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United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit (U)

WSRC-RP-2001-4197

Revision 1.3

April 2003

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

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

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U.S. Department of Energy
and
Westinghouse Savannah River Company LLC
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

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WSRC-RP-2001-4197
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Savannah River Site
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Westinghouse Savannah River Company LLC
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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU-30

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 A-Area Miscellaneous Rubble Pile (ARP) (731-6A) Operable Unit (OU) is 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) (FFA 1993) 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 following media are associated with this OU: soil and groundwater. The results of the soil and groundwater investigation indicate that the contaminated soil has not contributed to groundwater contamination adjacent to or beneath the ARP OU. Groundwater beneath this unit has been impacted by SRS operations not associated with this unit. The groundwater contamination is being addressed under the RCRA corrective action program for A/M Area.

Statement of Basis and Purpose

This decision document presents the selected remedy for the ARP OU at SRS in Aiken, South Carolina. The remedy was chosen in accordance with CERCLA, as amended by the Superfund

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

The State of South Carolina concurs with the selected remedy.

Assessment of the Site

The response action selected in this Record of Decision (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

Based on the ARP OU characterization results, the ARP OU has been subdivided into three subunits: the Piles Area, the Ash Area, and the Trenches Area. The ARP OU future land use will be industrial. After implementation of the Piles subunit remedy, the Piles subunit will be available for unrestricted land use and no land use controls will be required. After implementation of the Ash and Trenches subunit remedy, levels of soil contamination remaining in these subunits will make unrestricted use of these areas unsafe, and Land Use Controls are included in the remedy selected for these subunits for the purpose of 1) prohibiting residential use of the areas, and 2) limiting the activities of future industrial users there. However, the groundwater beneath the ARP OU has been impacted by SRS operations not associated with the unit. The groundwater contamination is being addressed under the RCRA corrective action program for A/M Area. The selected alternatives for the ARP OU are described in the following paragraphs:

Piles Area

The selected alternative for the Piles Area subunit is Alternative 3, Removal and Disposal of Lead Hot Spot and Polychlorinated Biphenyl/Polycyclic Aromatic Hydrocarbon (PCB/PAH) Waste Pile. The selected remedy for this subunit entails the following:

- Excavate the lead hot spot soil [1.5 m^3 (2 $yd^{3)}$] and remove the PCB/PAH waste pile, [7.6 m^3 (10 yd^3)].

- Remove the excavated soil and transport it from SRS to a permitted offsite disposal facility.

- Backfill the excavated spots with clean soil from an SRS borrow pit.

- Grade the clean soil to match the surrounding topography and cover the backfilled spots with vegetative cover to minimize erosion.

The PCB/PAH waste pile was identified as principal threat source material (PTSM) due to the high toxicity of benzo(a)pyrene and because it occupies a significant volume. The lead hot spot is not PTSM because it was not considered a discernible source although lead concentrations are high. Because of this limited size 1.5 m^3 (approximately 2 yd^3), the lead hot spot area is identified as low-level threat source material (LLTSM).

Time to complete construction is estimated to be one month.

Excavation and removal of contaminated soil from the Piles Area will remove the PTSM (benzo(a)pyrene) from the ARP OU and protect future industrial workers or residents from exposure to refined constituents of concern (COCs) at the Piles Area (arsenic and lead at the lead hot spot; and aroclor-1254, and benzo(a)pyrene, and other PAHs at the PCB/PAH waste pile).

Ash Area

The selected alternative for the Ash Area subunit is Alternative 2, Institutional Controls. The selected remedy for this subunit entails the following:

- Providing access controls for on-site workers via the Site Use Program, Site Clearance Program, work controls, worker training, worker briefing of health and safety requirements and identification signs located at the waste unit boundaries.

- Notifying the USEPA and SCDHEC in advance of any changes in land use or excavation of waste.

- Providing access controls against trespassers as described in the 1992 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems and warning signs in place at the SRS boundary. There is no PTSM at the Ash Area. The source material in the Ash Area is considered LLTSM.

Time to complete construction is estimated to be one month.

