LUCIP for the
R Area Operable Unit (consists of Area on the North Side of Building 105-R, Laydown Area North of 105-R, and Release from the Decontamination of R-Area Reactor Disassembly Basin, NBN, Combined Spills North of Building 105-R, NBN, Cooling Water Effluent Sump, 107-R, Potential Release from R-Area Disassembly Basin, NBN, Potential Release of NaOH/H2SO4 from 183-2R, NBN, R-Area Ash Basin, 188-0R, R-Area Groundwater, R-Area Process Sewer Lines as Abandoned, NBN, R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN)
Land Use Control Implementation Plan for the R Area Operable Unit
(SRNS-RP-2010-01208, Revision 1, February 2011)

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United States Department of Energy

Savannah River Site

Land Use Control Implementation Plan (LUCIP) for the R Area Operable Unit (RAOU) (U)

CERCLIS Number: 95

SRNS–RP–2010-01208

Revision 1

February 2011

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Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ac	acre
ACP	Area Completion Projects
bgs	below ground surface
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	curie
cm	centimeter
CMS/FS	Corrective Measures Study/Feasibility Study
D&D	deactivation and decommissioning
EE/CAs	Engineering Evaluation/Cost Analyses
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
ft	feet
ha	hectare
HCA	high contamination area
ICA	isolated contamination area
ISD	in situ decommissioning
km	kilometer
km^2	square kilometer
LTR	Lower Three Runs
LUC	land use control
LUCIP	Land Use Control Implementation Plan
LUCAP	Land Use Control Assurance Plan
m	meter
m^2	square meter
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mi	mile
mi^2	square mile
MNA	monitored natural attenuation
NBN	no building number
NFA	no further action
NTC	non-time critical
OU	operable unit
pCi/g	picocuries per gram
PSA	potential source area
PSL	process sewer line
PTSM	principal threat source material

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

RA	remedial action
RAGW	R-Area Groundwater
RAOU	R Area Operable Unit
RBC	Reactor Building Complex
RCRA	Resource Conservation and Recovery Act
RFI/RI	RCRA Facility Investigation/Remedial Investigation
ROD	Record of Decision
RSER	Removal Site Evaluation Report
SCDHEC	South Carolina Department of Health and Environmental Control
SE	site evaluation
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
UTR	Upper Three Runs
VOC	volatile organic compound
WSRC	Washington Savannah River Company LLC (formerly Westinghouse Savannah River Company LLC)
yd^2	square yard

1.0 INTRODUCTION

This Land Use Control Implementation Plan (LUCIP) has been prepared for the R Area Operable Unit (RAOU) at the Savannah River Site (SRS). The RAOU comprises multiple subunits, Potential Source Areas (PSA), Deactivation and Decommissioning (D&D) facilities, and a Site Evaluation (SE) Area within R Area. The groundwater subunit is included in the RAOU. The D&D facilities and the SE Area were determined to be No Further Action (NFA) sites, however, the selected remedy for the entire RAOU is land use controls (LUCs) along with Monitored Natural Attenuation (MNA) for the groundwater subunit. The purpose of this LUCIP is to describe how the LUCs selected in the Record of Decision (ROD) for the RAOU subunits will be implemented and maintained. The LUC objectives have been documented in the RAOU ROD (SRNS 2010a) and are listed in Section 3.0.

The selected remedy leaves hazardous substances in place that pose a potential future risk and will require land use restrictions until the concentrations of hazardous substances in the soil and groundwater are at levels that allow for unrestricted use. As agreed on March 30, 2000, among the U.S. Department of Energy (USDOE), the U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC), SRS has implemented 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 requirements of that LUCAP also apply to the LUCs that were selected as part of the RAOU remedial action (RA). This document, the RAOU LUCIP, contains the detailed and specific measures required to implement and maintain the LUCs selected as part of this particular remedial decision. The LUCs shall be maintained until the operable unit (OU) is suitable for unlimited exposure and unrestricted use. Approval by USEPA and SCDHEC is required for any modification or termination of the LUCs.

USDOE is responsible for implementing, maintaining, monitoring, reporting, and enforcing the LUCs in accordance with the approved LUCIP. Upon final approval, the LUCIP will be appended to the LUCAP and should be considered incorporated by reference into the RAOU ROD (SRNS 2010a), establishing implementation and maintenance requirements for the LUCs

under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the SRS Federal Facility Agreement (FFA) (FFA 1993). The LUCIP will remain in effect unless and until modifications are approved by USEPA and SCDHEC as necessary for protection of human health and the environment. This LUCIP will be evaluated for accuracy during the five-year remedy review, and any approved LUCIP modification will be appropriately documented for incorporation by reference into the RAOU ROD.

1.1 Format of LUCIP

The format of this LUCIP is consistent with the FFA protocol format approved by USEPA and SCDHEC in March 2004.

2.0 OVERVIEW OF RAOU REMEDIAL ACTION

2.1 General Description and History of the Unit

SRS occupies approximately 802.8 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 6.4 km (25 mi) southeast of Augusta, Georgia, and 32.1 km (20 mi) south of Aiken, South Carolina.

The RAOU is located approximately 5 km (3.1 mi) northeast of the geographical center of SRS and about 7.0 km (4.3 mi) northwest of the nearest site boundary (Figure 1). The RAOU is approximately 182 hectares (450 acres), including groundwater plumes, and is located predominantly in the Lower Three Runs (LTR) watershed; however, the northwestern portion of the RAOU is located in the Upper Three Runs (UTR) watershed. The RAOU is situated on a local topographic high that serves as the drainage divide between UTR and LTR. The water table in the RAOU assumes the shape of a mound or ridge, with radial outward flow. In the vicinity of the R-Reactor Building (105-R), the water table ranges between approximately 1 m (3 ft) to 3 m (10 ft) below ground surface (bgs), depending upon seasonal effects and the location within the RAOU.

In December 1953, R-Reactor began operations with a mission of producing nuclear materials for the defense program. SRS reactors were both low pressure and low temperature reactors with heavy water cooling of the core. R-Reactor was shut down in 1964 due to reduced requirements

