

United States Department of Energy

Savannah River Site

**Record of Decision
Remedial Alternative Selection for the
K-Area Sludge Land Application Site (761-4G) and
Par Pond Sludge Land Application Site (761-5G) (U)**

CERCLIS Numbers: 105 and 108

WSRC-RP-2005-4064

Revision 1

March 2006

**Prepared by:
Washington Savannah River Company LLC
Savannah River Site
Aiken, SC 29808**

The logo for the Savannah River Site (SRS) features the letters "SRS" in a bold, sans-serif font. The letters are white and are set against a dark, circular background that resembles a stylized arc or a partial circle.

Prepared for U.S. Department of Energy under Contract No. DE-AC09-96SR18500

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**Prepared for
U.S. Department of Energy
and
Washington Savannah River Company LLC
Aiken, South Carolina**

**RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)**

K-Area Sludge Land Application Site (761-4G)

and the

Par Pond Sludge Land Application Site (761-5G) (U)

CERCLIS Numbers: 105 and 108

WSRC-RP-2005-4064

Revision 1

March 2006

**Savannah River Site
Aiken, South Carolina**

Prepared by:

Washington Savannah River Company LLC

for the

U. S. Department of Energy under Contract DE-AC09-96SR18500

Savannah River Operations Office

Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

K-Area Sludge Land Application Site (761-4G) and
Par Pond Sludge Land Application Site (761-5G)

Comprehensive Environmental Response, Compensation, and Liability Information
System (CERCLIS) Identification Number: OU- CERCLIS numbers 105 and 108

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy

The K-Area Sludge Land Application Site (761-4G) (KSLAU) and Par Pond Sludge Land Application Site (761-5G) (PSLAU) Operable Units (OUs) are listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

The FFA is a legally binding agreement between regulatory agencies [United States Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC)] and regulated entities [United States Department of Energy (USDOE)] that establishes the responsibilities and schedules for the comprehensive remediation of SRS. The media associated with this operable unit are surface soils and groundwater.

Statement of Basis and Purpose

This decision document presents the selected remedy for the KSLAU and PSLAU, located in Barnwell County, South Carolina in SRS, which was chosen in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act

(SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this site.

USEPA, SCDHEC and USDOE concur with the selected remedy.

Assessment of the Site

There has been no release at the KSLAU or PSLAU into the environment. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

The selected remedy for the KSLAU and PSLAU is No Action. The sites pose no risk to human health and the environment based on unrestricted (residential) land use; therefore, no land use controls or other remedies are required. There are no human health, ecological or contaminant migration refined constituents of concern (RCOCs), and no principal threat source material (PTSM). The KSLAU and PSLAU are capable of supporting unrestricted (residential) use without any remedial actions.

Statutory Determinations

Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a five-year remedy review will not be required for this remedial action.

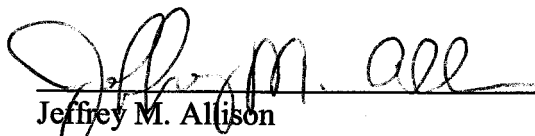
Hazardous substances, pollutants, or contaminants may have been released at the site; however, their concentrations do not pose a risk to human health and the environment based on unrestricted (residential) usage and unlimited exposure. Therefore, no remedial action is necessary to ensure protection of human health and the environment. Because the selected remedy for the KSLAU and PSLAU is No Action, a Certification Checklist is unnecessary.

ROD for the KSLAU and PSLAU (U)
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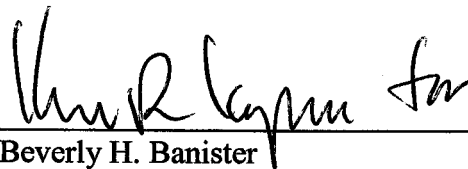
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Jeffrey M. Allison
Manager
U. S. Department of Energy
Savannah River Operations Office

4/26/06

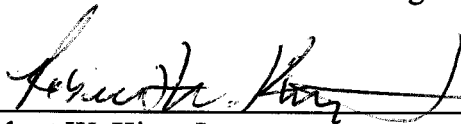
Date



Beverly H. Banister
Acting Director
Waste Management Division
U. S. Environmental Protection Agency - Region 4

6/6/06

Date



Robert W. King, Jr.
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

K-Area Sludge Land Application Site (761-4G)
and the
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CERCLIS Numbers: 105 and 108

WSRC-RP-2005-4064
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Savannah River Site
Aiken, South Carolina

Prepared By:

Washington Savannah River Company LLC
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U. S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cm	centimeter
CMCOC	contaminant migration constituent of concern
COC	constituent of concern
COPC	Constituent of Potential Concern
CS	Central Shops
CSM	conceptual site model
DQO	data quality objective
FFA	Federal Facility Agreement
HQ	hazard quotient
IOU	Integrator Operable Unit
KSLAU	K-Area Sludge Land Application Site Operable Unit
LLC	Limited Liability Company
m	Meter
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NPL	National Priorities List
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyls
PRG	preliminary remediation goal
PSLAU	Par Pond Sludge Land Application Site Operable Unit
PTSM	principal threat source material
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RG	remedial goal
RI	Remedial Investigation
ROD	Record of Decision

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SARA	Superfund Amendments Reauthorization Act
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
TAL	target analyte list
TBC	to-be considered
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substance Control Act
USC	unit-specific constituent
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOA	volatile organic analyte
VZCOMML	vadose zone contamination migration multi-layer model
WSRC	Washington Savannah River Company, LLC

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

Unit Name, Location, and Brief Description

K-Area Sludge Land Application Site (761-4G) and
Par Pond Sludge Land Application Site (761-5G)

Comprehensive Environmental Response, Compensation, and Liability
Information System (CERCLIS) Identification Numbers: OU- 105 and 108

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy (USDOE)

Savannah River Site (SRS) occupies approximately 310 square miles (800 square kilometers) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 25 miles (40 kilometers) southeast of Augusta, Georgia, and 20 miles (32 kilometers) south of Aiken, South Carolina.

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

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the K-Area Sludge Land Application Site (761-4G) and Par Pond Sludge Land Application Site (761-5G) Operable Units (OU) (KSLAU and PSLAU) as Resource Conservation and Recovery Act Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) units requiring further evaluation.

