☼
Curie content of metal	9,630 Ci	1,930 Ci	1,726 Ci	Not Available (NA)*	N/A

N/A: Information is not available. However, when conducting the RFI/RI for the C- and K-Reactor Complexes, this information will be collected to provide an overall inventory of radionuclides in the disassembly basin.

† Includes 800 ft^3 from contents of the settler tank.
‡ Includes 0.562 Ci from the Disassembly Basin and 1,260 Ci from the Emergency Basin.
☼ Includes 678 Ci from L-Reactor Complex waste water.

Table B-3. Summary of the Building Subunit Similarities

	Building Subunits				
	P-Reactor	R-Reactor	L-Reactor	K-Reactor	C-Reactor
Construction Materials	Reinforced concrete		Reinforced Concrete (Assembly Area used steel framed fiberboard construction)		
Foot Print *(sq ft)*	307,200 ft^2	336,324 ft^2	161,500 ft^2	177,300 ft^2	202,300 ft^2
Depth below grade (Bottom Elevation)	49.5 ft below ground surface				
	267 ft-mean sea level (msl)	241 ft-msl	200 ft-msl	220 ft-msl	236 ft-msl
Approximate Exterior Wall Thickness	Range from 2 ft 6 in to 6 ft#				
Stack Height above grade	200 ft				
Top Floor Height above grade	130 ft				
Actuator Tower Height above grade	149 ft				
Bottom Depth to Groundwater*	9 ft below water table.	43 ft below water table.	16 ft below water table.	16 ft above water table.	23 ft above water table.

Exterior wall thickness ranges from 2 ft 6 in to 6ft for the reactor buildings. The thickness of the assembly area section of the C-, K-, and L-Reactor Complexes is excluded from this range, as this section of the superstructure is constructed of transite material.

* Depth to groundwater presented here is based on water level averages from 1987-2008 from nearby water table wells.

Table B-4. Reactor Building Structural Analyses

Structural Event	Alternative A (years)		Alternative B (years)		Alternative C (years)	
	105-P	105-R	105-P	105-R	105-P	105-R
Roofs away from Process Room begin to collapse	150	150	150	150	1350	1350
Water infiltration into Process Room due to roof degradation/collapse	200	200	1400	1400	1400	1400
Water infiltration through slab directly over reactor vessel	225	225	1550	1350	1550	1350
Cap exposed due to roof collapses	400	400	1700	1450	2700	1450
Only rubble left above grade	1000	1000	1000 (all but Process Room structure) 2500 (Process Room)	1000 (all but Process Room structure) 2500 (Process Room)	2500	2500

Alternative A: No intervention; vegetation allowed to grow unrestricted on all roofs
Alternative B: Vegetative growth is prevented on roofs over Process Room
Alternative C: Vegetative growth is prevented on all roofs

T-CLC-P-00004, *Long Term Assessment of 105-P Structure for in-situ D&D Alternatives*, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC, August 2008

T-CLC-R-00002, *Long Term Assessment of 105-R Structure for in-situ D&D Alternatives*, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC, January 2009

Table B-5. Risk Characterization Summary - Carcinogens for the P-Reactor Vessel

Scenario Time Frame:			Future	
Receptor Population:			Industrial Worker	
Receptor Age:			Adult	
Medium	**Exposure Medium**	**Exposure Route**	**Constituent of Concern**	**Carcinogenic Risk***
105-P Reactor Vessel	Metal	External Radiation, Incidental Ingestion	Barium-133	1.8E-02
			Carbon-14	2.8E-05
			Cobalt-60	1.3E+03
			Europium-152	5.3E-03
			Europium-154	4.6E-04
			Iron-155	8.2E-05
			Molybdenum -93	7.3E-06
			Nickel-59	9.3E-06
			Nickel-63	2.2E-03
			Niobium-94	6.1E-05
			Potassium-40	1.1E-05
			Total Cumulative Risk =	**1.3E+03**

* Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration derived from standardized equations and combines 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. Radiological PRGs are industrial worker values for concrete media (WSRC 2005).