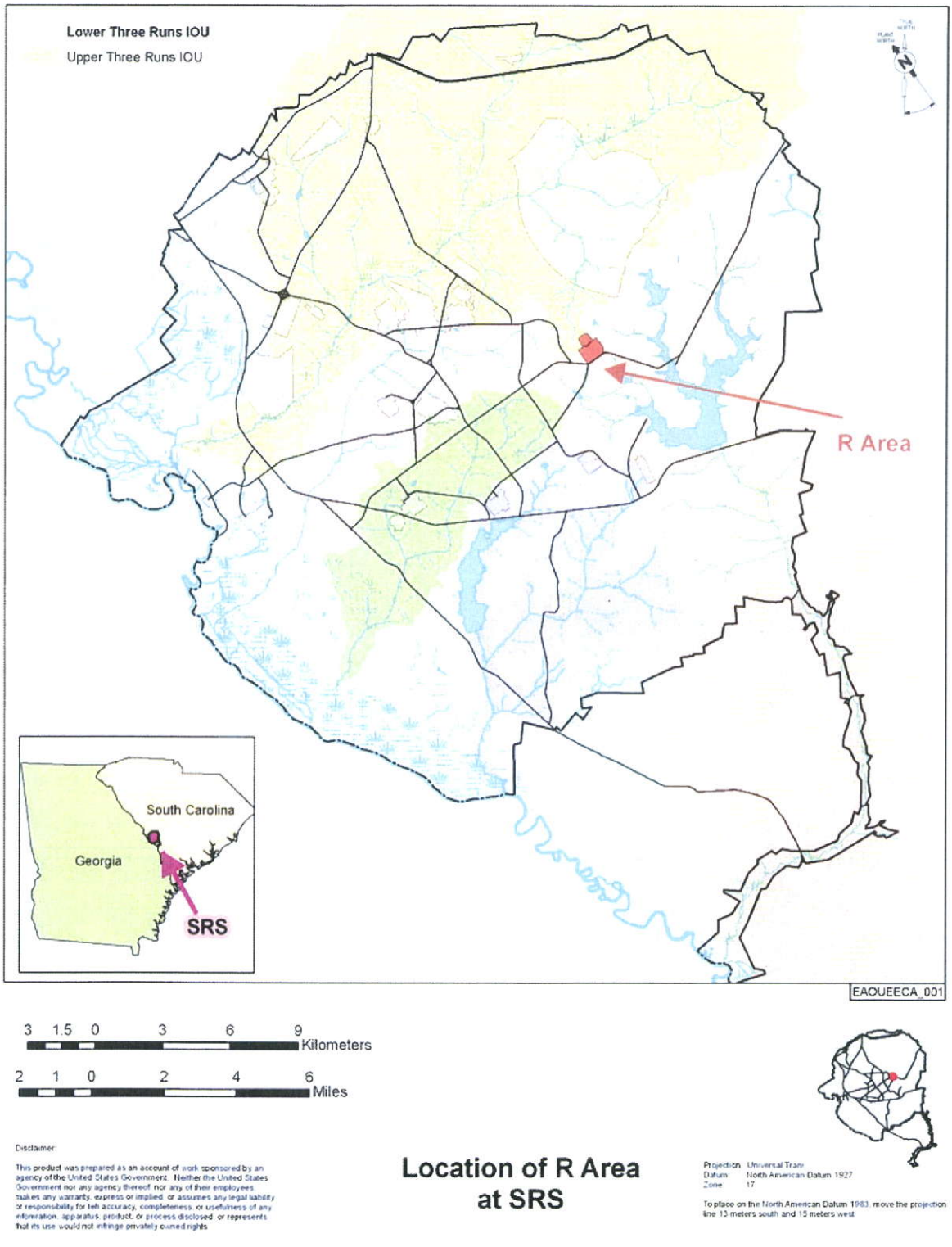

Figure 1. Location of the RAOU within the Savannah River Site

for defense-related products. Immediately following the shutdown, the R-Reactor was de-fueled and all fissile materials were removed. Reactor operations resulted in the generation of chemical and radioactive wastes.

Contamination in R Area has been addressed under an area-wide remedial strategy. As part of this strategy, Resource Conservation and Recovery Act (RCRA)/CERCLA/SE units and D&D facilities (or remnants) in the former R-Area industrial area were consolidated into a single OU (i.e., the RAOU). The characterization evaluation and analysis of the RAOU were documented in the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment (BRA), and Corrective Measures Study/Feasibility Study (CMS/FS) for RAOU (SRNS 2009a).

The RAOU is comprised of multiple subunits, PSAs, D&D facilities and a SE area, as identified in Figure 2.

Regulatory decisions were previously made on select RAOU subunits. These decisions included Non-Time Critical (NTC) removal actions documented in multiple Removal Site Evaluation Reports (RSER)/Engineering Evaluation/Cost Analyses (EE/CAs) (WSRC 1995a, WSRC 1995b SRNS 2009b, c, d, and e, USDOE 2002). The Cask Car Railroad Tracks, RBC (including the Disassembly Basin), the Process Sewer Lines (PSLs), and the R-Ash Basin are all subunits that were selected for NTC removal actions. The NTC removal actions are scheduled to be completed by 2011. The LUCs for the RAOU were selected based on the assumption of successful completion of the NTC removal actions. The RAGW Subunit and the R-Area Isolated Contamination Area (ICA) PSA have an unacceptable exposure risk to human health and will require LUCs as part of the selected remedy. All other RAOU subunits, presented in the RCRA RFI/RI/BRA/CMS/FS report (SRNS 2009a), were determined to pose no impact to human health (industrial use). However these units will be managed with LUCs to prevent unrestricted land use.

Within the RAOU boundary, six D&D facilities and one SE area were determined to require No Further Action (NFA). These facilities and area pose no impact to human health or the

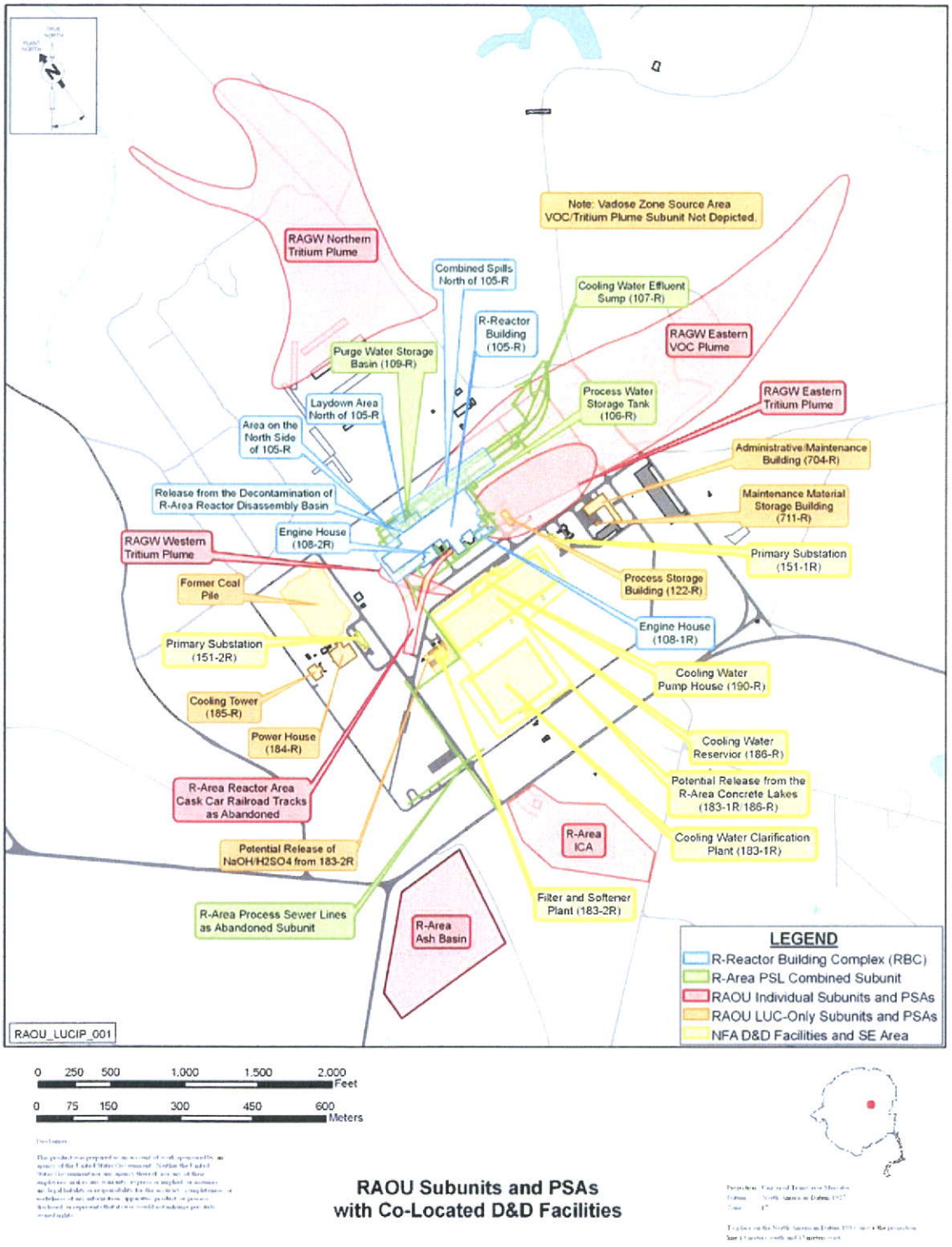

Figure 2. Layout of the R Area Operable Unit with Subunit Groups

environment based on an unrestricted land use scenario. Although LUCs are not required for these subunits, these facilities will be included with the LUCs selected for the RAOU because of their location within the R-Area fence line. Table 1 presents a summary of the regulatory decisions for each of the subunits.