Institutional controls implemented at the Ash Area will protect future industrial workers from exposure to surface soil containing arsenic (ingestion risk = 2 x 10^{-6}). The institutional controls will include deed restriction/notification and warning signs. The ARP OU is located in A Area at SRS. The United States Department of Energy (USDOE) currently controls access to SRS through fencing, security gates and badging requirements. SRS activities at any specific OU are controlled through the site use/site clearance program. The field conditions at the Ash Area will be evaluated to determine the effectiveness of the selected alternative and to identify whether further or additional remedial action is appropriate for this subunit during the 5-year remedy reviews.

Trenches Area

The selected alternative for the Trenches Area subunit is Alternative 3b, Active Soil Vapor Extraction (ASVE), Institutional Controls, and 1-foot Soil Cover. The selected remedy for this subunit entails the following:

- Cover the entire Trenches Area (approximately 7,711 m^2 [83,000 ft^2]) with a 1-foot soil cover.

- Install approximately 10 ASVE wells, connect ASVE wells to an existing soil vapor extraction unit (782-3M) that is adjacent to the unit, and operate (estimated remediation time

is 5 years) the system until the trichloroethylene (TCE) and tetrachloroethylene (PCE) are removed from the soil to the levels where they no longer pose a migration threat to the groundwater.

- Install warning signs and implement institutional controls to prohibit future residential land use and restrict access to the unit and activities at the unit by future industrial workers.

There is no PTSM at the Trenches Area. The source material in the Trenches Area is considered LLTSM.

Time to complete construction is estimated to be one year.

Operation of the ASVE at the Trenches Area will treat TCE and PCE and prevent TCE and PCE from leaching into the groundwater. Arsenic, PAHs including benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and benzo(a)pyrene have been identified as refined COCs for the future industrial workers exposed to surface soil. The 1-foot soil cover added prior to the installation and operation of the ASVE system will reduce the exposure of current remedial workers and future workers to surface contamination. The institutional controls specified above for the Ash Area will also be implemented for the Trenches Area in order to protect future industrial workers from exposure to refined COCs. Field conditions will be evaluated to determine the effectiveness of the selected remedy and to identify whether further or additional remedial action is appropriate for this subunit during the 5-year remedy reviews.

The results of the field investigations and soil samplings, conducted to completely characterize the ARP OU, show that the ARP OU has not impacted the groundwater. Soil samples collected in native soils beneath the contaminated ash in the trench were clean. This indicates that the PCE and TCE contamination in the trench has not migrated below the trench, which demonstrates that the ARP source unit has not contributed to the groundwater contamination in this area. The groundwater does not outcrop in the vicinity of the ARP OU.

The ARP is an OU located within the Upper Three Runs watershed. In addition to the ARP OU, there are many other OUs within the watershed. Under the overall site management strategy, all

the source control and groundwater OUs located within the watershed will be evaluated to determine their impacts, if any, on the associated streams and wetlands. SRS will manage all source control units to prevent impact to groundwater and the watershed. Upon disposition of all source control and groundwater OUs within the watershed, a final comprehensive ROD for the Upper Three Runs watershed will be pursued.

The vadose zone leachability modeling has identified only two contaminant migration constituents of concern (CMCOCs), TCE and PCE, at the Trenches Area only. These are being addressed in this ROD. The contaminated soils associated with the ARP OU are also being addressed in the ROD. Therefore, the ARP OU will not impact the response actions of other OUs at SRS.

The SCDHEC has modified the SRS RCRA permit to incorporate the above mentioned remedies.

Statutory Determinations

Based on the RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment (RFI/RI/BRA) for the ARP OU (WSRC 2000), the ARP OU poses unacceptable risk to human health and the environment, based on the presence of PTSM and predicted future groundwater impacts of TCE and PCE in fill material. Therefore, remedial actions as discussed in the *Description of the Selected Remedy*, have been identified as the selected remedies for the ARP OU.

Section 300.430 (f)(ii) of the NCP requires that a 5-year remedy review be performed if hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure remain in the OU. The three Parties, SCDHEC, USEPA, and USDOE, have determined that a 5-year remedy review for the ARP OU will be performed to ensure that the remedy continues to provide adequate protection of human health and the environment.

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions, are cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. These remedies also satisfy the statutory preference for treatment as a principal element.

Per the USEPA – Region IV Land Use Controls (LUCs) Policy, a LUC Assurance Plan (LUCAP) for SRS has been developed and approved by the regulators. In addition, a LUC Implementation Plan (LUCIP) for the ARP OU will be developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the LUC elements of the ARP OU selected alternatives to ensure that the remedies remain protective of human health and the environment.