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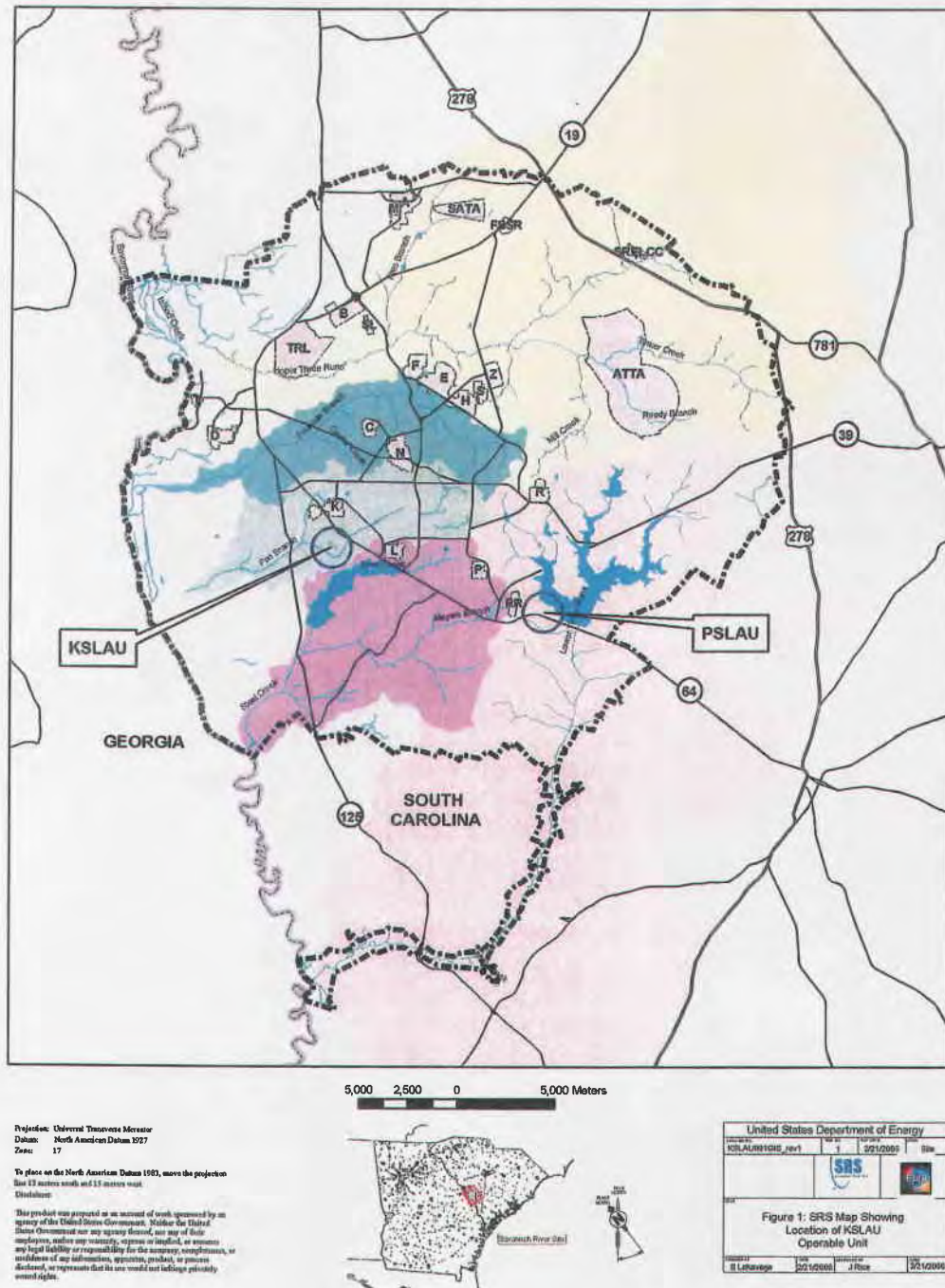


Figure 1. Location of the KSLAU and PSLAU within the Savannah River Site

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The KSLAU and PSLAU were evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational and Compliance History

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

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

KSLAU Operational and Compliance History

KSLAU is located in the central portion of SRS, near K Area and south of Road B. It was originally a borrow pit of about 17 acres (7 hectares) (Figure 2) and was

reclaimed beginning in 1980. In that year, about 300,000 gallons (1,100,000 liters) of liquid sludge from the Augusta (Georgia) Wastewater Treatment Plant was applied to the unit (WSRC 1991a). Sludge was injected 5 to 8 inches (13 to 20 cm) below the surface. In 1981, loblolly pines and hardwood trees were planted on the unit. In 1988, about 210 tons of sanitary sewage sludge from the Central Shops (CS) Sewage Sludge Lagoon was spread over the surface of 14 acres (6 hectares) of the unit (WSRC 2005a).