The R Area at SRS is located in an area of historically heavy industrial (nuclear) land use as identified in the LUCAP (WSRC 1999). Remedial action objectives and likely response actions were developed consistent with future industrial non-residential land use. LUCs will restrict use because of the contamination that will be left behind at the RAOU. Appropriate LUCs against unrestricted and/or residential use will be part of all RAs for the RAOU. As detailed herein, land use restrictions to prevent unrestricted use will be placed on the entire area outlined as the RAOU LUC boundary depicted on Figure 3 and further restrictions will be placed to prohibit industrial use in the ICA PSA.

2.2 Nature and Extent of Contamination

Hazardous and radioactive substances at the RAOU have been released into the environment. Subsequent to the completion of the NTC removal actions, hazardous and radioactive wastes will remain in place at some of the subunits. The characterization evaluation and analysis of each of the subunits requiring LUCs in the RAOU are documented in the RFI/RI/BRA/CMS/FS for RAOU (WSRC 2009a). The subunits selected for NTC removal actions, where residual contamination will remain are discussed briefly below.

The **RBC (105-R)** is located centrally within R Area. The RBC Subunit is subdivided into the following four components:

- R-Reactor Building (105-R) including the Engine Houses [108-1R/ 108-2R]) Subunits
- Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin (NBN) Subunits
- Combined Spills North of Building 105-R (NBN) Subunit
- Potential Release from the R-Area Disassembly Basin (105-R) Subunit

Table 1. List and Status of Subunits at the RAOU

FFA Appendix	Combined Subunit Name	RAOU Subunit or PSA Name	Removal Action	Reference Documents	Final Selected Remedy
C.5 Area OU	R-Reactor Building (105-R) Complex	R-Reactor Building (105-R) and Engine Houses (108-1R and 108-2R) Subunits	Dewater Disassembly Basin (DB); Grout Below-Grade areas; Grout Reactor Vessel in place; Concrete cover over grouted Reactor Vessel; Seal exterior openings to Reactor Building; Demolish Above-Grade DB and dispose at the slit trenches; Concrete Cover for DB and contaminated soil;	RSER/EE/CA for the R-Reactor Disassembly Basin (USDOE 2002)); ROD Remedial Alternative Selection for R-Area Operable Unit (SRNS 2010a); RSER/EE/CA for the R-Reactor Building (105-R) Complex (SRNS 2009e).	RAOU LUCs
C.5 Area OU		Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin Subunits			
C.5 Area OU		Combined Spills North of Building 105-R Subunit			
C.5 Area OU		Potential Release from the R-Area Disassembly Basin (105-R) Subunit			
C.5 Area OU	RPSL Combined Subunit	R-Area Process Sewer Lines as Abandoned (NBN) Subunit	Isolation Plugging of R-Reactor RPSLs and Drainage System; Grouting of Manholes, Diversion Boxes, and Tanks; Plug Outfalls; and LUCs.	RSER/EE/CA for the R-Area Process Sewer Lines (SRNS 2009b)	RAOU LUCs
Other PSA		Process Water Storage Tank (106-R) PSA			
C.5 Area OU		Cooling Water Effluent Sump (107-R) Subunit			
C.5 Area OU		Purge Water Storage Basin (109-R) Subunit			
C.5 Area OU	NA	R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) Subunit	Removal & disposal Cesium-137 (+D) (>10pCi/g); and LUCs.	RSER/EE/CA for the R-Area Reactor Area Cask Car Railroad Tracks (SRNS 2009d)	RAOU LUCs
C.5 Area OU	NA	R-Area Ash Basin (188-R) Subunit	Vegetation Removal; Soil Cover; LUCs	RSER/EE/CA for the R-Area Ash Basin (SRNS 2009c)	RAOU LUCs
C.5 Area OU	NA	R-Area Groundwater (NBN) Subunit	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs and MNA
Other PSA	NA	R-Area Isolated Contamination Area PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs (Prevent Industrial Land Use)
C.5 Area OU	NA	Process Storage Building (122-R) Subunit	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
C.5 Area OU	NA	Potential Release of NaOH/H2SO4 from 183-2R Subunit	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Power House (184-R) PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Cooling Tower (185-R) PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Former Coal Pile (NBN) PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Administrative and Maintenance Building (704-R) PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Maintenance Material Storage Building (711-R) PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs
Other PSA	NA	Eastern VOC/Tritium Groundwater Plume PSA	None	RAOU RFI / RI / BRA / CMS / FS (SRNS 2009a)	RAOU LUCs

Table 1. List and Status of Subunits at the RAOU *(Continued/End)*

FFA Appendix	Combined Subunit Name	D&D Facility or SE Area Name	Removal Action	Reference Documents	Final Selected Remedy
K.2 D&D NFA	NA	Primary Substation 151-1R	No Further Action	SRNS 2009f	Not Applicable
K.2 D&D NFA	NA	Primary Substation 151-2R	No Further Action	WSRC 2006a	Not Applicable
K.2 D&D NFA	NA	Cooling Water Clarification Plant (183-1R)	No Further Action	WSRC 2005a	Not Applicable
K.2 D&D NFA	NA	Filter and Softener Plant (183-2R)	No Further Action	WSRC 2005b	Not Applicable
K.2 D&D NFA	NA	Cooling Water Reservoir (186-R)	No Further Action	WSRC 2006b	Not Applicable
K.2 D&D NFA	NA	Cooling Water Pump House (190-R)	No Further Action	WSRC 2006c	Not Applicable
G.2 SE NFA	NA	Potential Release from the R-Area Concrete Lakes (183-1R/186-R)	No Further Action	WSRC 1994	Not Applicable