In the long term, if the property is ever transferred to nonfederal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA Section 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility when contamination remains at the unit.

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

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

The selected remedies for the Ash and the Trenches subunits leave hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As negotiated with the USEPA, and in accordance with USEPA – Region IV Policy (*Assuring Land Use Controls of Federal Facilities*, April 21, 1998), SRS has developed a LUCAP to ensure that land use restrictions are maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide details and specific measures required for the LUCs selected as a part of the remedies. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as a part of this action, will be submitted concurrently with the Corrective Measures Implementation/Remedial Action Implementation Plan, as required in the FFA for review and approval by the USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect until modified as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

Data Certification Checklist

This is to certify that this ROD provides the following information:

- There is PTSM at this OU (see Section VII in the Decision Summary)
- COCs and their respective concentrations (see Section VII and Table 8 in the Decision Summary)
- Baseline risk represented by the COCs (see Section VII and Table 11 in the Decision Summary)
- Cleanup levels established for the COCs and the basis for the levels (see Section VIII and Table 12 in the Decision Summary)

- Current and future land and groundwater use assumptions used in the BRA and ROD (see Section VI in the Decision Summary)

- Land and groundwater use that will be available at the site as a result of the selected remedy (see Section XI in the Decision Summary)

- Estimated capital, operation and maintenance, and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected (see Section IX in the Decision Summary)

- Decision factor(s) that led to selecting the remedy (see Section X and Tables 14 through 16 in the Decision Summary)

- How source materials constituting principal threats are addressed (see Section XI in the Decision Summary)

6/18/03
Date

Jeffrey M. Allison
Manager
U. S. Department of Energy, Savannah River Operations Office

7/1/03
Date

Winston A. Smith
Director
Waste Management Division
U. S. Environmental Protection Agency - Region IV

7/21/03
Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit

WSRC-RP-2001-4197
Revision 1.3

April 2003

Savannah River Site
Aiken, South Carolina

Prepared By:

Westinghouse Savannah River Company LLC
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Savannah River Operations Office
Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
ARP	A-Area Miscellaneous Rubble Pile
ASVE	active soil vapor extraction
bls	below land surface
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CMI/RAIP	Corrective Measures Implementation/Remedial Action Implementation Plan
CMCOC	contaminant migration constituent of concern
CMCOPC	contaminant migration constituent of potential concern
CMS/FS	Corrective Measures Study/Feasibility Study
COC	constituent of concern
COPC	constituent of potential concern
CPT	cone penetrometer technology
CSM	conceptual site model
FFA	Federal Facility Agreement
ft	feet
gal	gallon
HHCOC	human health constituent of concern
HSWA	Hazardous and Solid Waste Amendments
in	inch
IRIS	Integrated Risk Information System, USEPA
km	kilometer
km^2	square kilometer
L	liter
lb	pound
LDR	Land Disposal Restriction
LLC	Limited Liability Company
LLTSM	low-level threat source material
LUC	Land Use Control
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

m	meter
m^2	square meter
m^3	cubic meter
MCL	maximum contaminant level
mg/kg	milligram/kilogram
mi	mile
mi^2	square mile
MSSB	Motor Shops Seepage Basin
msl	mean sea level
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	operating and maintenance
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pCi	picocurie
PCR	Post Construction Report
ppm	parts per million
PSVE	passive soil vapor extraction
PTSM	principal threat source material
RAO	remedial action objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
RME	reasonable maximum exposure
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
SRFS	Savannah River Forest Station
SVEU	soil vapor extraction unit
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
T&E	threatened and endangered
TAL	target analyte list
TBC	to-be-considered
TCE	trichloroethylene
TCL	target compound list
TSCA	Toxic Substance Control Act
µg/L	microgram per liter
USC	unit specific constituent
UCL	upper confidence limit
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC	Westinghouse Savannah River Company LLC
yd^3	cubic yards

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

Unit Name, Location, and Brief Description

A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 30

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 Savannah River Site (SRS) occupies approximately 800 km^2 (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina.