Table B-6. Risk Characterization Summary - Carcinogens for the R-Reactor Vessel

Scenario Time Frame:			Future	
Receptor Population:			Industrial Worker	
Receptor Age:			Adult	
Medium	**Exposure Medium**	**Exposure Route**	**Constituent of Concern**	**Current Carcinogenic Risk***
105-R Reactor Vessel	Metal	External Radiation, Incidental Ingestion	Americium-241	2.9E-06
			Americium-242m	6.9E-06
			Americium-243 (+D)	8.1E-04
			Argon-39	1.5E-06
			Barium-133	1.8E-02
			Carbon-14	1.1E-05
			Cesium-137 (+D)	9.5E-03
			Chlorine-36	3.0E-04
			Curium-243	9.9E-05
			Cobalt-60	5.4E+01
			Europium-152	5.3E-03
			Europium-154	4.7E-04
			Molybdenum-93	1.9E-06
			Nickel-59	5.0E-06
			Nickel-63	1.0E-03
			Niobium-94	9.0E-02
			Potassium-40	9.9E-06
			Silver-108m	2.8E-01
			Strontium-90 (+D)	5.2E-05
			Total Cumulative Risk =	**5.5E+01**

* Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration derived from standardized equations and combines 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. Radiological PRGs are industrial worker values for concrete media (WSRC 2005).

Table B-7. Risk Characterization Summary — Carcinogens for the P-Reactor Disassembly Basin

Scenario Time Frame: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Current Carcinogenic Risk*
P-Reactor Disassembly Basin	Sediment	Ingestion, Inhalation, Dermal Contact, External Radiation	Arsenic	1.80E-05
			Americium-241	6.50E-03
			Americium-243 (+D)	7.20E-03
			Antimony-124	1.20E-04
			Antimony-125 (+D)	1.50E-03
			Barium-133	4.40E-04
			Californium-249	8.80E-04
			Californium-251	9.60E-04
			Carbon-14	1.50E-04
			Cerium-141	1.10E-06
			Cerium-144 (+D)	2.50E-05
			Curium-243/244	3.10E-03
			Curium-245	4.30E-03
			Curium-246	3.10E-04
			Cobalt-57	6.20E-05
			Cobalt-58	4.50E-05
			Cobalt-60	3.60E+00
			Cesium-134	9.10E-04
			Cesium-135	1.20E-06
			Cesium-137 (+D)	5.40E-01
			Europium-152	1.90E-02
			Europium-154	5.20E-02
			Europium-155	9.00E-05
			Iodine-129	2.20E-06
			Potassium-40	3.00E-03
			Manganese-54	3.10E-04
			Sodium-22	5.60E-03
			Niobium-94	1.20E-02
			Nickel-63	3.20E-04
			Neptunium-237 (+D)	5.80E-04
			Praseodymium-144	2.20E-04
			Praseodymium-146	7.50E-04
			Plutonium-238	1.80E-02
			Plutonium-239/240	1.40E-03
			Plutonium-241	7.80E-05
			Plutonium-242	5.80E-05
			Radium-228 (+D)	9.40E-03
			Selenium-79	2.30E-05
			Thorium-228 (+D)	1.20E-03
			Hydrogen-3	2.00E+00
			Tin-126	2.80E-04
			Strontium-90 (+D)	3.10E-03

Table B-7. Risk Characterization Summary — Carcinogens for the P-Reactor Disassembly Basin *(Continued/End)*

Scenario Time Frame: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Current Carcinogenic Risk*
P-Reactor Disassembly Basin	Sediment	Ingestion, Inhalation, Dermal Contact, External Radiation	Uranium-233	4.50E-06
			Uranium-234	3.50E-06
			Uranium-235 (+D)	2.80E-05
			Uranium-238 (+D)	3.00E-05
			Yttrium-88	7.90E-05
			Zinc-65	2.60E-04
			Zirconium-95	5.20E-05
			Total Cumulative Risk =	**6.30E+00**

* Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration derived from standardized equations and combines 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. Radiological PRGs are industrial worker soil values from *Radionuclide Preliminary Remediation Goals*, Engineering Calculation K-CLC-G-00077, Rev. 1, Washington Savannah River Company (November 2003); nonradiological PRGs are industrial worker soil values (USEPA 2004).

Table B-8. Risk Characterization Summary — Non-Carcinogens for the P-Reactor Disassembly Basin

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Current Non-Carcinogenic Hazard Quotient*
P- Reactor Disassembly Basin	Sediment	Ingestion, Inhalation, Dermal Contact	Antimony	1.2
			Iron	2.7
			Lead	1.3
			Uranium	19.0
			Soil Hazard Index Total =	**24.2**

*Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration that is derived from standardized equations and combines 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. Nonradiological PRGs are industrial worker soil values (USEPA 2004).