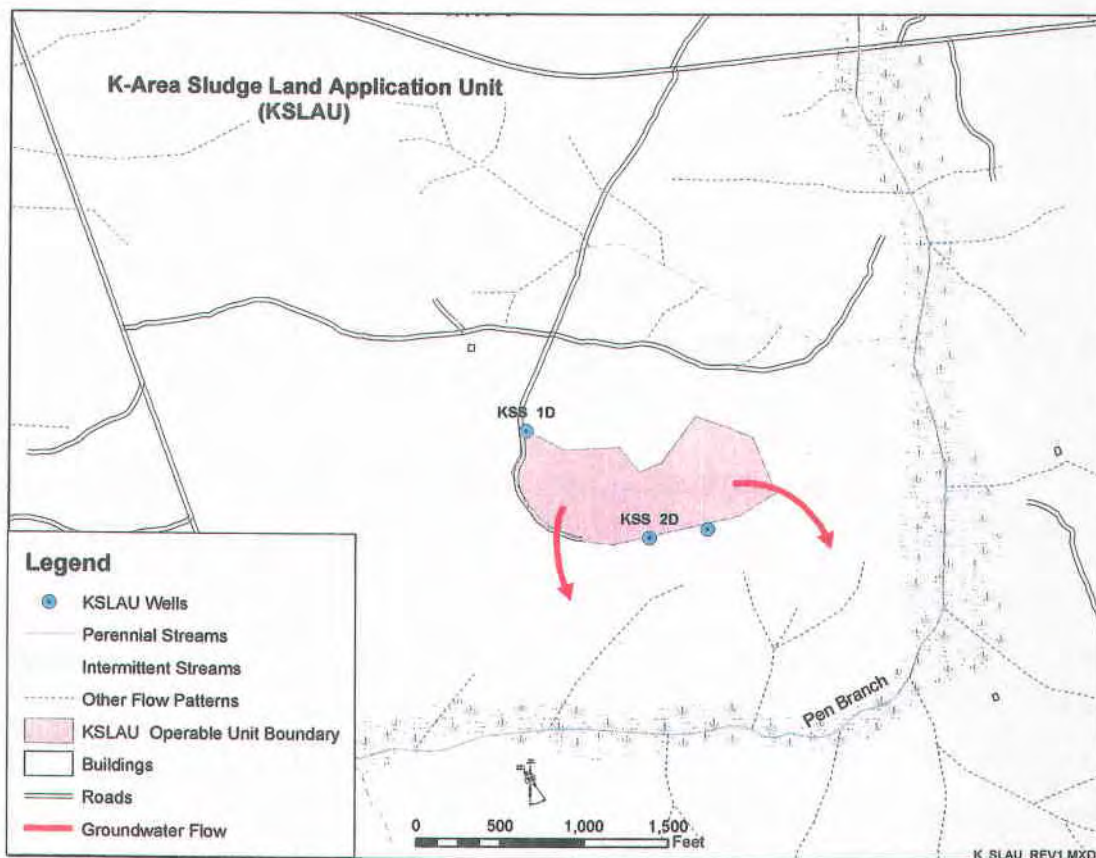


Figure 2. Layout of the KSLAU

Sludge and underlying soil samples were taken at the CS Sewage Sludge Lagoon prior to the sludge removal and sample results were not reported until after the sludge had been applied at the KSLAU. The analytical results indicated the presence of chlordane, a hazardous pesticide used in termite control. The results also indicated the presence of certain metals, including silver, cadmium, nickel, and lead, at higher concentrations in the sludge material than in the sampled underlying soils. The source of the chlordane in the sludge material has not been determined (WSRC 1991a). Subsequently, the KSLAU was included on Appendix C of the FFA.

KSLAU is a mixture of pine forest and open land. The land surface within the KSLAU slopes gently to the southeast; ground elevations range from a high of 230 ft (70 m) at the northwest corner to 190 ft (58 m) at the southeast corner. The water table is about 20 to 60 ft (6 to 18 m) below the surface, and groundwater flow is toward the south or southeast in the direction of Pen Branch. The groundwater is not a source of drinking water.

PSLAU Operational and Compliance History

PSLAU is located in the eastern portion of SRS, between Road B and Par Pond. It was originally a borrow pit of about 31 acres (13 hectares) (Figure 3) and was reclaimed beginning in 1980. In that year, about 300,000 gallons (1,100,000 liters) of liquid sludge from the Augusta (Georgia) Wastewater Treatment Plant was applied to the unit (WSRC 1991b). Sludge was injected 5 to 8 inches (13 to 20 cm) below the surface. In 1981, loblolly pines and hardwood trees were planted on the unit. In 1988, 340 tons of sanitary sewage sludge from the CS Sewage Sludge Lagoon was spread over the surface of 22 acres (9 hectares) of the unit (WSRC 2005a).

Sludge and underlying soil samples were taken at the CS Sewage Sludge Lagoon prior to the sludge removal and sample results were not reported until after the

sludge had been applied at the PSLAU. The analytical results indicated the presence of chlordane, a hazardous pesticide used in termite control. The results also indicated the presence of certain metals, including silver, cadmium, nickel, and lead, at higher concentrations in the sludge material than in the sampled underlying soils. The source of the chlordane in the sludge material has not been determined (WSRC 1991a). Subsequently, the PSLAU was included on Appendix C of the FFA.

PSLAU is a mixture of pine forest and open land. The land surface within the PSLAU is rather flat; ground elevations range from a high of 230 ft (70 m) at the southern boundary to 210 ft (64 m) at the northwest corner. The water table is about 20 to 40 ft (6 to 12 m) below the surface, and groundwater flow is toward the southeast. The groundwater is not a source of drinking water.

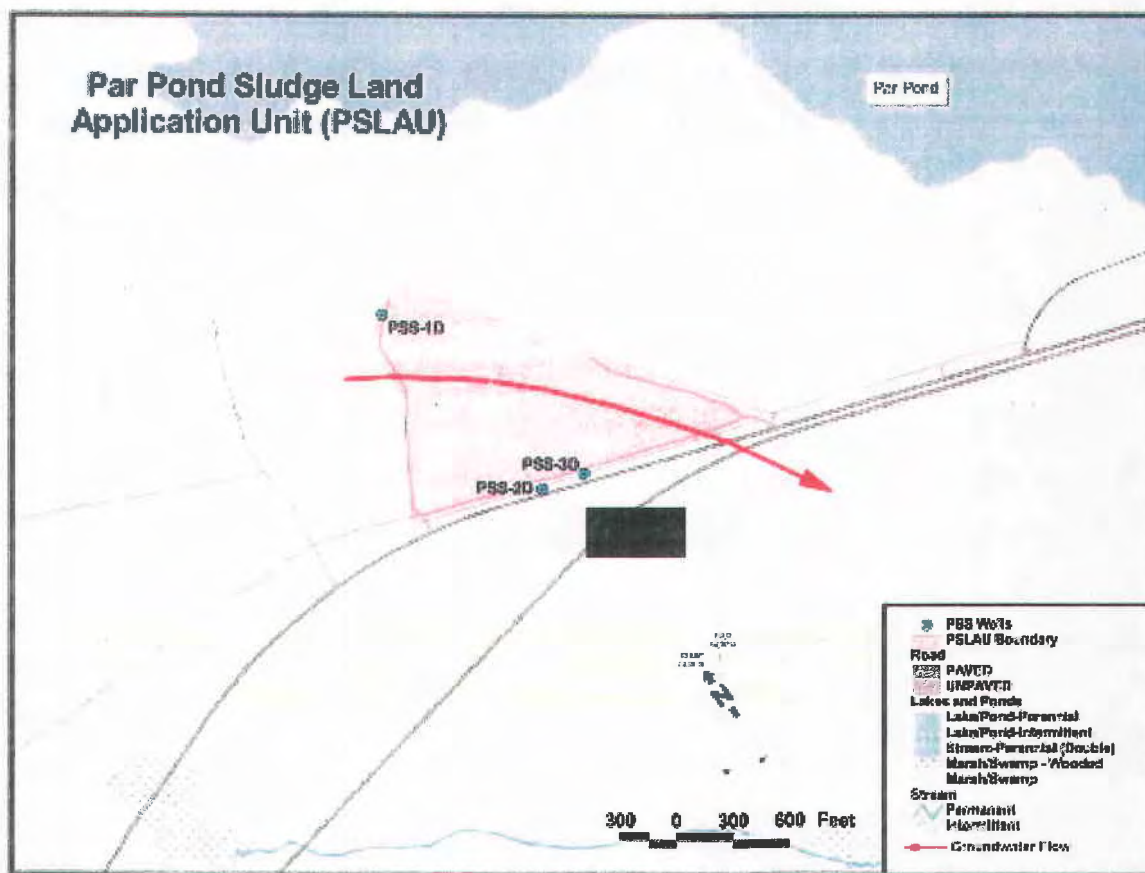


Figure 3. Layout of the PSLAU

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

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

The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the K-Area Sludge Land Application Site (761-4G) and Par Pond Sludge Land Application Site (761-5G)*, a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the KSLAU and PSLAU.