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

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the A-Area Miscellaneous Rubble Pile (731-6A) operable unit (ARP OU) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit requiring further evaluation. The ARP OU required further evaluation through an investigation process that integrates and combines the RCRA facility investigation (RFI) process with the CERCLA remedial investigation (RI) process to determine the actual or potential impact of releases of hazardous substances to human health and the environment.

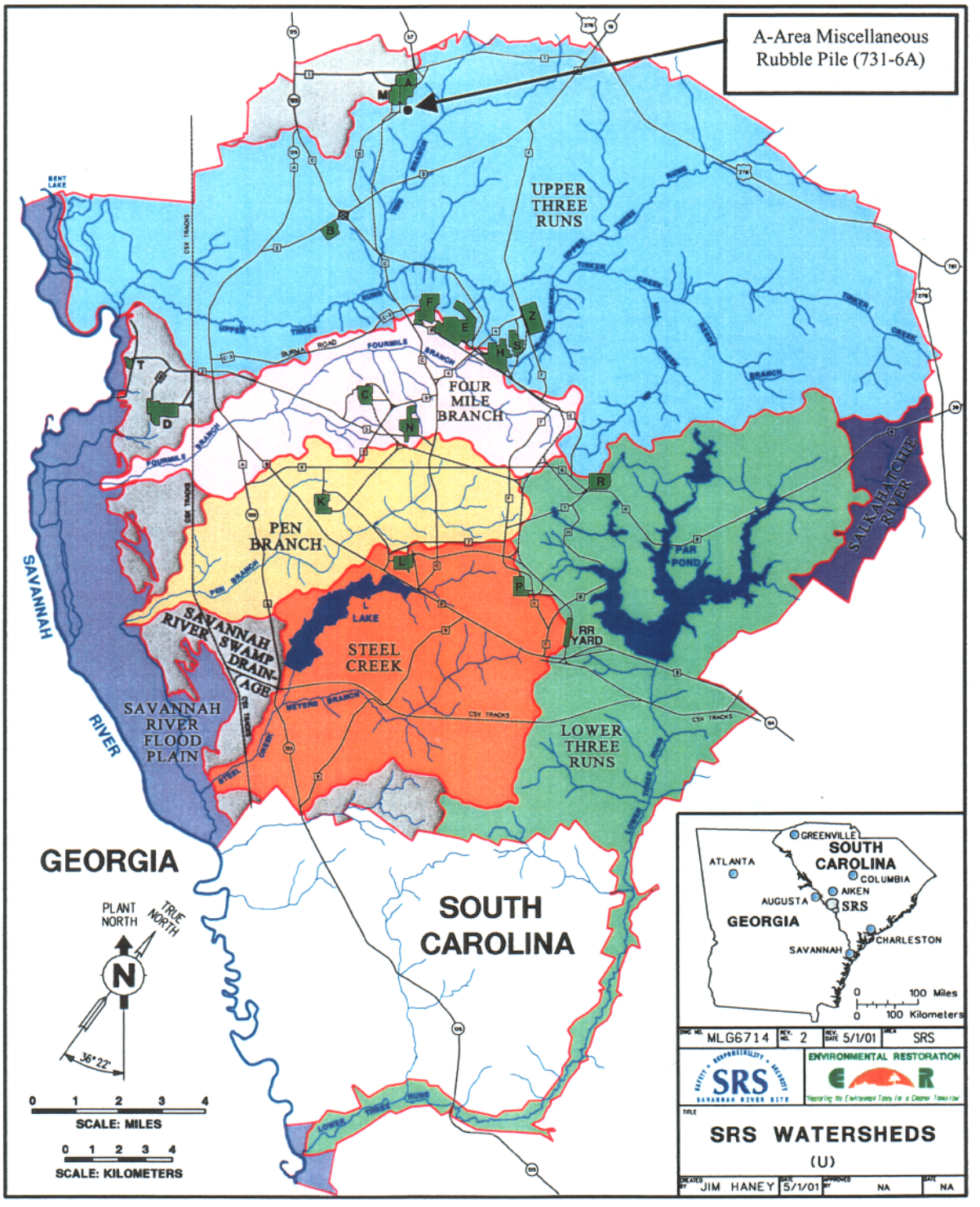


Figure 1. Location of the Savannah River Site and Major SRS Facilities

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

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on September 5, 1995. Module IV of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established 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 that fulfills these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA - Region IV and SCDHEC.