Table B-9. Risk Characterization Summary - Carcinogens for the R-Reactor Disassembly Basin

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Current Carcinogenic Risk*
R-Reactor Disassembly Basin	Sediment	Ingestion, Inhalation, Dermal Contact, External Radiation	Antimony-125 (+D)	1.6E-05
			Americium-241	1.8E-05
			Carbon-14	5.0E-06
			Californium-249	2.8E-05
			Californium-251	6.4E-06
			Cesium-137 (+D)	1.8E-01
			Cobalt-60	8.0E-01
			Europium-152	6.3E-04
			Europium-154	4.3E-03
			Europium-155	7.0E-06
			Iodine-129	1.0E-06
			Manganese-54	6.5E-06
			Neptunium-237 (+D)	5.2E-06
			Niobium-94	2.2E-04
			Plutonium-238	1.2E-06
			Plutonium-239/240	1.1E-05
			Plutonium-241	1.3E-05
			Sodium-22	9.6E-04
			Strontium-90 (+D)	3.0E-04
			Thorium-228 (+D)	1.4E-05
			Tritium	9.4E-02
			Yttrium-88	4.4E-05
			Zinc-65	3.9E-05
			Zirconium-95	7.3E-06
			Total Cumulative Risk =	**1.1E+00**

*Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration that is derived from standardized equations and combines 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. Radiological PRGs are industrial worker soil values from *Radionuclide Preliminary Remediation Goals*, Engineering Calculation K-CLC-G-00077, Rev. 1, Washington Savannah River Company (November 2003).

Table B-10. Risk Characterization Summary — Carcinogens for the P-Reactor Building and Attached Structures

Scenario Time Frame:	Future			
Receptor Population:	Industrial Worker			
Receptor Age:	Adult			
Medium	**Exposure Medium**	**Exposure Route**	**Constituent of Concern**	**Current Carcinogenic Risk***
P-Reactor Building minus 6.1 m (20 ft) level	Concrete	Ingestion, External Radiation	Aroclor-1254	3.2E-05
			Cesium-137 (+D)	9.9E-03
			Cobalt-60	4.2E-03
			Strontium-90 (+D)	2.6E-05
			Uranium-238 (+D)	6.0E-06
Total Cumulative Risk (minus 20 ft level) =				**1.4E-02**
P-Reactor Building minus 12.2 m (40 ft) level	Concrete	Ingestion, External Radiation	Aroclor-1254	5.7E-06
			Cesium-137 (+D)	1.3E-02
			Cobalt-60	5.7E-05
			Strontium-90 (+D)	6.6E-05
Total Cumulative Risk (minus 40 ft level) =				**1.3E-02**
P-Reactor Building minus 15.1 m (49.5 ft) level	Concrete	Ingestion, External Radiation	Cesium-137 (+D)	1.7E-04
Total Cumulative Risk (minus 49.5 ft level) =				**1.7E-04**

* Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration that is derived from standardized equations and combines 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. Radiological PRGs are industrial worker values (WSRC 2005). Nonradiological PRGs are ten times (10x) the industrial worker soil values (USEPA 2004).

Table B-11. Risk Characterization Summary — Carcinogens for the R-Reactor Building and Attached Structures

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Current Carcinogenic Risk*
R-Reactor Building ground level	Concrete	Ingestion, External Radiation	Arsenic	2.1E-06
			Aroclor-1254	2.3E-05
			Americium-243(+D)	3.0E-06
			Cesium-137 (+D)	1.7E-02
			Strontium-90 (+D)	2.1E-05
Total Cumulative Risk (ground level) =				**1.7-02**
R-Reactor Building minus 6.1 m (20 ft) level	Concrete	Ingestion, External Radiation	Amercium-243 (+D)	2.8E-06
			Cesium-137 (+D)	6.0E-05
			Cobalt-60	1.9E-05
Total Cumulative Risk (minus 20 ft level) =				**8.2E-05**
R-Reactor Building minus 12.2 m (40 ft) level	Concrete	Ingestion, External Radiation	Aroclor-1254	1.2E-05
			Amercium-241	9.9E-06
			Cesium-137 (+D)	1.5E-03
			Cobalt-60	1.2E-02
			Strontium-90	1.1E-05
Total Cumulative Risk (minus 40 ft level) =				**1.4E-02**

*Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration that is derived from standardized equations and combines 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. Radiological PRGs are industrial worker values (WSRC 2005).Nonradiological PRGs are ten times (10x) the industrial worker soil values (USEPA 2004).