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

US Department of Energy	Thomas Cooper Library
Public Reading Room	Government Documents Department
Gregg-Graniteville Library	University of South Carolina
University of South Carolina – Aiken	Columbia, South Carolina 29208
171 University Parkway	(803) 777-4866
Aiken, South Carolina 29801	
(803) 641-3465	

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

The South Carolina Department of	SCDHEC Region 5
Health and Environmental Control	Aiken Environmental Quality Control
Bureau of Land and Waste	Office
Management	206 Beaufort Street, Northeast
8911 Farrow Road	Aiken, South Carolina 29801
Columbia, South Carolina 29203	(803) 641-7670
(803) 896-4000	

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

The SB/PP 45-day public comment period began on December 5, 2005 and ended on January 19, 2006. No comments were received during the public comment period. Because no comments were received, a Responsiveness Summary was not prepared.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT

Due to the complexity of multiple contaminant areas, the SRS is divided into integrator operable units (IOUs) for the purpose of managing a comprehensive

cleanup strategy. Waste units within an IOU are evaluated and remediated individually.

KSLAU is located within the Pen Branch IOU and PSLAU is located within the Lower Three Runs IOU. Upon disposition of all operable units within the Pen Branch IOU and Lower Three Runs IOU, a final comprehensive ROD for each IOU will be pursued with additional public involvement.

Soils

The KSLAU and PSLAU pose no risk to human health or the environment under an unrestricted use scenario. No refined constituents of concern (RCOCs) have been identified for human health or ecological receptors at the KSLAU and PSLAU.

Groundwater

The groundwater beneath the KSLAU and PSLAU poses no risk to human health or the environment under an unrestricted scenario. Results of the contaminant migration analysis indicate that groundwater has not been impacted by these OUs.

Since no RCOCs are associated with the KSLAU and PSLAU, a No Action remedy is recommended for these units. This means no action will be taken at the KSLAU and PSLAU, and these units will remain in their present condition.

V. OPERABLE UNIT CHARACTERISTICS

Characterization of KSLAU

Characterization of the KSLAU soil and groundwater took place between June 2003 and October 2004 (WSRC 2003a, 2003b).

Soil Characterization

Sixty-three locations were sampled at the KSLAU (Figure 4). All soil samples were analyzed for Appendix IX acids, base/neutrals, cyanide, metals, pesticides, and volatile organic analytes (VOAs). Samples from fifty-three locations were analyzed for gross alpha, nonvolatile beta, gamma spectroscopy, and tritium. Additionally, 16 soil samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOAs, and 18 samples were analyzed for TCLP metals and TCLP pesticides.

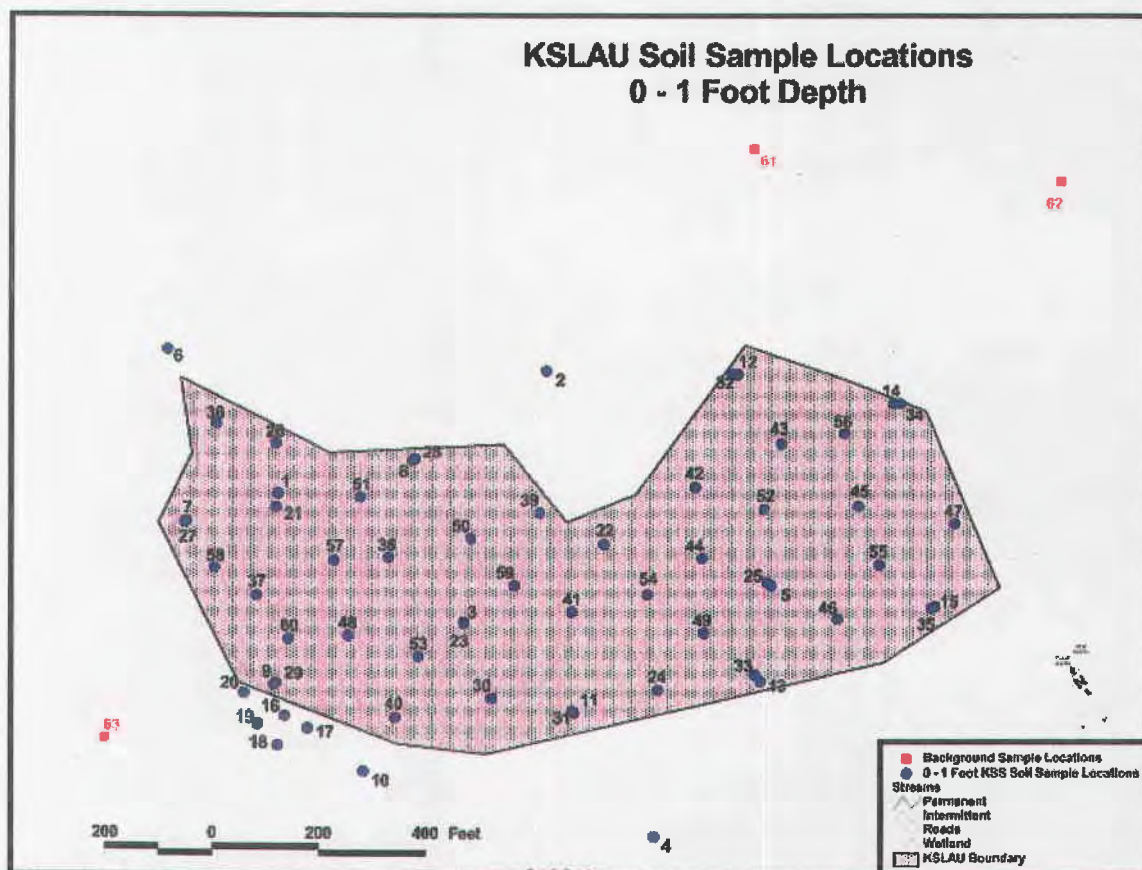


Figure 4. KSLAU Soil Sample Locations

Groundwater Characterization

Three groundwater monitoring wells were installed at KSLAU in 1988: KSS 1D, KSS 2D, and KSS 3D (Figure 2). Each is screened in the Upper Three Runs aquifer, which is an unconfined aquifer. KSS 1D is an upgradient well screened at 51 to 71 ft deep (16 to 22 m). KSS 2D and KSS 3D are downgradient wells screened at 26 to 46 ft (8 to 14 m) and 24 to 44 ft (7 to 13 m) deep, respectively.

All three wells were sampled six times between June 2003 and October 2004. The samples were analyzed for Appendix IX acids, base/neutrals, cyanide, metals, pesticides, VOAs, gross alpha, nonvolatile beta, gamma spectroscopy, and tritium.

KSLAU Site Specific Factors

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

KSLAU Characterization Conclusions

Inorganics, semi-volatiles, volatiles, and pesticides/PCBs were identified as unit-specific contaminants (USCs) in soil for KSLAU and carried forward for further evaluation.

No USCs were identified in groundwater for KSLAU.

Characterization of PSLAU

Characterization of the PSLAU soil and groundwater took place between September 2003 and December 2004 (WSRC 2003c).