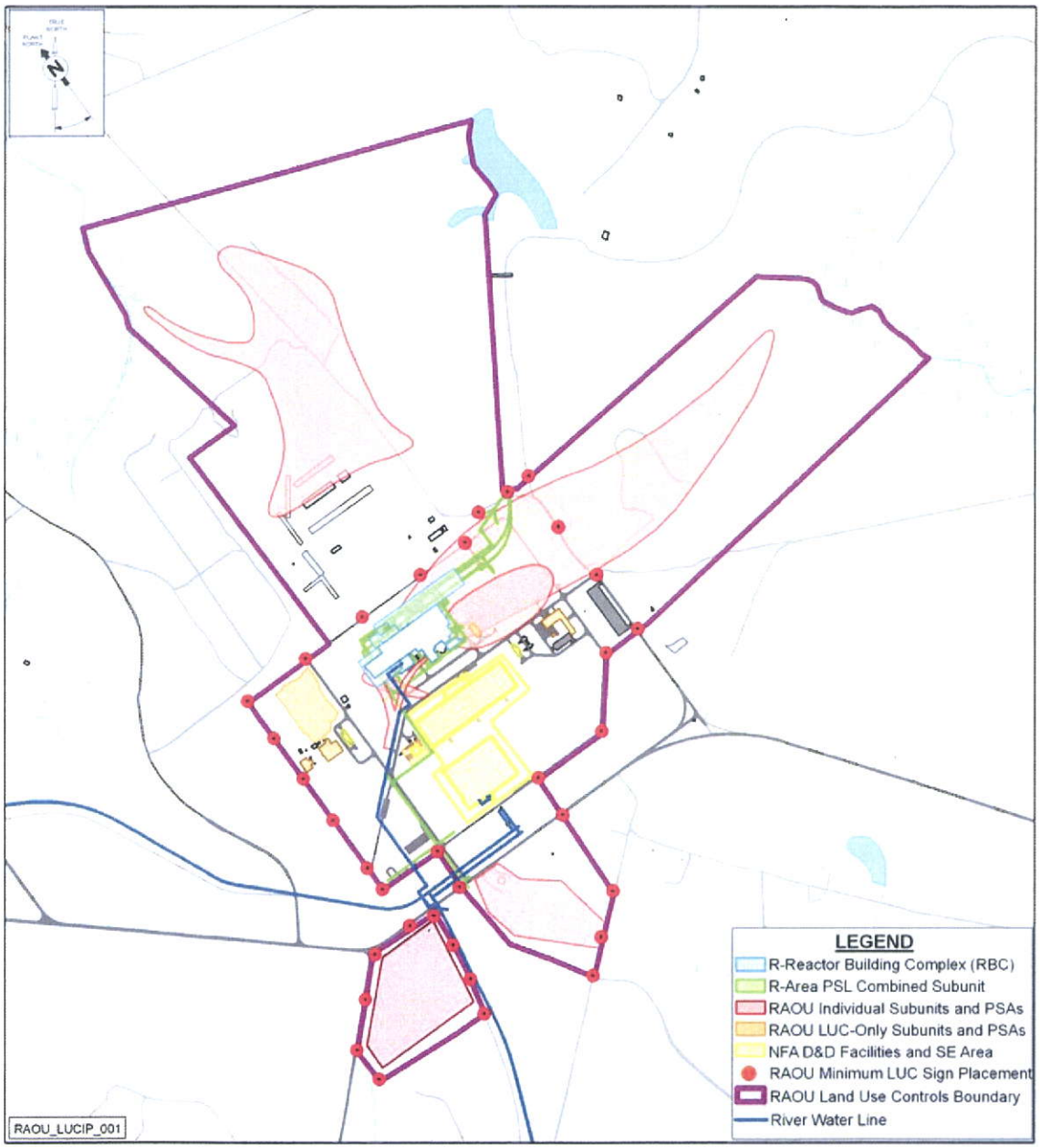

Figure 3. Land Use Control Boundary for the R Area Operable Unit

The primary sources of contamination in the RBC subunit are due to the facility operations. Spills, leaks, accidental releases, or simply the operation itself resulted in a release of hazardous and/or radioactive substances. Within the R-Reactor Building (105-R), including the Disassembly Basin, and Engine Houses (108-1R and 108-2R), there is an estimated total of 6.39E+04 Ci of radionuclide inventory/contamination, primarily activation products in the stainless steel and aluminum components of the reactor vessel. Hazardous material is also present in the subunit. Lead and polychlorinated biphenyls constitute the majority of the hazardous inventory. Cesium-137 contamination was found in the soils and on concrete slabs, and near penetrations in the asphalt in an area on the north side of the R-Reactor Building (105-R). The contaminants present an unacceptable risk to human health (industrial worker) and the potential to impact groundwater.

RPSLs are located throughout the RAOU. The RPSLs consist of 6.4 km (4 mi) of underground process and storm sewer lines of various sizes and configuration throughout R Area. The RPSLs as Abandoned (NBN) Subunit has been combined with the Process Water Storage Tank PSA (106-R), the cooling Water Effluent Sump (107-R) Subunit, and the Purge Water Storage Basin (109-R) Subunit because they are interconnected and have similar process histories. No contamination was found in the soils exterior to the RPSL Combined Subunit during characterization efforts. Based on process knowledge and limited data from PSL investigations conducted in R- and C-Reactor Areas, there is a potential for radiological contamination (such as cesium-137 and cobalt-60) to be fixed within the pore spaces of the concrete or trapped in the rust and scale in these lines above principal threat source material (PTSM) thresholds. Any structures outside the RBC (105-R) that came in contact with the RPSLs are also assumed to be contaminated with cobalt-60 and cesium-137.

The **R-Area Reactor Groundwater (NBN)** Subunit comprises three distinct tritium plumes and a VOC plume. The combined area of the RAGW Subunit is approximately 22.3 ha (55 ac). The tritium and VOC concentrations within the RAGW Subunit exceed their respective maximum contaminant levels (MCLs). The area of the plumes exceeding MCLs is shown on Figure 2.

The **R-Area ICA PSA** contains cesium-137 contamination that typically would require active remediation. However, the Core Team agreed that any remedial activity in this area would result in unacceptable damage to the sensitive ecology of the cypress wetland where the contamination is present. This subunit is located south of R Area and comprises an area of approximately 3.44 ha (8.5 ac). LUCs were selected as the remedy for this subunit to prevent future residential use and limit exposure to the industrial worker. The wetland area is not a favorable location for future industrial use.

The **Cask Car Railroad Tracks Subunit** is located southwest of the RBC (105-P). Soils, railroad ties, and railbed material in the Cask Car Railroad Tracks were contaminated with cesium-137 as a result of rainwater carrying the radiological materials from outside of the casks onto the ground surfaces along the tracks. The total area of the Cask Car Railroad Tracks Subunit is approximately 7,625 m^2 (9119 yd^2).

The **R-Ash Basin** is located outside of the southwestern perimeter of R Area south of the RBC (105-R). The R-Ash Basin received coal ash from the R-Area Powerhouse. The ash and associated contaminants are contained within the earthen basin, which is approximately 49,776 m^2/5.0 ha (59,532 yd^2/12.3 ac). The ash thickness in the basin tapers from 4.9 m (16 ft) at the point the coal ash was sluiced into the basin in the north to 0.15 m (0.5 ft) at the lowest point of the basin at the southern end. Arsenic and naturally occurring radionuclides (potassium-40, radium-226, uranium-235, uranium-238), were identified as constituents of concern in the R-Area Ash Basin.

The RCRA RFI/RI Report with BRA, and CMS/FS for RAOU (WSRC 2009a) provides the characterization data and interpretation of the nature and extent of contamination for the remaining eight subunits that are included within the LUC boundary. These subunits were evaluated based on use by a future industrial receptor. No problems warranting action were identified.

The selected remedy for the RAOU leaves radioactive and hazardous substances that pose a potential future risk in place. Land use restrictions will be required until the concentrations of

radioactive and hazardous substances in the soil are at levels that allow for unrestricted use and exposure.

2.3 Remedial Actions Selected

The selected RA for the RAOU is LUCs and MNA. The selected RA is based on successful completion of the NTC removal actions. NTC removal actions have been documented in the RSER/EE/CAs (SRNS 2009b, 2009c, 2009d, 2009e, USDOE 2002). These actions will require long-term maintenance as part of this final action LUCIP to ensure that the remedy remains protective. The removal actions are presented below.

- Excavation and disposal of contaminated media at the R-Reactor Cask Car Railroad Tracks (SRNS 2009d);
- Soil cover over the R-Ash Basin (SRNS 2009c);
- Isolation/plugging of RBC (105-R) PSLs; grouting of associated underground structures, manholes, weirs and boxes; select removal of process equipment external to the RBC (105-R; sealing/plugging of outfalls (SRNS 2009b);
- Dewatering and grouting the R-Reactor Disassembly Basin to stabilize the contaminants (USDOE 2002),
- In Situ Decommissioning (ISD) of the RBC (105-R). ISD of the R-Reactor Building (105-P) Complex entails the following (SRNS 2009e):
  - Leave the Process, the Purification, the Assembly Areas of the RBC (105-R) and the Actuator Tower in place,
  - Grout the contents of the Disassembly Basin to grade,
  - Demolish the above-grade structure of the Disassembly Area to grade-level,
  - Remove the stack above the plus 16.8-m (55-ft) elevations,
  - Construct a new partial roof over the shield door slots to prevent rainwater ingress,

- Grout the Reactor Vessel in place with a constructed concrete cover, sloped to allow water runoff in the event of future rainwater ingress,
- Leave the Process Room, an above-grade structure, in its current state,
- Place a sloped concrete cover over the grouted Disassembly Basin and contaminated soil and slabs in the area north of the R-Reactor Building (105-R),
- Grout all vacant spaces from the 0-m (0-ft) level (grade) down to the minus 15.1-m (49.5-ft) level in place (to the extent practical),
- Grout the Purification Area cells and the below-grade area of Purification in place,
- Seal all RBC exterior openings.

Following successful completion of NTC removal actions, residual hazardous substances will remain at the RAOU. The selected final remedy for the RAOU, as established in the RAOU ROD (SRNS 2010a), includes LUCs. These LUCs are also for the entire RAOU, including the subunits designated in Table 1.