Operable Unit Operational and Compliance History

As shown on Figure 1, the ARP OU is located in SRS A Area in the northwestern part of SRS, approximately 1.8 km (1.1 mi) from the closest site boundary and located approximately 1.1 km (0.7 mi) south-southeast of the intersection of SRS Road 1-A and SRS Road D. A Area serves as a main administrative and research center for SRS, and the ARP OU is situated immediately east of M Area (Figure 2), which is an industrial center. These two areas are collectively referred to as the A/M Area. Figure 3 shows that about two-thirds of the unit is open forest with pine and hardwood trees. Other RCRA/CERCLA units in the vicinity of the ARP OU are the A-Area Coal Pile Runoff Basin and the 716-A Motor Shop Seepage Basin as shown in Figures 2 and 4, respectively.

Also as shown in Figure 4, the unit is bounded on the southwest and southeast by outfall drainages emanating from National Pollutant Discharge Elimination System (NPDES) Outfall A-014 and the former Outfall A-011, respectively. A gravel road bounds the unit to the north. Power lines cross the central and western portion of the unit. The area under the power lines is covered with grass, woody vines and small shrubs.

The adjacent 782-3M soil vapor extraction unit (SVEU) exists to remediate solvents released from the A-014 outfall as required by a RCRA Part B Permit (Figure 4).

The unit covers an area of approximately 5.9 acres. The ARP OU is a permanently inactive unit.