APPENDIX C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This page was intentionally left blank

Table C-1. Summary of Applicable or Relevant and Appropriate Requirements for In Situ Decommissioning of the C-, K-, L-, and R-Reactor Complexes

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Chemical-Specific			
National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart M, 40 CFR 61.140-141, 40 CFR 61.145 National Emission Standard for Asbestos	Applicable	Requirements for asbestos identification and control. Standards for demolition and renovation. Inspection, notification, and procedures for emission controls.	Given the age and type of buildings covered in the EAPP, there is a potential for asbestos in building materials. Any investigation, removal, or handling of these materials would require compliance with these regulations.
NESHAP 40 CFR 61 Subpart H, 40 CFR 60.90-97 National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.	Applicable	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 millirem (mrem) per year.	Demolition of contaminated buildings, excavation activities, or grouting could produce airborne emissions of radionuclides which would be subject to the 10 mrem/yr limit for airborne radionuclide emissions during cleanup of federal facilities.
Toxic Substance Control Act (TSCA) 40 CFR 763 Asbestos Standard of Performance for Asbestos Projects SC R.61-86.1	Applicable	Applicability and state licensing and notification requirements. Inspection, testing, work practices, containerization and packaging requirements, air sampling and disposal requirements.	Given the age and type of buildings covered in the EAPP, there is a potential for asbestos in building materials. As such, worker training, company licensing, and work practices required by these regulations would be necessary during removal activities to protect workers.

Table C-1. Summary of Applicable or Relevant and Appropriate Requirements for In Situ Decommissioning of the C-, K-, L-, and R-Reactor Complexes *(Continued)*

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Chemical-Specific *(Continued)*			
Occupational Radiation Protection 10 CFR 835	Applicable	Establishes a total effective dose of 5 rem or specified doses to eyes or skin limits for general employees. Also establishes a 0.1 rem/yr total effective dose equivalent limit for members of the public entering controlled areas. Other sections of this regulation specify monitoring, recordkeeping, labeling, posting, and training requirements for occupational workers.	Since radionuclides are present, requirements related to worker dose limits, monitoring, labeling, training, and recordkeeping must be met. Exposure to members of the public to radionuclides must be controlled.
National Primary Drinking Water Regulations 40 CFR 141 SC R. 61-58 State Primary Drinking Water Regulations SC R. 61-68 Water Classification and Standards	Applicable	Establishes requirements and standards for chemicals and radionuclides to protect human health from the potential effects of drinking-water contamination.	The state of South Carolina classifies all groundwater as potential sources of drinking water and mandates that groundwater meet maximum contaminant levels (MCLs) established by the Safe Drinking Water Act.
Radiation Protection of the Public and the Environment DOE Order 5400.5	To Be Considered	Establishes standards and requirements for operations of the Department of Energy (DOE) and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation	Reactor facilities contain radioactive contamination and radioactive material. As such, the requirements of the Order must be followed.
Radioactive Waste Management DOE Order 435.1	To Be Considered	Ensures that all DOE radioactive waste is managed in a manner that protects the worker, public safety, and the environment.	Demolition could generate radioactive waste that would have to be managed appropriately at a DOE facility. Active SRS radioactive disposal facilities are authorized under this Order.

Table C-1. Summary of Applicable or Relevant and Appropriate Requirements for In Situ Decommissioning of the C-, K-, L-, and R-Reactor Complexes *(Continued)*