LUCs will include administrative controls (i.e., institutional controls) and engineering controls. LUCs will consist of property record notices and restrictions, Site Use/Site Clearance Program restrictions, and physical access controls. Warning signs will be posted at the LUC boundary as depicted in Figure 3 upon completion of the removal actions. LUCs will also include site maintenance (site inspections, general housekeeping, repair of erosion damage and other routine maintenance as needed).

The post-RA conceptual site model (Figure 4) demonstrates that the exposure pathways to an industrial worker are incomplete following implementation of the RA. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential use of SRS land is prohibited.

3.0 LAND USE CONTROL OBJECTIVES

The following RAOU LUC objectives have been developed to ensure the protectiveness of the remedy described above:

- Restrict unauthorized access and prevent contact, removal, or excavation of contaminated waste, pipelines, equipment and buildings
- Prohibit industrial use of the R-Area ICA PSA
- Prohibit the development and use of property for residential housing, elementary schools, childcare facilities and playgrounds
- Maintain the integrity of any current or future remedial or monitoring systems such as soil covers, or groundwater monitoring wells
- Prevent access to 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

Current access controls and deed notification needed to maintain the future land use are described in the following sections of this LUCIP.

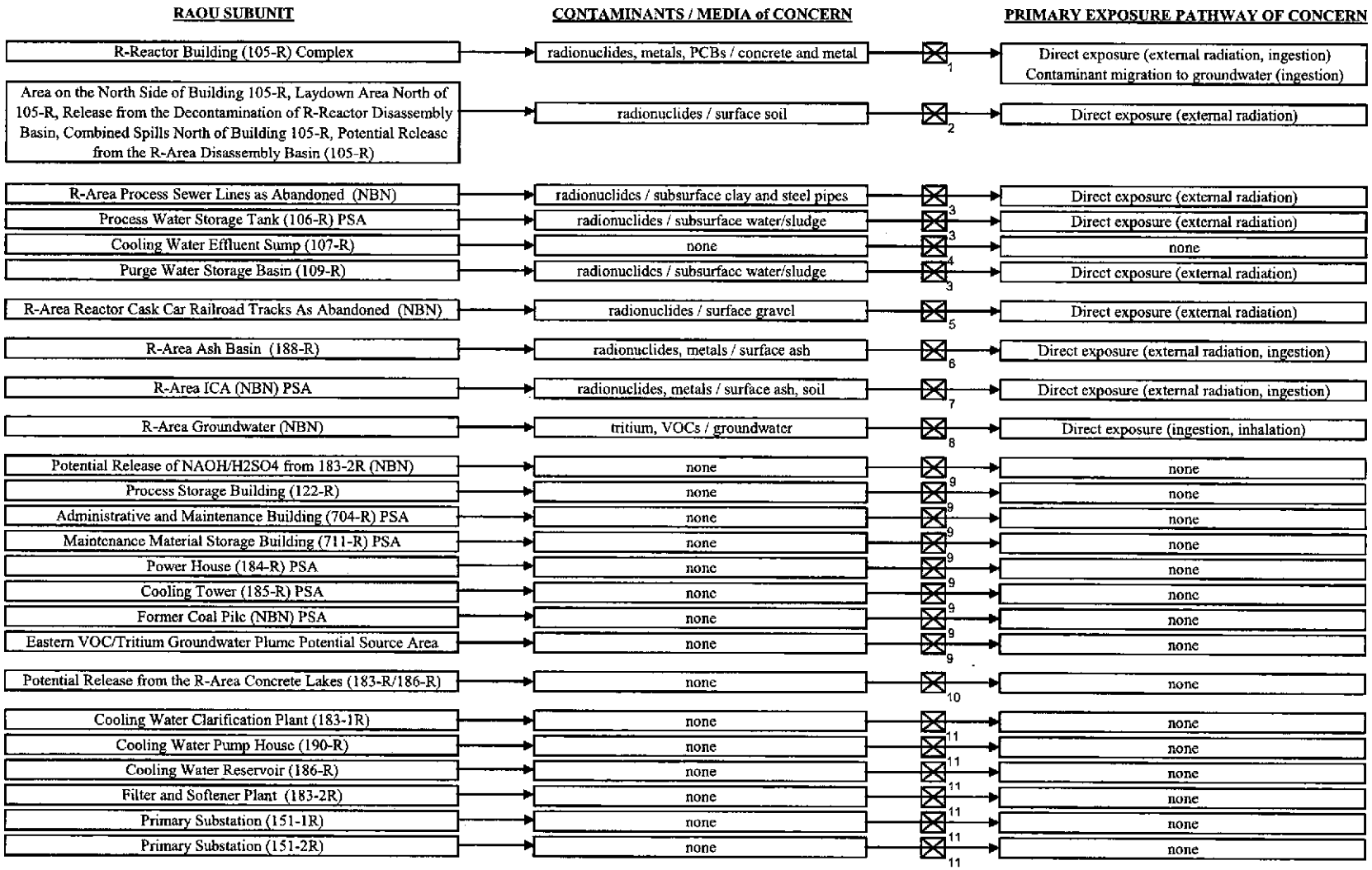

Figure 4. Conceptual Site Model for the R Area Operable Unit Final Action

LEGEND

Symbols: → Complete exposure pathway. ⊠→ Incomplete exposure pathway due to final remedial action.

1 - In Situ Decommissioning with Reactor Vessel grouted in place (SRNS 2009e); RAOU Land Use Controls after completion of removal action .

2 - Concrete Cover (SRNS 2009e), RAOU Land Use Controls after completion of removal action.

3 - Isolation, Plugging of RPSLs and Drainage System; Grouting of Manholes, Diversion Boxes, and Process Tanks; Select Removal of Process Equipment External to the Reactor Building; Sealing/ Plugging of Outfalls (SRNS 2009b), RAOU Land Use Controls after completion of removal action.

4 - No COCs identified for these individual waste units- however they have been combined with the RPSLs because they are interconnected and have similar process histories (SRNS 2009b). RAOU Land Use Controls after completion of removal action.

5 - Excavate, Remove and Cover (SRNS 2009d), RAOU Land Use Controls after completion of removal action.

6 - Soil Cover (SRNS 2009c), RAOU Land Use Controls after completion of removal action.

7 - RAOU Land Use Controls.

8 - Monitored Natural Attenuation, R-Area Land Use Controls.

9 - No COCs based on an industrial land use scenario; RAOU Land Use Controls needed to prevent unrestricted land use.

10 - No COCs per evaluation performed in the Site Evaluation Program (FFA Appendix G.2). No Further Action (unrestricted land use).

11 - No COCs per evaluation performed in the D&D Program (FFA Appendix K.2). No Further Action (unrestricted land use).

Figure 4. Conceptual Site Model for the R Area Operable Unit Final Action *(Continued/End)*

4.0 IMPLEMENTATION OF LAND USE CONTROLS

This section describes the LUCs selected in the ROD to achieve the objectives stated in Section 3.0. A summary of the types of controls is provided in Table 2. USDOE is responsible for implementing, maintaining, reporting on, and enforcing the RAOU LUCs. The LUCIP will become enforceable and will be implemented when approved by USEPA and SCDHEC following the completion of the RA prescribed by the RAOU ROD. USDOE shall notify USEPA and SCDHEC 60 days in advance of any proposed land use changes that are inconsistent with LUC objectives or the selected remedy.

The RAOU will be maintained as an industrial use area, except where industrial use is prohibited in the ICA PSA, by implementation of the property record notices (Section 4.1) and restrictions (Section 4.2), and the use of a certified LUC survey plat (Section 4.3). Figure 3 illustrates approximate RAOU land-use boundary requirements.

The Site Use Program (Section 4.4) will be implemented to prevent onsite worker exposure to contamination left in place at the RAOU. Other existing measures (i.e., Site Clearance Program, worker training, health and safety requirements, work controls) will also be used to ensure worker safety at the RAOU. Physical access controls (Section 4.5) are implemented at the SRS boundary to control and restrict public and trespasser access to the RAOU and to prevent unauthorized entry into the RBC.