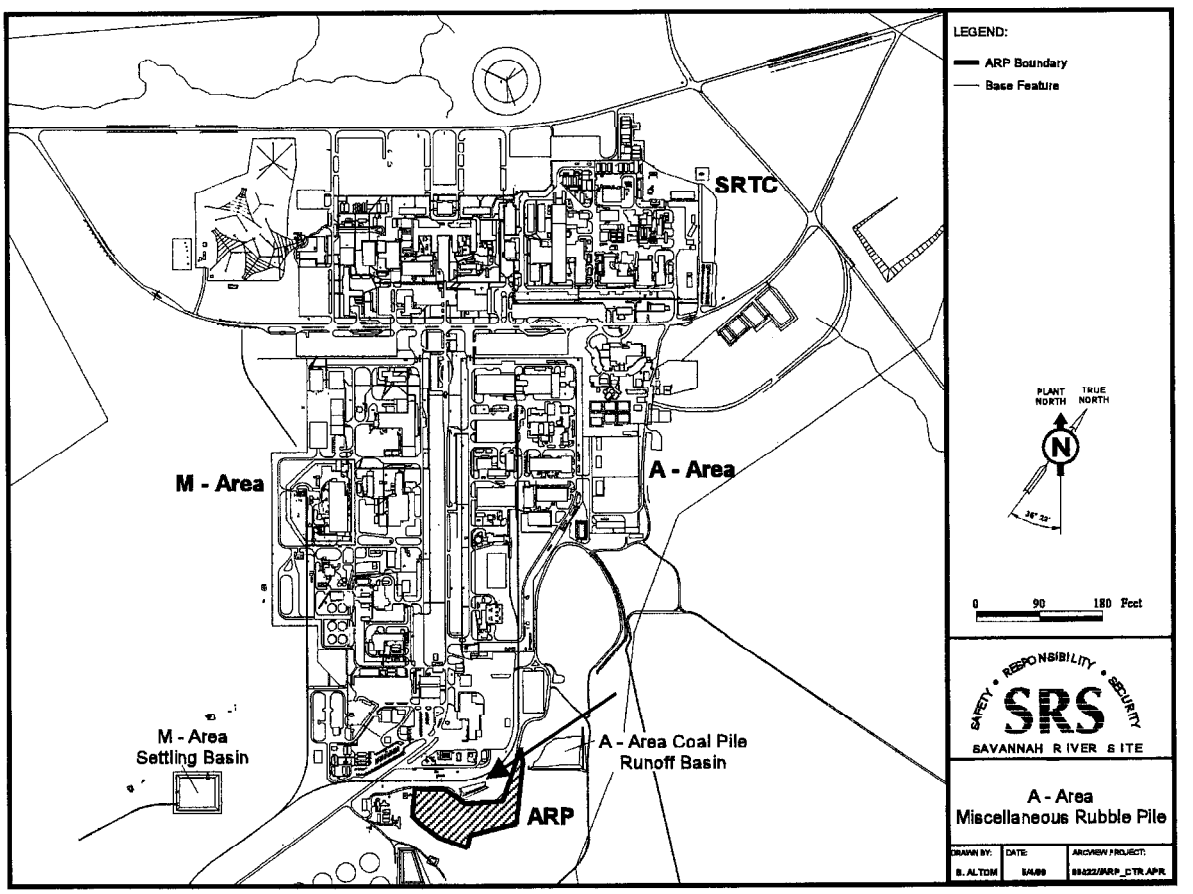
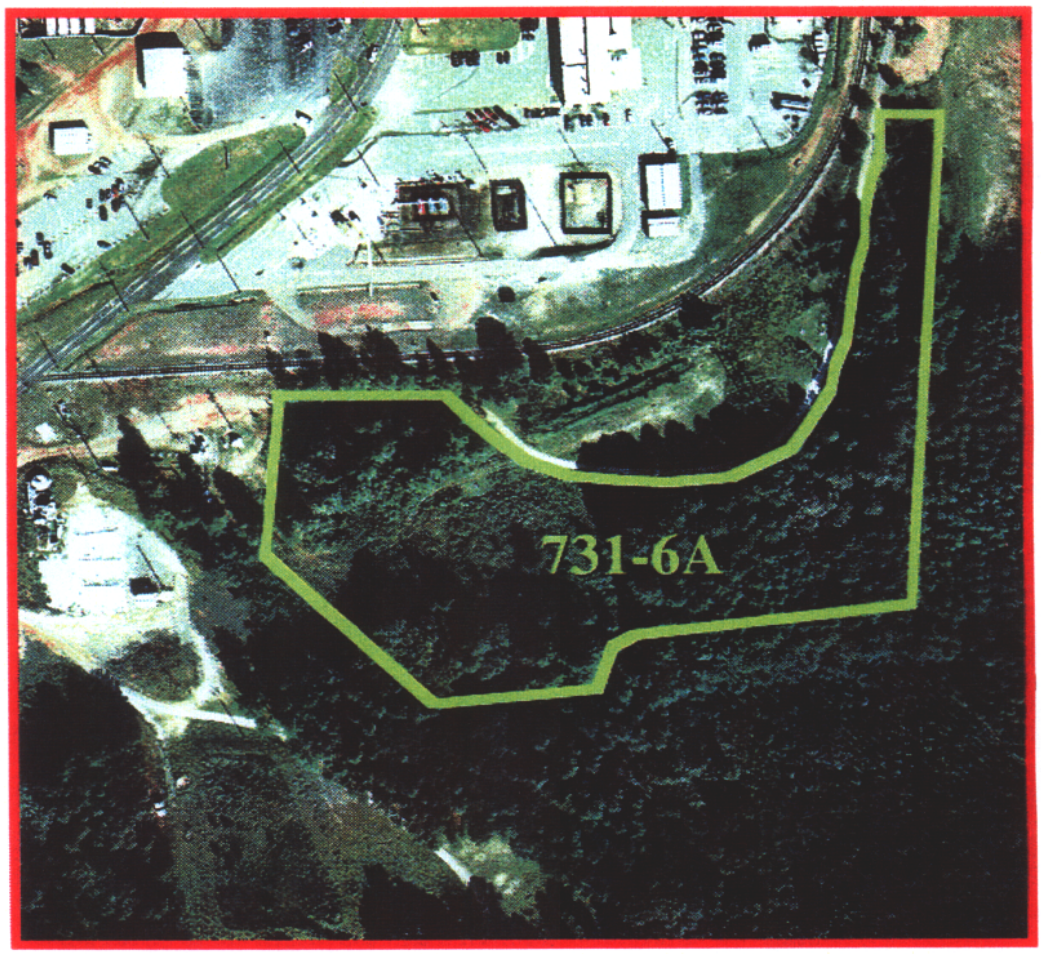


Figure 2. Location of the ARP within the Savannah River Site



Boundary is approximate

Figure 3. **Aerial Photograph of the A-Area Miscellaneous Rubble Pile Operable Unit (731-6A)**