Soil Characterization

Fifty-three locations were sampled at the PSLAU (Figure 5). Samples from 20 locations were analyzed for Appendix IX acids, base/neutrals, cyanide, metals, pesticides, and VOAs. Samples from the remaining 33 locations were analyzed for target compound list (TCL) volatiles, semivolatiles, pesticides, and target analyte list (TAL) metals and cyanide. Samples from 23 locations were analyzed for gross alpha, nonvolatile beta, gamma spectroscopy, and tritium. Additionally, 10 soil samples were analyzed for TCLP VOAs, TCLP metals, and TCLP pesticides.

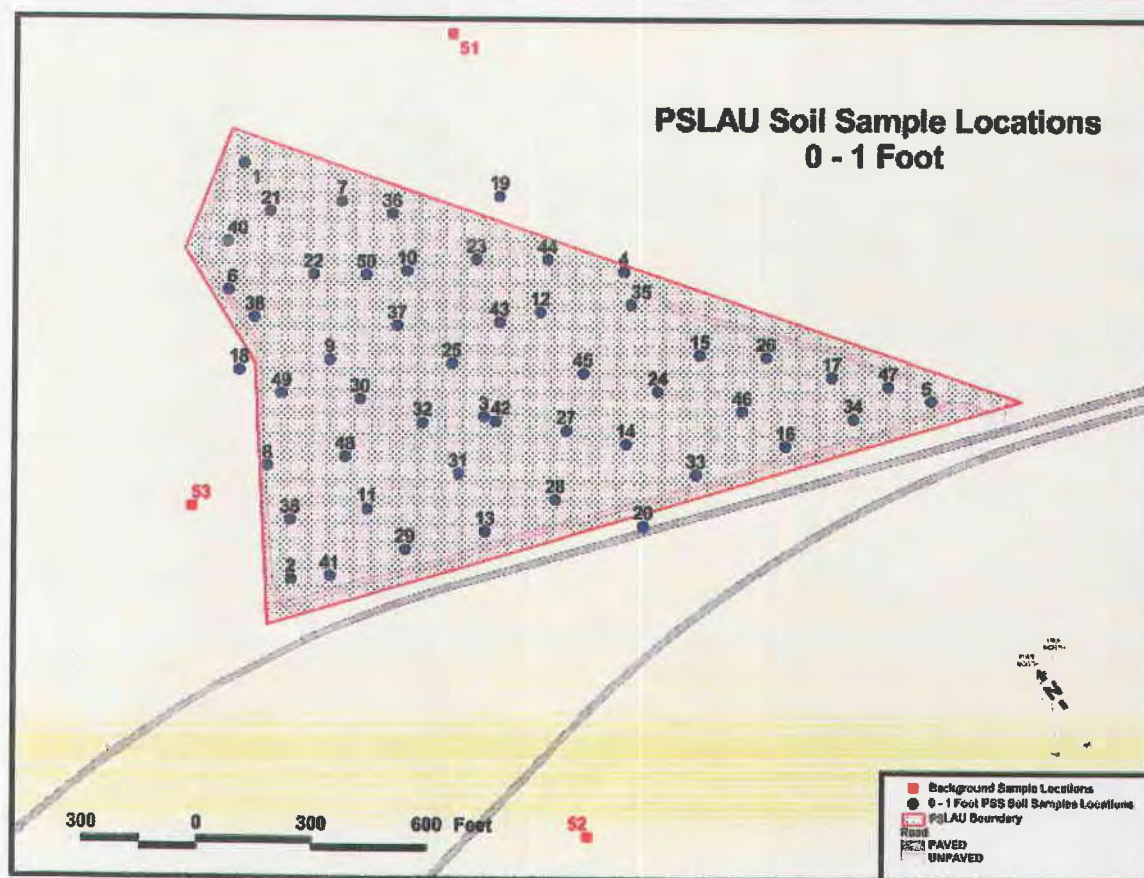


Figure 5. PSLAU Soil Sample Locations

Groundwater Characterization

Three groundwater monitoring wells were installed at PSLAU in 1988: PSS 1D, PSS 2D, and PSS 3D (Figure 3). Each is screened in the Upper Three Runs aquifer, which is an unconfined aquifer. PSS 1D is an upgradient well and is screened at 15 to 35 ft (5 to 11 m) deep. PSS 2D and PSS 3D are downgradient wells and are screened at 30 to 50 ft (9 to 15 m) and 33 to 53 ft (10 to 16 m) deep, respectively.

All three wells were sampled three times between May and December 2004; samples were analyzed for TCL volatiles, semivolatiles, pesticides, TAL metals and cyanide, gross alpha, nonvolatile beta, gamma spectroscopy, and tritium.

PSLAU Site Specific Factors

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

PSLAU Characterization Conclusions

Inorganics, semi-volatiles, volatiles, and pesticides/PCBs were identified as USCs in soil for PSLAU and carried forward for further evaluation.

No USCs were identified in groundwater for PSLAU.

Conceptual Site Model

This section presents the conceptual site model (CSM) for KSLAU and PSLAU. A CSM identifies known and suspected sources of contamination, types of contaminants and potentially affected media, known and potential routes of migration, known and potential human and ecological receptors. The CSM provides an objective framework around which existing information can be

designed to address critical data needs identified in accordance with the data quality objectives (DQOs).

The primary contamination source material is known for both KSLAU and PSLAU. It consists of liquid sludge from the Augusta (Georgia) Wastewater Treatment Plant and sanitary sewage sludge from the CS Sewage Lagoon. Sludge from both sources was analyzed and found to be contaminated with chlordane and to have possibly elevated levels of metals, including arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, and silver. Sludge was applied at 5 to 8 in (13 to 20 cm) depth in 1980 and to the ground surface in 1988 at both waste units. The surface (0 to 1 ft, or 0 to 0.3 m), subsurface (1 to 4 ft, or 0.3 to 1.2 m), and deep soils (deeper than 4 ft, or 1.2 m) are secondary sources of contamination.

Secondary releases mechanisms for KSLAU and PSLAU include direct contact with soil, release of volatile constituents (volatilization), generation of fugitive dust, biotic uptake, and contaminant leaching to groundwater.

Contact with contaminated environmental media creates exposure pathways for both human and ecological receptors. Potential exposure media for KSLAU and PSLAU include surface and subsurface soil, ambient air (vapors and particulates), biota, and groundwater. Potential exposure routes include inhalation of volatile emissions and particulates, ingestion of contaminated media, dermal contact with contaminated media and external radiation from radiological constituents. Potential human receptors include current on-unit workers, future industrial workers, and future residents. Potential ecological receptors include terrestrial receptors such as soil invertebrates, herbivorous mammals, insectivorous mammals, omnivorous mammals, insectivorous birds, and carnivorous birds. The CSM for KSLAU is provided in Figure 6. The CSM for PSLAU is in Figure 7.