Signs at the RAOU will be maintained to alert onsite workers to the presence of hazardous substances. The signs will also convey the restrictions of unauthorized personnel. Access control warning signs will be placed after completion of the removal actions and will be maintained to prevent unknowing entry and unrestricted use at the surface units at the RAOU.

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Table 2. RAOU Land Use Controls

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 concentrations 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.	RAOU where hazardous substances are left in place at levels requiring land use and 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 concentrations 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	RAOU where hazardous substances are left in place at levels requiring land use and 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 concentrations 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	RAOU where hazardous substances are left in place at levels requiring land use and 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	Subunits at RAOU where remedy components cannot be disturbed, where industrial us is prohibited, and where levels requiring land use and 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 concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use	Controls maintained by USDOE	Security is provided at site boundaries in accordance with SRS procedures.

Table 2. RAOU Land Use Controls *(Continued/End)*

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas[a]
6. Warning Signs[g]	Provide notice or warning to prevent unauthorized uses	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use	Signage maintained by USDOE	Warning signs will be posted in accordance with applicable site procedures and will be placed in appropriate areas of the RAOU after completion of the removal actions..
7. Security Surveillance Measures	Control and monitor access by workers/public	Until the concentrations 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 RAs	Security and surveillance measures are in place at the SRS boundary in accordance with RCRA-permit requirements.

[a]Affected areas – Specific locations identified in the SRS LUCIP or subsequent post-ROD documents.
[b]Property Record Notices – Refers to any non-enforceable, purely informational document recorded along with the original property acquisition records of USDOE and its predecessor agencies that alerts anyone searching property records to important information about residual contamination or 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 recoded 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 of 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.

4.1 Property Record Notices

In the long term, if the property is ever transferred to non-federal ownership, the United States 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, areas of groundwater contamination that exceed MCLs, and RAs 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 RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

4.2 Property Record Restrictions

The deed shall also include deed restrictions precluding residential use of the property, specifically preventing the installation of any groundwater supply well within the contaminated aquifer so that groundwater containing contaminants exceeding MCLs cannot be used for drinking water and preventing industrial use within the ICA PSA. The deed shall expressly prohibit activities inconsistent with the remedial goals and objectives in the RAOU ROD upon any and all transfers. USDOE shall provide a copy of the executed deeds to the regulatory agencies as soon as practicable after the transfer of fee title, but no later than 30 days. However, the need for these deed restrictions may be re-evaluated 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 or the groundwater contamination levels no longer exceed MCLs. Any re-evaluation of the need for the deed restrictions will be done through an amended ROD.

USDOE shall provide USEPA and SCDHEC at least six-months' notice prior to transfer or sale so that USEPA and SCDHEC can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective

LUCs. If it is not possible for the facility to notify USEPA and SCDHEC at least six months prior to any transfer or sale, then the facility will notify USEPA and SCDHEC as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to LUCs. In addition to the land transfer notice and discussion provisions above, USDOE further agrees to provide USEPA and SCDHEC with similar notice within the same time frames as to federal to federal transfer of property.

4.3 Other Public Notices

The LUCIP identifies the proposed area under land use restrictions in Figure 3 for the RAOU. The LUC boundary depicted in Figure 3 encloses the subunits, PSAs, D&D facilities and SE areas that are subject to restriction because contamination has been left in place. In addition, the LUC boundary encloses the contaminant concentrations in local groundwater that exceed MCLs. All areas of MCL exceedance are enclosed by the RAOU LUC boundary, which also provides a buffer zone around the exceedances. Preparation of a survey plat will be deferred until the site is transferred to non-federal ownership. If the survey plat for the area subject to LUCs is prepared at the time the land is transferred, the description of the groundwater area under restrictive covenant will be more current and accurate. The deferred survey plat will be appended to this LUCIP when it is completed.

4.4 Site Use Program

Under DOE Order 430.1A, *Life Cycle Management* (USDOE 1998), SRS is required to implement an asset management program for the use, maintenance, and disposal of physical assets, including real estate. SRS complies with this order through its Site Use Program, which is conducted in accordance with SRS Manual 1D, *Site Infrastructure and Services Manual*, Procedure 3.02, "Site Real Property Configuration Control" (SRS 2006). All employees, contractors, and visitors at SRS are required to adhere to the Site Use Program. No use of land (i.e., excavation or any other land use) shall be undertaken without prior approval documented by a Site Use Permit. Also, in accordance with SRS Manual 1D, Procedure 3.02, all work at SRS that adds to or modifies features or facilities portrayed on SRS development maps (i.e., plot

plans of facilities/utilities at SRS) will be authorized by a Site Clearance Permit before any activities are conducted. All Site Clearance Requests will be reviewed to verify that either an approved Site Use Permit has been obtained or that the request is sanctioned by an existing Site Use Permit. All land use requirements applicable for the OU will be provided to the Site Use Program for use in determining issuance of Site Clearance Permits. In addition, the Site Use Permit must be amended when the geographic configuration or buffer zone used to establish the permit boundary changes or permitted land use changes.

SRS is responsible for updating, maintaining, and reviewing site maps, including FFA (FFA 1993) OU identifications. If a Site Clearance Request potentially impacts an FFA OU, the Site Clearance Request Form is sent to the appropriate FFA OU reviewer for approval. The roles and responsibilities of each individual are detailed in SRS Manual 1D, *Site Infrastructure and Services Manual*, Procedure 3.02, "Site Real Property Configuration Control" (SRS 2006). Before a Site Clearance Permit is issued, verification of USDOE approval for intended land use must be obtained. The site use and site clearance processes are applicable to all activities and personnel on site (including subcontractors). USDOE will notify USEPA and SCDHEC in advance of any change to any internal procedure, including the Site Use Program, which would affect implementing or maintaining the LUCs. The processes are controlled within the SRS Quality Assurance Program in accordance with SRS 1Q Manual, *Quality Assurance* (SRS 2010). The SRS Quality Assurance Program governs all SRS activities.

SRS identifies all buildings and facilities on maps used in the Site Use Program. This waste unit is identified on these maps as a CERCLA facility. The RAOU LUC boundaries are shown in Figure 3.

Any work proposed in these areas will be strictly controlled, and workers will be trained and briefed about health and safety requirements if work is deemed necessary for maintenance or groundwater or surface water. No change in land use at the RAOU shall be undertaken without USEPA and SCDHEC approval. Proposed excavation activities within the RAOU LUC boundary must be approved by the RAOU facility custodian. Approval by USEPA and SCDHEC is required for any modification or termination of the LUCs and implementation

actions, and USDOE must obtain prior approval from USEPA and SCDHEC before taking any anticipated action that may disrupt the effectiveness of the LUCs or alter or negate the need for LUCs.

4.5 Physical Access Controls

Site-specific physical access controls are required at the RAOU. Specifically, manholes and the sewer connections to those manholes will be grouted in accordance with the RSER/EE/CA (SRNS 2009c). In addition, the entry doors will be sealed to prevent access to the RBC. SRS-wide physical access controls are provided at the SRS boundary as mentioned in Table 2, item 5.

4.6 Warning Signs

To prevent unknowing entry and to ensure that unrestricted use of the waste unit does not occur while the unit is under ownership of the government, access control warning signs will be posted at the unit as shown in Appendix B. Warning signs will not be installed around the groundwater plume because the depth to the contaminated groundwater is a sufficient barrier to prevent exposure. The signs shall be legible for a distance of at least 7.6 m (25 ft). Custodial responsibilities for maintenance and inspection of the RAOU will be maintained by the SRS Post-Closure Maintenance Group. Warning signs will be installed by December 30, 2011 as part of the RAOU construction. The signs will be placed at approximate locations indicated in Figure 3. The final placement of the signage will be documented in the Post-Construction Report.

4.7 Other Access Controls and Security/Surveillance Measures

While under the ownership of USDOE, access control of the entire SRS will be maintained in accordance with the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1. This section describes the 24-hour surveillance system (R.61-79.264.14(b)(1)), artificial or natural barriers (R.61-79.264.14(b)(2)(I)), control entry systems (R.61-79.264.14(b)(2)(ii)), and access control warning signs (R.61-79.264.14(c)) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility.