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Chemical-Specific *(Continued)*			
The National Pollutant Discharge Elimination System (NPDES Permit SCR10000) SC R.61-9.122	Applicable	Requirements for permits and control of stormwater discharges.	Any stormwater discharges from demolition and remedial activities must meet permit conditions and standards established by state.
40 CFR 261, Identification and Listing of Hazardous Waste, 40 CFR 268, Land Disposal Restrictions Hazardous Waste Managements System SC R.61-79.261 and SC R.61-79.268	Potentially Applicable	Defines criteria for determining whether a waste is a solid waste and is RCRA hazardous waste. If a waste is RCRA hazardous requirements for storage, treatment, disposal recordkeeping, and training of workers must be met.	If any hazardous waste is generated during demolition and remediation activities, these materials—such as piping, equipment, material, and concrete—removed from the facilities would have to be evaluated to determine if they are hazardous waste per RCRA.
Solid Waste Management SC R.61-107.11 Construction, Demolition and Land Clearing Debris Landfills SC R. 61-107.258 Municipal Solid Waste Landfills	Applicable	Regulations governing disposal of nonhazardous solid waste.	Demolition activities will generate solid waste requiring disposal that must comply with these requirements.
Toxic Substances Control Act 40 CFR 761	Applicable	Identifies identification, sampling, marking, labeling, storage and disposal requirements for PCB remediation waste and bulk product waste.	Due to the age of the facilities, coatings, caulking, and lighting fixtures used in construction could contain PCBs. Demolition activities could generate concrete, piping, and electrical and mechanical equipment manufactured before the PCB ban. If PCBs are identified in these materials, compliance with these requirements is necessary.

Table C-1. Summary of Applicable or Relevant and Appropriate Requirements for In Situ Decommissioning of the C-, K-, L-, and R-Reactor Complexes *(Continued)*

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Location-Specific			
National Historic Preservation Act 36 CFR 800; 36 CFR 79; 36 CFR 65	Applicable	Establishes a national registry of historic sites for preservation of historic and prehistoric resources	Must take action to identify and preserve buildings or historic properties.
Action-Specific			
Control of Fugitive Particulate Matter 40 CFR 50.6 South Carolina Air Pollution Control Regulations and Standards SC 61-62.6 Control of Fugitive Particulate Matter	Applicable	Requires that fugitive particulate material be controlled with the use of water, chemicals, or other means in demolition or construction operations.	Demolition of existing structures, excavation of contaminated materials, grading of roads and other demolition/construction actions may require dust suppression if potential exists for particulate emissions.
South Carolina Air Pollution Control Regulations and Standards SC 61-62.1 and 62.5	Applicable	Identifies allowable air concentrations and permit requirements for air emissions of toxic criteria and air pollutants for new and existing sources	Applicable to portable diesels (nonrad). Would apply to air emissions of Standard 2 Toxic Air Pollutants and Standard 8 Ambient Air Quality Standards and permitting.
The National Pollutant Discharge Elimination System (NPDES Permit SCR10000) SC R.61-9.122	Applicable	Requirements for permits and control of stormwater discharges.	Any stormwater discharges from demolition and remedial activities must meet permit conditions and standards established by state.
Standards for Stormwater Management and Sediment Reduction SC R.72-300	Applicable	Stormwater management and sediment control plan for land disturbances.	Demolition activities may require an erosion control plan to prevent environmental impacts from stormwater runoff

Table C-1. Summary of Applicable or Relevant and Appropriate Requirements for In Situ Decommissioning of the C-, K-, L-, and R-Reactor Complexes *(Continued/End)*

Citation(s)	Status	Requirement Summary	Reason for Inclusion
Action-Specific *(Continued)*			
Solid Waste Management SC R.61-107.11 Construction, Demolition and Land Clearing Debris Landfills SC R. 61-107.258 Municipal Solid Waste Landfills	Applicable	Regulations governing disposal of nonhazardous solid waste.	Demolition activities would generate solid waste requiring disposal in accordance with these regulations.
USEPA OSWER Directive 9200.4-18 Establishment of Cleanup Levels for CERCLA sites with Radioactive Contamination	To Be Considered	Cleanups of radioactive contamination outside the risk range (in general, exceeding 15 mrem/yr EDE which equates to approx. 3 x 10-04 increased lifetime risk) are not protective.	EPA policy establishing protective range for radionuclide cleanups at CERCLA sites. Mandates use of CERCLA risk range rather than dose limits established under other regulations