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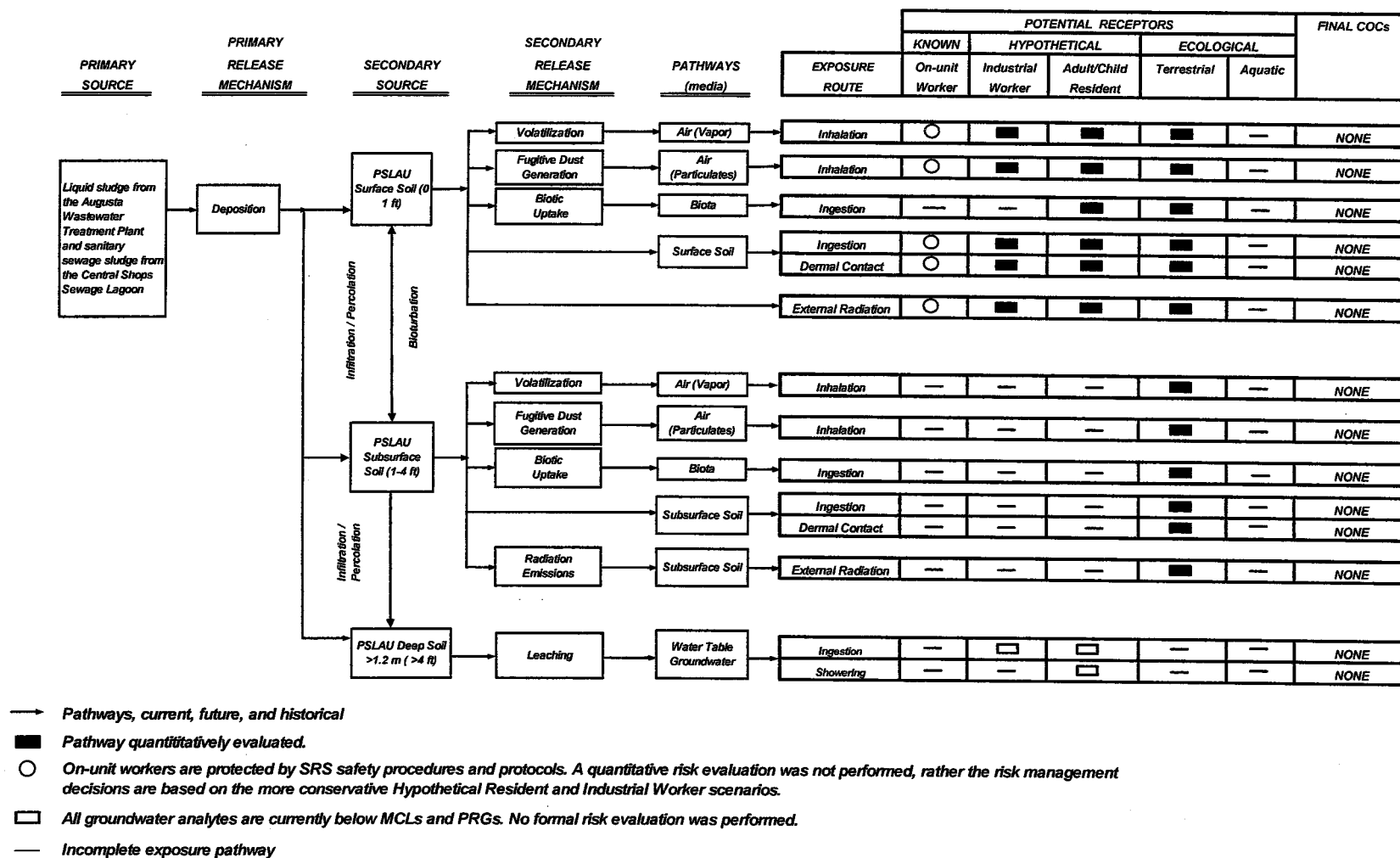


Figure 7. Conceptual Site Model for the PSLAU

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VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

Current Land Use

Currently, the KSLAU and PSLAU are inactive waste units. The KSLAU is located near K-Area and the PSLAU is located near Par Pond. Access to SRS is controlled by USDOE, and access to the KSLAU and PSLAU is restricted within the SRS boundaries.

The potential receptor for exposure to constituents associated with the KSLAU and PSLAU is the current on-unit worker who comes to the area on an infrequent or occasional basis. On-unit workers are defined as SRS employees who work at or near the vicinity of the waste units under current land use conditions. An on-unit worker may be a researcher, environmental sampler, or other SRS personnel who work in close proximity to the units.

Future Land Use

According to the *Savannah River Site Future Use Project Report, Stakeholder Recommendations for SRS Land and Facilities* (USDOE 1996), residential uses of SRS land should be prohibited. The SRS FFA Implementation Plan (WSRC 1996) designates the preferred land use for the KSLAU and PSLAU as industrial. The potential receptor for exposure to constituents associated with the KSLAU and PSLAU is the future industrial worker.

Groundwater Uses/Surface Water Uses

Groundwater beneath the KSLAU and PSLAU is not used for any type of human consumption. The groundwater that flows beneath the KSLAU is discharged to

the Pen Branch watershed. The groundwater that flows beneath the PSLAU is discharged to the Lower Three Runs watershed.

There are no distinct surface water features on the unit and no drainage or surface runoff features that indicated that the surface runoff is being used for irrigation or any other beneficial uses.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment

As a component of the RFI/Remedial Investigation (RI) process, a baseline risk assessment (BRA) was performed to evaluate risks associated with the KSLAU and PSLAU. The BRA estimates what risks the site poses if no action were taken. It provides the bases for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The BRA includes human health and ecological risk assessments. This section of the ROD summarizes the results of the BRA for this OU.

The purpose of the human health and ecological risk evaluation is to assess the potential for adverse effects associated with exposure to constituents present at the KSLAU and PSLAU. The evaluation estimates the risk potential in the absence of institutional controls or remedial actions at this site and provides a basis for determining whether or not remedial action is necessary.

A summary of the constituent of concern (COC) identification process is provided in Tables 1 and 2; the results of the risk evaluation are summarized in the following paragraphs.