4.8 Field Inspection and Maintenance for Land Use Controls

After remediation of the RAOU, inspection, monitoring, and maintenance activities will be required as part of the RA. The RAOU will be inspected annually per the example Field Inspection Checklist (Appendix C) and will include:

- The roof structure of the 105-R RBC to ensure that it is functioning properly. Herbicides will be applied to the 105-R RBC roof structure as necessary to prevent the growth of woody vegetation on the roof structure.
- The doors into the 105-R RBC to ensure that they remain sealed.
- The Disassembly Basin cover to ensure that excessive deterioration has not occurred and that no woody vegetation is growing on the cover.
- The R-Ash Basin cover to verify that significant erosion has not occurred (60.9 cm [2 ft] thickness maintained), to ensure that no woody vegetation is growing on the cover, and to ensure that no burrowing or mounding animals are present.
- The RAOU to ensure no unauthorized excavations, digging, or construction activities within the LUC boundaries have occurred.
- Posted signs.

Additional inspections may be necessary in the event of unusual weather or any other condition warranting inspection. Inspection records will be kept in the operations record file for future access.

Groundwater monitoring will be conducted to ensure that the ISD remedy is performing as expected and that no contaminant migration constituents of concern have impacted groundwater. Groundwater and surface water monitoring will also be conducted as part of the MNA remedy of

the tritium and VOC plumes. The details of these monitoring efforts are described in the MNA Effectiveness Monitoring Plan for the RAGW Subunit (SRNS 2010b).

Maintenance (including site inspections, general housekeeping, and repair of erosion damage) will be performed as needed at RAOU. Annual inspections will ensure that access control signs are in place. Maintenance activities will be documented and maintained in files subject to USEPA and SCDHEC review and audit. A copy of the completed inspection form is maintained in the SRS Document Control Center. 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.

The waste unit inspectors are to be trained in Hazardous Waste Operations and Emergency Response, RCRA Well Inspections (ACP-specific training), RCRA Waste Unit Inspections, Radiological Worker Training, etc., as applicable for the specific inspection. They will also be trained based on the individual requirements of the regulatory-approved closure documents for each OU. In addition, the inspectors are to attend yearly refresher courses. Over the years, different personnel may conduct the inspections and maintenance activities.

Any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs will be addressed by the USDOE as soon as practicable. In no case will the process be initiated later than 10 days after USDOE becomes aware of the breach. USDOE will notify USEPA and SCDHEC as soon as practicable but no later than 10 days after discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. The USDOE will notify USEPA and SCDHEC regarding how the USDOE has addressed or will address the breach within 10 days of sending USEPA and SCDHEC notification of the breach. The FFA Annual Progress Report, submitted to the regulatory agencies by USDOE, will provide the status of the LUCs and describe how any LUC deficiencies or inconsistent uses have been addressed. In the event of property transfer or lease, the Annual Report will cite findings on the following: whether the use restrictions and controls referenced above were communicated in the deed(s) or lease restrictions; whether property use conforms with the deed or lease restrictions

and controls; and whether the owners and state/local agencies have been notified regarding the deed or lease restrictions and controls. The FFA Annual Progress Report(s) will be used in the preparation of the Five-Year Remedy Review Report.

This unit-specific LUCIP, including the checklist (Appendix C), will be appended to the SRS LUCAP upon final regulatory approval. After completion of the Post-Construction Report, the preliminary checklist in the LUCAP will be replaced with the final approved checklist.

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5.0 REFERENCES

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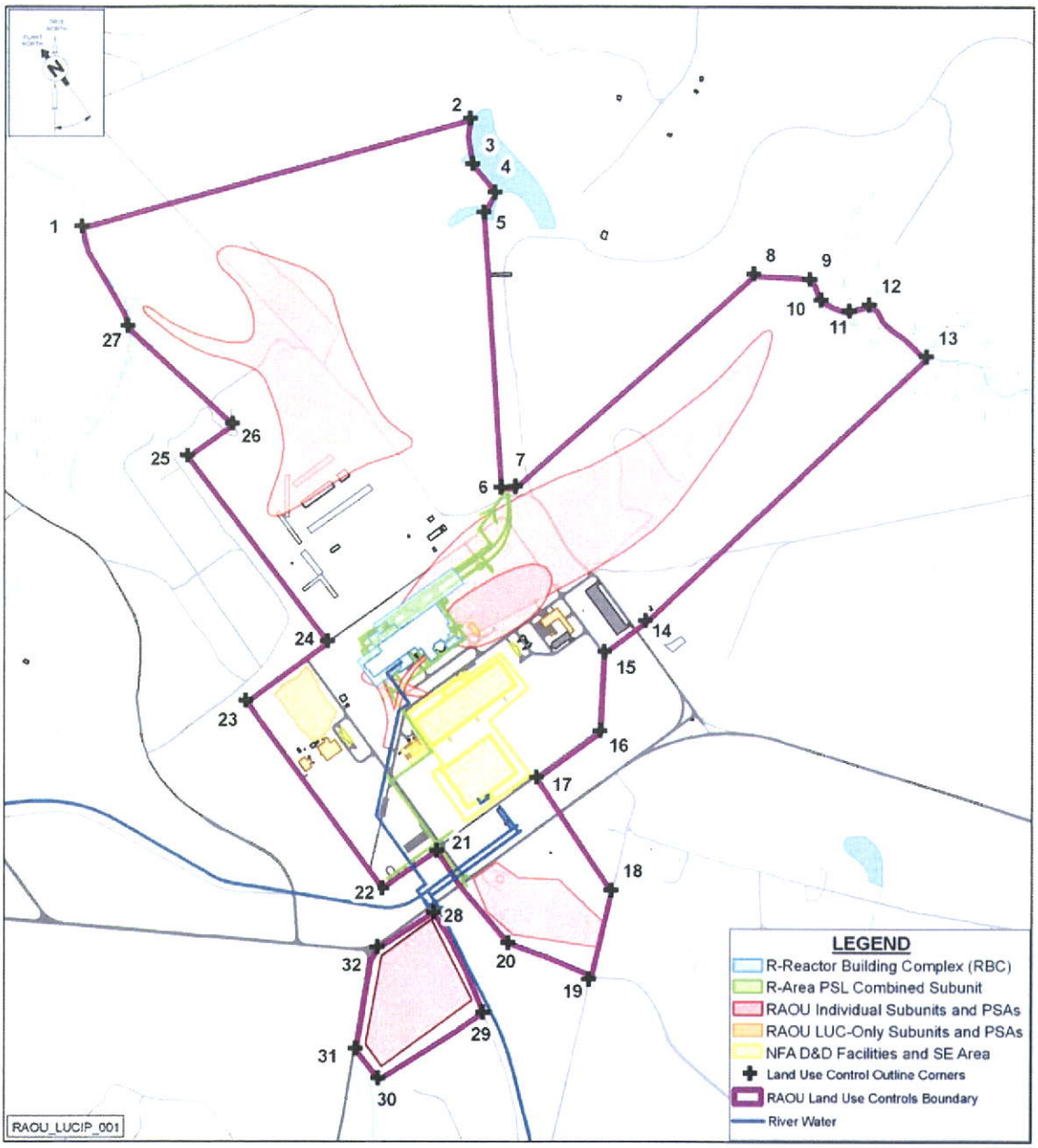
APPENDIX A

LAND USE CONTROL BOUNDARY WITH COORDINATES



RAOU Land Use Controls (LUCs) Boundary Vertices for Coordinate Identification

Projection: Universal Transverse Mercator
Datum: North American Datum 1927
Zone: 17

To place on the North American Datum 1983, move the projection line 15 meters south and 15 meters west

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RAOU Land Use Control Boundary Coordinates