This page was intentionally left blank

APPENDIX D

COST ESTIMATES FOR THE REACTOR COMPLEXES

This page was intentionally left blank

Table D-1. Cost Estimate for Alternatives for the P-Reactor Complex

Item	Quantity	Units	No Action	ISD	ISD Max Case
Direct Capital Costs					
Removal of Major Contaminated Equipment			$0	$130,000	$210,000
Fix Contaminated Equipment that is Abandoned In Place			$0	$650,000	$220,000
Removal of Shield Door Gantries / Modify Roof (includes disposal costs)			$0	$4,820,000	$4,820,000
Remove Stack to +55 ft (includes disposal costs)			$0	$2,030,000	$2,030,000
Decontamination			$0	$150,000	$150,000
Characterization and Surveys			$0	$2,650,000	$2,650,000
Fill Spaces with Grout			$0	$12,500,000	$12,500,000
Demolition and Removal of Above Ground Structures with Size Reduction			$0	$540,000	$7,530,000
Removal of Reactor Vessel, Plenum, and Internals (includes disposal costs)			$0	$0	$5,520,000
Grade and Cover			$0	$1,700,000	$4,990,000
Major Equipment Waste Disposal			$0	$333,000	$850,000
Above Ground Structure Waste Disposal			$0	$0	$91,000,000
Total Direct Capital Cost			**$0**	**$25,503,000**	**$132,470,000**
Indirect Capital Costs					
Engineering and Management			$0	$5,540,600	$9,640,000
Total Indirect Capital Cost			**$0**	**$5,540,600**	**$9,640,000**
Total Estimated Capital Cost			**$0**	**$31,043,600**	**$142,110,000**
Direct O&M Costs					
	200	year O&M period	*Years 2008 - 2208*		
Present value of 200 years of Surveillance and Monitoring			$0	$700,000	$0
Total Direct O&M Cost			**$0**	**$700,000**	**$0**
Indirect O&M Costs					
Contingency	25%	of direct costs	$0	$7,760,900	$35,527,500
Overhead	33%	of direct costs + contingency	$0	$13,036,485	$58,620,375
Total Indirect O&M Cost			**$0**	**$20,797,385**	**$94,147,875**
Total Estimated O&M Cost			**$0**	**$21,497,385**	**$94,147,875**
TOTAL ESTIMATED COST			**$0**	**$52,540,985**	**$236,257,875**

Cost Estimates were taken from *105-P D&D Alternatives Cost Analysis* (SDD-2008-00003, Rev. 0)

Cost Element Description

The cost elements in Table D-1 are order of magnitude estimates in 2008 dollars that are based on limited engineering data using specific analogy techniques (scale up or scale down factors from prior known systems and parametric techniques. The cost estimates are for comparison purposes between alternatives only and are not intended to portray actual costs for any alternatives chosen. Once an alternative is chosen, formal estimates will be prepared for costing/funding purposes.

The major components of each cost element are summarized below. A more detailed description of the scope included in each element together with the unit rates used is given in *105-P Alternatives Cost Analysis (U)* (WSRC 2008c)

Element #1 - Removal of Major Contaminated Equipment

Cost Element #1 estimates the cost to dismantle the major equipment that will be removed from the building, which is itemized in Table A in SDD 2008a. The quantity, volume, and weight for each item were calculated along with a removal complexity factor. Unit rates were then consistently applied to calculate the total cost. The cost of waste disposal is captured in Element #12.

Element #2 - Abandoned-In-Place Contaminated Equipment

This Cost Element estimates the cost to abandon in place the contaminated equipment that will remain inside the building and is itemized in Table B in SDD 2008a). This equipment primarily consists of the reactor tank and associated components.

Element #3 - Removal of Shield Door Gantries and Install New Roof

This Cost Element estimates the cost of removing the Shield Door Gantries and allows for construction of a new roof. This portion of the 105-P building is showing signs of structural degradation.

Element #4 - Removal of Stack

This Cost Element estimates the cost of removing the stack above the +55 ft roof elevation. The stack is considered unsound to last as a structure over the time frames being considered for in situ decommissioning. The disposal cost is included in Element #12.

Element #5 - Decontamination

This Cost Element estimates the cost of decontaminating or fixing-in-place the radionuclide contamination on exposed surfaces that are within reach of human receptors within the building structure based on current knowledge of radiological conditions.

Element #6 - Characterization and Surveys

See SDD 2008a for a detailed description of this complex Cost Element.

Element #7 - Fill Lower Spaces with Grout

This Cost Element estimates the cost of grouting the 105-P building to grade level (approximately 114,000 cubic yards).

Element #8 - Demolition and Removal of Above-Ground Structures with Size Reduction

This cost was based on construction drawings that indicated that around 137,000 tons of material would need to be demolished, size reduced and transported to a repository. The disposal cost is captured in Element #12.