Table 1. Summary of Constituent of Concern Selection for the K-Area Sludge Land Application Unit (All Depths)

Analyte	USC	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
		(None)	(None)	(None)	(None)				(None)	(None)
<i>Inorganics</i>										
Antimony	x							x		
Arsenic	x					x	x			
Barium	x									
Beryllium	x									
Cadmium	x							x		
Chromium	x							x		
Cobalt	x									
Copper	x									
Cyanide	x									
Lead	x							x		
Mercury	x									
Nickel	x									
Selenium	x							x		
Silver	x							x		
Thallium	x					x		x		
Tin	x									
Vanadium	x					x		x		
Zinc	x							x		

Table 1. Summary of Constituent of Concern Selection for the K-Area Sludge Land Application Unit (All Depths)
(Continued)

Analyte	USC	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
Semivolatiles										
2-Chlorophenol	x							x		
2-Nitrophenol	x									
Acenaphthene	x							x		
Benzo(k)fluoranthene	x							x		
Benzo(a)pyrene	x							x		
Bis(2-ethylhexyl) phthalate	x									
Chrysene	x							x		
Di-n-octyl phthalate	x									
Fluoranthene	x							x		
Fluorene	x							x		
Naphthalene	x							x		
Phenanthrene	x							x		
Pyrene	x							x		
Volatiles										
Acetone	x									
Benzene	x									
1,2-Dichlorobenzene	x									
Ethylbenzene	x									

Table 1. Summary of Constituent of Concern Selection for the K-Area Sludge Land Application Unit (All Depths)

(Continued)

Analyte	USC	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
Volatiles										
Methyl ethyl ketone	x									
Toluene	x									
1,2,3-Trichloropropane	x							x		
Pesticides/PCBs										
delta-Benzene hexachloride	x									
alpha-Chlordane	x									
gamma-Chlordane	x									
p,p'-DDD	x									
p,p'-DDE	x									
p,p'-DDT	x									
Dieldrin	x							x		
Endosulfan II	x									
Endosulfan sulfate	x									
Endrin aldehyde	x									
Heptachlor epoxide	x									
Methoxychlor	x									

Table 2. Summary of Constituent of Concern Selection for the PAR Pond Sludge Land Application Unit (All Depths)

Analyte	USC?	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
		(None)	(None)	(None)	(None)				(None)	(None)
<i>Inorganics</i>										
Aluminum	x							x		
Antimony	x									
Arsenic	x					x	x	x		
Barium	x							x		
Beryllium	x							x		
Calcium	x									
Chromium	x							x		
Cobalt	x									
Copper	x									
Cyanide	x							x		
Iron	x					x		x		
Lead	x							x		
Magnesium										
Manganese	x					x		x		
Mercury	x									

Table 2. Summary of Constituent of Concern Selection for the PAR Pond Sludge Land Application Unit (All Depths)

(Continued)

Analyte	USC?	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
<i>Inorganics</i>										
Nickel	x									
Potassium										
Selenium	x							x		
Silver	x									
Sodium	x									
Tin	x									
Vanadium	x					x		x		
Zinc	x							x		
<i>Semivolatiles</i>										
Pentachlorophenol	x							x		
Benzo(b)fluoranthene	x							x		
Bis(2-ethylhexyl) phthalate	x									
Butyl benzyl phthalate	x									
Di-n-octyl phthalate	x									
Fluoranthene	x							x		
Phenanthrene	x							x		
Pyrene	x							x		

Table 2. Summary of Constituent of Concern Selection for the PAR Pond Sludge Land Application Unit (All Depths)
(Continued)

Analyte	USC?	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
<i>Volatiles</i>										
Acetone	x									
Carbon disulfide	x									
Dichloromethane (Methylene chloride)	x									
Ethylbenzene	x									
Methyl acetate	x							x		
Methyl ethyl ketone	x									
Styrene	x									
Toluene	x									
Xylenes (total)	x									

Table 2. Summary of Constituent of Concern Selection for the PAR Pond Sludge Land Application Unit (All Depths)
(Continued)

Analyte	USC?	ARAR COC	PTSM COC	Contaminant Migration		Human Health		Ecological		Refined COC
				COPC	COC	COPC	COC	COPC	COC	
<i>Pesticides/PCBs</i>										
alpha-Chlordane	x									
gamma-Chlordane	x									
p,p'-DDD	x									
p,p'-DDE	x									
p,p'-DDT	x									
Dieldrin	x							x		
Endosulfan II	x									
Endosulfan sulfate	x									
Endrin aldehyde	x							x		
Endrin ketone	x									
Heptachlor	x									
Heptachlor epoxide	x							x		
gamma-Benzene hexachloride (Lindane)	x							x		
Toxaphene	x							x		

Summary of Human Health Risk Assessment

Based on the conceptual site models (Figures 6 and 7), the potential receptors for exposure at KSLAU and PSLAU include the current on-unit worker, the future industrial worker, and the future resident. The current on-unit worker is protected by SRS safety procedures and protocols and the risk was not quantitatively assessed; however, the exposure scenarios for the future industrial worker and the future resident allow a conservative estimate of site risk to address risk management decision requirements. KSLAU and PSLAU are in locations where both the current and future land use designation is industrial. The human health risk assessment evaluated both the industrial worker and unrestricted (residential) scenarios. The residential scenario was evaluated since it is the most conservative approach for the risk assessment.

Human Health Risk – KSLAU

Arsenic, thallium, and vanadium were identified as constituents of potential concern (COPCs) for KSLAU. However, following the quantitative risk evaluation, arsenic is the only constituent identified as a COC for the future resident (risk estimate = 5.6×10^{-6}) and the future industrial worker (risk estimate = 1.4×10^{-6}) scenarios. The risk estimates are based on a ratio of the exposure point concentration with the USEPA Region 9 Preliminary Remediation Goal (PRG).

Following an uncertainty analysis, arsenic was not recommended for further remedial evaluation because (1) it is naturally occurring at SRS; (2) unit concentrations are comparable to unit-specific background concentrations; (3) the unit data are not elevated relative to SRS background; and (4) risk is likely overestimated due to conservative risk factors based on drinking water exposure that are extrapolated to exposure via soil ingestion.

With the elimination of arsenic, no constituents were identified as human health refined COCs (RCOCs) that would require further remedial evaluation for the future resident or future industrial worker scenarios at the KSLAU. The details of the KSLAU human health risk assessment is provided in the RFI/RI with BRA (WSRC 2005a).

Human Health Risk – PSLAU

Arsenic, iron, manganese, and vanadium were identified as COPCs for PSLAU. However, following the quantitative risk evaluation, arsenic is the only constituent identified as a COC for the future resident (risk estimate = 4.7×10^{-6}) and the future industrial worker (risk estimate = 1.2×10^{-6}) scenarios. The risk estimates are based on a ratio of the exposure point concentration with the USEPA Region 9 PRG.

Following an uncertainty analysis, arsenic was not recommended for further remedial evaluation because (1) it is naturally occurring at SRS; (2) unit concentrations are comparable to unit-specific background concentrations; (3) the unit data are not elevated relative to SRS background; and (4) risk is likely overestimated due to conservative risk factors based on drinking water exposure that are extrapolated to exposure via soil ingestion.

With the elimination of arsenic, no constituents were identified as human health RCOCs that would require further remedial evaluation for the future resident or future industrial worker scenarios at the PSLAU. The details of the PSLAU human health risk assessment is provided in the RFI/RI with BRA (WSRC 2005a).