LUC Boundary Corner Number*	SRS E	SRS N	UTM E 27	UTM N 27	LONG 27	LAT 27
1	74965.9200	61086.1200	445240.5910	3682642.1210	-81.5881	33.2832
2	77899.7700	59986.9100	446160.4580	3682897.4570	-81.5782	33.2855
3	77707.4200	59688.2400	446166.6330	3682789.3860	-81.5781	33.2845
4	77715.6800	59411.1800	446218.3530	3682722.6140	-81.5776	33.2839
5	77556.6700	59332.6500	446193.2650	3682674.7540	-81.5778	33.2835
6	76406.7500	57522.6900	446234.5640	3682022.6610	-81.5773	33.2776
7	76501.6200	57461.4600	446268.9150	3682024.5910	-81.5770	33.2777
8	78976.2000	57706.3900	446834.5980	3682528.6930	-81.5709	33.2822
9	79306.8600	57416.5400	446968.0330	3682516.5890	-81.5695	33.2821
10	79285.3400	57234.5300	446995.3720	3682467.8910	-81.5692	33.2817
11	79413.3700	57036.4300	447062.4370	3682442.0480	-81.5685	33.2815
12	79565.5300	56984.6200	447109.2120	3682456.5720	-81.5680	33.2816
13	79687.4600	56398.2000	447244.4110	3682333.9740	-81.5665	33.2805
14	76704.6500	56016.2600	446578.0990	3681704.9810	-81.5736	33.2748
15	76303.3400	56007.7100	446480.7700	3681630.9060	-81.5747	33.2741
16	75919.6800	55532.6000	446471.4570	3681445.0630	-81.5748	33.2724
17	75307.8300	55532.4900	446320.7500	3681335.3130	-81.5764	33.2714
18	75260.4700	54478.3300	446498.1270	3681067.1310	-81.5745	33.2690
19	74710.8300	54018.3600	446445.2100	3680855.2520	-81.5750	33.2671
20	74368.7500	54618.5500	446253.3090	3680941.7610	-81.5771	33.2679
21	74342.6800	55528.6000	446083.6860	3681161.2740	-81.5789	33.2699
22	73827.3000	55542.4100	445954.2480	3681072.2540	-81.5803	33.2690
23	73828.7400	57340.2400	445632.1970	3681515.4000	-81.5838	33.2730
24	74610.0900	57340.6800	445824.6020	3681655.6290	-81.5817	33.2743
25	74583.6400	59152.1400	445493.2370	3682097.1330	-81.5853	33.2783
26	75012.5900	59151.0600	445599.1010	3682173.7930	-81.5842	33.2790
27	74800.4500	60247.9400	445350.1390	3682405.9620	-81.5869	33.2810
28	74041.4700	55151.7400	446077.0670	3681014.4190	-81.5790	33.2685
29	73893.2900	54293.4200	446194.4850	3680776.4020	-81.5777	33.2664
30	72934.1600	54361.2700	445946.0390	3680621.1160	-81.5804	33.2650
31	72926.8500	54650.7000	445892.3360	3680691.1040	-81.5809	33.2656
32	73529.5100	55191.7600	445943.7710	3680932.4680	-81.5804	33.2678

*See map titled "RAOU Land Use Controls (LUCs) Boundary Vertices, Appendix A of RAOU LUCIP for loction of corners

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APPENDIX B

TYPICAL ACCESS CONTROL WARNING SIGN

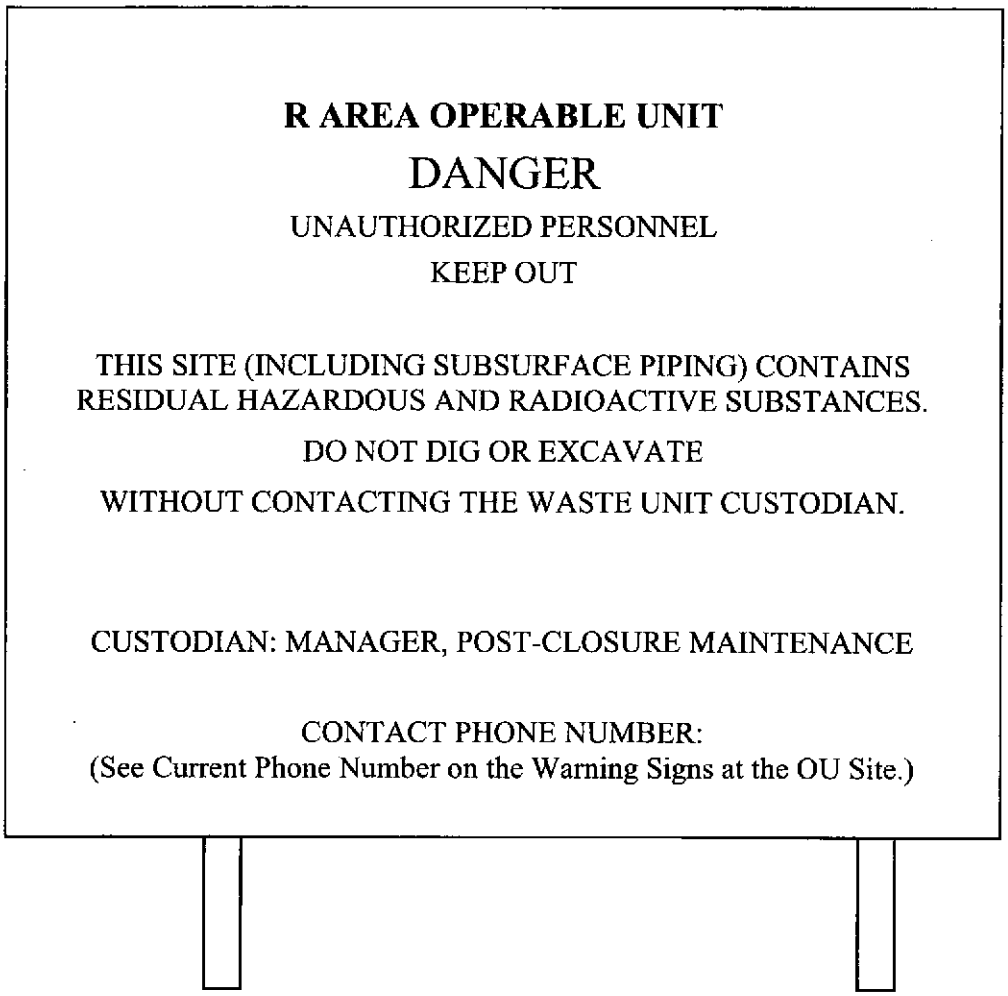

Figure B-1. Typical Access Control Warning Sign

APPENDIX C

RAOU FIELD INSPECTION CHECKLIST

FIELD INSPECTION CHECKLIST

☐ **SCHEDULED** ☐ **UNSCHEDULED**

A= Satisfactory X= Unsatisfactory (Explanation required)	**A or X**	**Observation of Corrective Action Taken**
1. Verify that roads are accessible.		
2. Verify that the waste unit signs are in acceptable condition, have the correct information, and are legible from a distance of 25 feet (ft).		
3. Verify that roof structure of 105-R Reactor Building Complex is free of woody vegetation.		
4. Verify that doors to 105-R Reactor Building Complex are sealed.		
5. Verify that excessive deterioration of the disassembly basin cover has not occurred and that the disassembly basin cover is free of woody vegetation.		
6. Verify that no woody vegetation is growing on the R Ash Basin soil cover. Remove or identify as needed.		
7. Verify that the R Ash Basin soil cover has no signs of unacceptable erosion (subsidence).		
8. Verify that signs of burrowing or mounding animals are not present at the R Ash Basin soil cover.		
9. Verify that there are no unauthorized excavations, digging, or construction activities within the LUC boundaries at RAOU.		

Inspected by:		
(Print Name)	(Signature)	(Date)

Post-Closure Manager:		
(Print Name)	(Signature)	(Date)

CAUTION: The inspector shall notify the Post-Closure Manager and Environmental Compliance Authority **IMMEDIATELY** if there has been a breach or compromise of the land use controls of this waste unit. The notification shall be in accordance with SRS post-closure inspection procedures.