Element #9 - Removal of Reactor Vessel

This Cost Element is based on the weight of the vessel at 247.3 tons. See SDD 2008a for a detailed description of this complex cost element.

Element #10 - Grade and Cover

This Cost Element is based on covering up to 12 acres of land at $400,000 per acre with a cover design consisting of backfill, geo-synthetic material, clay, drainage, topsoil, and vegetation layers.

Element #11 - Engineering and Management

This Cost Element is based on a team of exempt professionals assigned for the full duration of the project.

Element #12 - Waste Disposal

Cost Element #12 is divided into two sub-elements: #12a and 12b. The disposal cost for the major equipment removed in Elements #1 and #2 are included in sub-element #12a. The disposal cost for the above-ground structure removed in Elements #4 and #8 are included in sub-element #12b. Costs were based on disposal options at the Nevada Test Site and Clive, Utah.

Table D-2. Cost Estimate for Complete Removal of P-Reactor Complex

Bldg No	Cost Basis	End State	ROM (03 $K direct) (Model Calc)	ROM (08 $K direct)	ROM + Adders (28% for Demo) (08 $K direct)
105-P	ROM	D	$85,060	$101,219	$129,560
108-1P	ROM	D	$266	$217	$405
108-2P	ROM	D	$345	$410	$525
				Total ROM	**$130,490**

Adders to the ROM

Remove/dispose of the reactor vessel	$10,000
Remove/dispose of tritiated heat exchangers (offsite disposal)	$400
Remove/dispose tritiated process water piping and tanks (offsite disposal)	$200
Offsite disposal of tritiated concrete (10,000 truck loads)	$91,500
Disposal of mixed waste (contaminated lead, brass, & 630K sq ft of PCBs)	$1,200
Excavate to access below grade structure (7500 truck loads)	$7,209
Remove sludge/activated metal from Disassembly Basin	$500
Remove/dispose of Disassembly Basin water	$2,700
Disposal of Disassembly Basin activated metal and sludge	$128
Total Estimated Cost (direct)	**$244,327**
Contingency @ 20%	$48,865
Overheads @ 30%	$73,298
Total Estimated Cost (FY-2008 dollars)	**$366,490**

ROM = Rough Order of Magnitude

D = Demolish

Assumptions:

- Complete demolition of 105-P, 108-1P and 108-2P, including below grade structures down to the footers
- Soil excavated from Underground Radiological Materials Area must be disposed of as Low-Level Waste (some must go to the Nevada Test Site [NTS] for trichloroethylene)
- Concrete in pump room, heat exchanger bay, process room, purification cells and Disassembly Basin walls can not go to slit trenches due to tritium
- Heat Exchangers, moderator piping, moderator storage tanks, purification equipment can not go to slit trenches due to tritium
- Reactor vessel will be segmented, packaged and disposed of off site
- Disassembly Basin sludge can not go to the slit trenches due to tritium
- Disassembly Basin activated metal will be packaged in shipping casks and can go to slit trenches
- Polychlorinated biphenyl paint will have to be scabbled from concrete walls before demolition and disposed of as mixed waste
- Will include removal/disposal of 109-P and 106-P (required t excavated below grade structure)
- No Materials Controls & Accountability issues with Disassembly Basin sludge/activated metal
- All waste for offsite disposal (except for mixed) will go to NTS
- Mixed waste will go to either EnviroCare or Oak Ridge
- Non Mixed Waste costs are for packaging and shipment only.....NTS disposal is no charge
- Mixed waste costs include treatment costs and disposal
- Heat Exchangers shipped as is with no additional packaging
- Concrete disposal to Clive, Utah by rail using existing 50 site gondola rail cars and rail spur to 100-P must be refurbished