Summary of Ecological Risk Assessment

Ecological Risk – KSLAU

Initial ecological screening identified the following constituents as COPCs at the KSLAU based on hazard quotients (HQs) greater than one.

- Inorganics: arsenic, cadmium, chromium, lead, selenium, silver, thallium, vanadium, and zinc
- Polynuclear aromatic hydrocarbons (PAHs): 2-chlorophenol, acenaphthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene
- Volatile organics: 1,2, 3 – trichloropropane
- Pesticides: Dieldrin

However, after applying additional lines of evidence to the evaluation of these COPCs, no constituents were ultimately identified as ecological RCOCs. The refinement process considers the range and magnitude of HQs, the frequency and patterns of detection, a comparison to site background, and professional judgment. The details of the KSLAU ecological risk assessment is provided in the RFI/RI with BRA (WSRC 2005a).

Ecological Risk – PSLAU

Initial screening identified the following constituents as ecological COPCs at the PSLAU based on HQs greater than one.

- Inorganics: aluminum, arsenic, beryllium, barium, chromium, cyanide, iron, lead, manganese, selenium, vanadium, and zinc

- PAHs: pentachlorophenol, benzo(b)fluoranthene, fluoranthene, phenanthrene, and pyrene
- Pesticides: dieledrin, lindane, toxaphene, heptachlor epoxide and endrin aldehyde
- Volatile organics: methyl acetate

However, after applying additional lines of evidence to the evaluation of these COPCs, no constituents were ultimately identified as ecological RCOCs. The refinement process considers the range and magnitude of HQs, the frequency and patterns of detection, a comparison to site background, and professional judgment. The details of the PSLAU ecological risk assessment is provided in the RFI/RI with BRA (WSRC 2005a).

Summary of Contaminant Fate and Transport Analysis

A vadose zone contamination migration multi-layer model (VZCOMML[®]) (Rucker 1999, 2004) was used to evaluate whether analytes qualify as contaminant migration constituents of concern (CMCOCs). The model simulates leaching and migration of constituents downward through the vadose zone to the groundwater and determines the value of two parameters: (1) whether the conservative future constituent groundwater concentration will exceed an MCL or preliminary remediation goal (PRG), and (2) whether the mean analyte travel time to groundwater is less than 1,000 years. If both conditions apply, then the analyte is considered a CMCOC.

KSLAU

Application of the VZCOMML[®] model shows that there are no CMCOCs at KSLAU based on a 1,000-year transport evaluation time. The details of the

KSLAU contaminant migration analysis is provided in the RFI/RI with BRA (WSRC 2005a).

PSLAU

Application of the VZCOMML[®] model shows that there are no CMCOCs at PSLAU based on a 1,000-year transport evaluation time. The details of the PSLAU contaminant migration analysis is provided in the RFI/RI with BRA (WSRC 2005a).

ARAR Constituents of Concern

All analytical results were compared to applicable or relevant and appropriate requirements (ARARs) and information to-be-considered (TBC). If the concentration of any detected constituent exceeded a chemical-specific ARAR or TBC, that constituent was considered an ARAR COC.

KSLAU

For soil, chemical-specific ARARs or TBCs exist under federal and state regulations for polychlorinated biphenyls (PCBs) and lead. PCBs were not detected in the KSLAU soils; therefore, the ARAR for PCBs is not applicable. For lead in soil, the RCRA/CERCLA screening value of 400 mg/kg was set by the USEPA Office of Solid Waste Emergency Response and adopted as a TBC for the screening process (USEPA 1994). The maximum concentration of lead observed in the KSLAU soils is 19.3 mg/kg and does not exceed the TBC concentration. There are no ARAR COCs for the KSLAU soils.

As of the October 2004 groundwater sampling, all analytes were below groundwater ARARs. There are no ARAR COCs for the KSLAU groundwater.

PSLAU

PCBs were not detected in the PSLAU soils; therefore, the ARAR for PCBs is not applicable. The maximum concentration of lead observed in the PSLAU soils is 15.9 mg/kg and does not exceed the TBC concentration (400 mg/kg). There are no ARAR COCs for the PSLAU soils.

As of the December 2004 groundwater sampling, all analytes were below groundwater ARARs. There are no ARAR COCs for the PSLAU groundwater.

Principal Threat Source Material Evaluation

Principal threat source material (PTSM) is material that has high toxicity or mobility and cannot be reliably contained or presents significant risk to human health or the environment (USEPA 1991). Source material qualifies as PTSM for toxicity if USC concentrations exceed any one of the following criteria:

- Total risk from carcinogens greater than 1×10^{-3} (USEPA 1991)
- Cumulative noncarcinogen HQ greater than 100
- Maximum soil lead concentration above 4,000 mg/kg (10 times USEPA action level)
- Maximum soil PCB concentration above 50 mg/kg [Toxic Substance Control Act (TSCA) threshold for regulating PCB waste]
- Source material qualifies as PTSM for mobility if CMCOCs are predicted to travel to groundwater within 10 years and result in groundwater concentrations that exceed MCLs or PRGs.

PTSM Evaluation of KSLAU

Based on the results of the toxicity screen and the mobility screen, the KSLAU does not contain PTSM.

PTSM Evaluation of PSLAU

Based on the results of the toxicity screen and the mobility screen, it is concluded that PSLAU does not contain PTSM.

Conclusion

There are no hazardous substances, pollutants, or contaminants from the KSLAU and PSLAU that would present a current or potential future threat to public health, welfare, or the environment.

- There are no human health RCOCs in soil or groundwater.
- There are no ecological RCOCs in soil.
- There are no contaminant migration RCOCs in soil.
- There are no ARAR or PTSM RCOCs in soil or groundwater.

The KSLAU and PSLAU do not pose an unacceptable risk to human health and the environment based on unrestricted (residential) land use; therefore, no land use controls or other remedies are required.

VIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy selected in this ROD does not contain any significant changes from the preferred alternative presented in the Statement of Basis/Proposed Plan (WSRC 2005b).

IX. RESPONSIVENESS SUMMARY

No comments were received during the public comment period.

X. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

No remedial action will be performed at the KSLAU and PSLAU; therefore, a schedule for post-ROD cleanup activities is not provided.

XI. REFERENCES

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WSRC, 2005b. *Statement of Basis/Proposed Plan for the K-Area Sludge Land Application Site (761-4G) (KSLAU) and the Par Pond Sludge Land Application Site (761-5G) (PSLAU) (U)*, WSRC-RP-2005-4032, Rev. 0, October, Savannah River Site, Aiken, SC.

APPENDIX A -
RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the K-Area Sludge Land Application Site Operable Unit (761-4G) and Par Pond Sludge Land Application Site Operable Unit (761-5G) began on December 5, 2005 and ended on January 19, 2006.

Public Comments

No comments were received from the public.