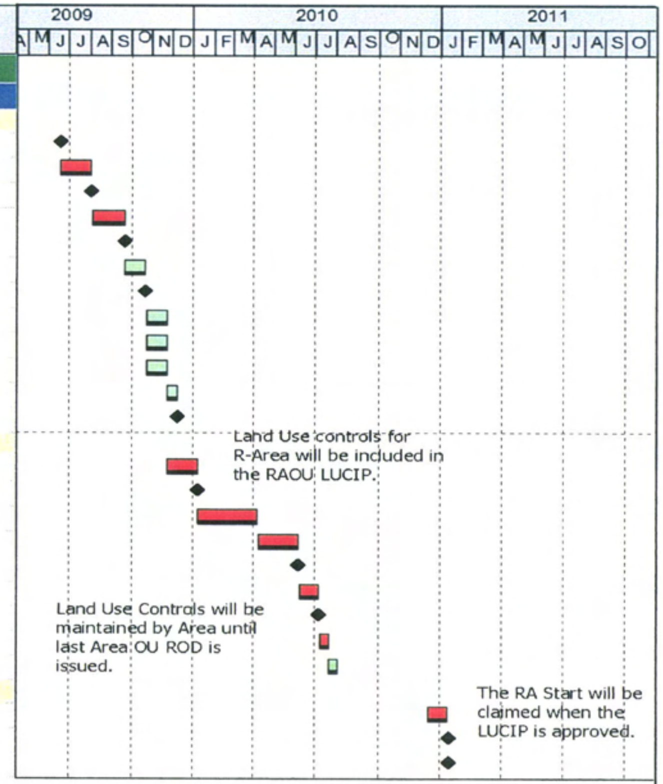
APPENDIX E

EARLY ACTION POST-ROD SCHEDULE

This page was intentionally left blank

ARF # 16479

Activity Name	OD	Start	Finish
FNTI.01.29.50.32.02 New and Accelerated	328d	16-Jun-09	12-Jan-11
FNTI.01.29.50.32.02.03 Lower Three Runs Watershed	328d	16-Jun-09	12-Jan-11
FNTI.01.29.50.32.02.03.01.05 Interim/Early Actions	100d	16-Jun-09	8-Dec-09
Submit Rev. 0 EA ROD without Responsiveness Summary	0d		16-Jun-09
EPA/SCDHEC Review Rev. 0 EA ROD	45d	17-Jun-09	31-Jul-09
EPA/SCDHEC Return Rev. 0 EA ROD Comments	0d		31-Jul-09
SRS Incorporate EPA/SCDHEC EA ROD Comments	50d	3-Aug-09	21-Sep-09
SRS Submit Redline Rev. 1 EA ROD w/Respons Sum	0d		21-Sep-09
EPA/SCDHEC Final Review/Approval EA ROD	31d	22-Sep-09	22-Oct-09
Receipt of EA ROD Approval	0d		22-Oct-09
DOE Obtain Signature on EA ROD	32d	23-Oct-09	23-Nov-09
EPA Obtain Signature on EA ROD	32d	23-Oct-09	23-Nov-09
SCDHEC Obtain Signature on EA ROD	32d	23-Oct-09	23-Nov-09
Prepare for Public Notice	15d	24-Nov-09	8-Dec-09
Issue EA ROD	0d		8-Dec-09
FNTI.01.29.50.32.02.03.01.15 Engineering & Pre-Construction	145d	23-Nov-09	2-Aug-10
SRS Develop Rev. 0 Early Action LUCIP for C-, K-, L-Reactors	45d	23-Nov-09	6-Jan-10
SRS Submit Rev. 0 Early Action LUCIP	0d		6-Jan-10
EPA/SCDHEC Review Rev. 0 Early Action LUCIP	90d	7-Jan-10	6-Apr-10
SRS Incorporates Comments for Rev. 0 Early Action LUCIP	59d	7-Apr-10	4-Jun-10
SRS Submit Redline Rev. 1 Early Action LUCIP	0d		4-Jun-10
EPA/SCDHEC Review/Approval for Rev. 1 EA LUCIP	30d	7-Jun-10	6-Jul-10
EPA/SCDHEC Approve Rev. 1 EA LUCIP	0d		6-Jul-10
Prepare for Public Notice of Early Action Fact Sheet	13d	7-Jul-10	19-Jul-10
Issue Fact Sheet	14d	20-Jul-10	2-Aug-10
FNTI.01.29.50.32.02.03.01.16 Construction	18d	13-Dec-10	12-Jan-11
Develop EA RA Start Letter	30d	13-Dec-10	11-Jan-11
Early Action Remedial Action Start	0d	12-Jan-11	
Maintain Land Use Controls	0d	12-Jan-11	



Primary Baseline
Actual Work
Actual Work Crit
Remaining Work
Critical Remaining ...
Milestone

C, K, L, and R-Reactor Complexes
Early Action Implementation Schedule

Date	Revision	Checked	Approved

Figure E-1. Early Action Post-ROD Schedule

This page was intentionally left blank