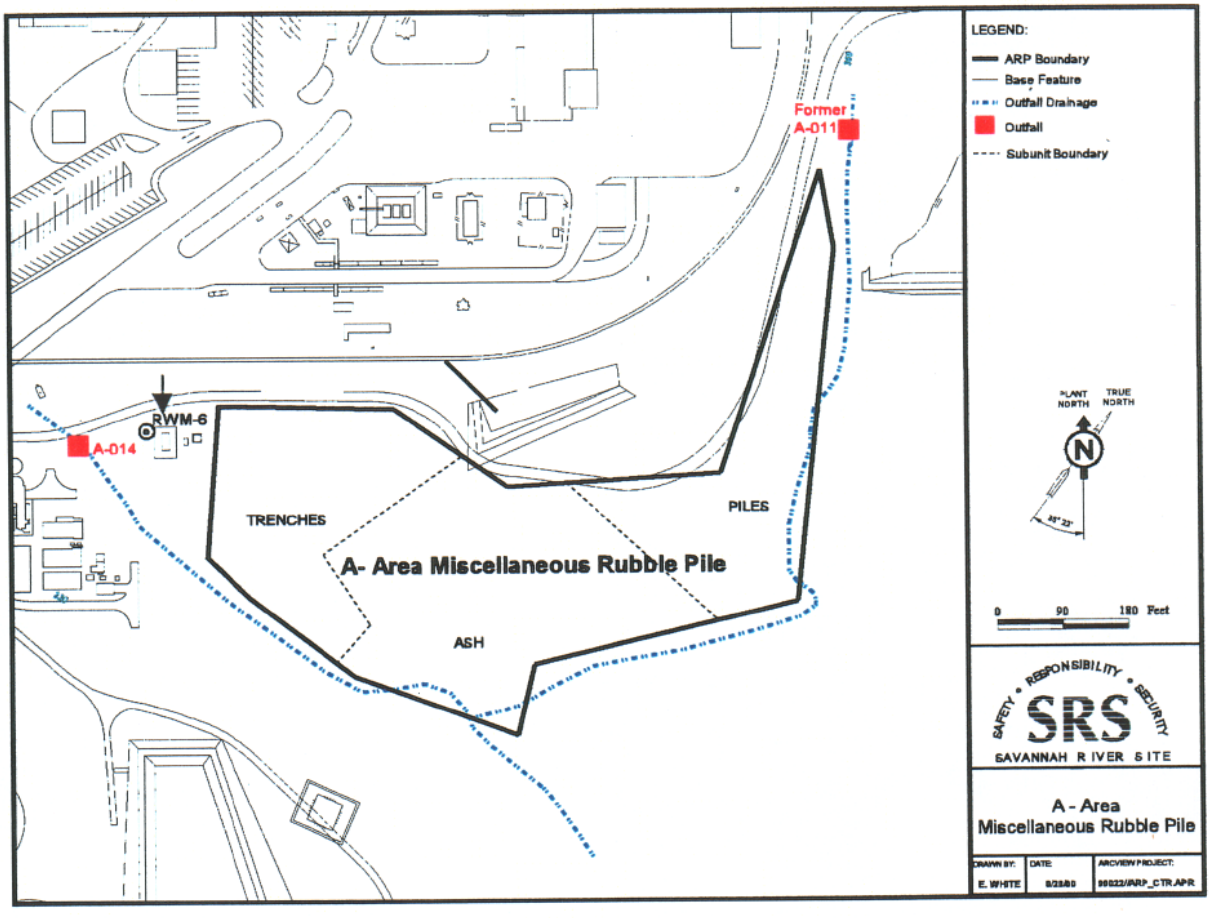


Figure 4. Unit Map of the A-Area Miscellaneous Rubble Pile Operable Unit (731-6A)

Disposal activities at ARP OU began in the early 1950s but the specific waste disposal at the unit was not documented. Based on field investigation and characterization work performed at the unit, it is clear that the primary wastes disposed of at the unit were construction rubble and an ash material. An aerial photograph taken in 1953 (Figure 5) shows the T-shaped trench in the western portion of the unit and ash piles in the center of the unit.

Based on the results of the Phase II characterization, the ARP OU has been subdivided into three subunits: the Piles Area, the Ash Area and the Trenches Area. Figure 4 shows the locations of these subunits at the ARP OU. Each subunit is described below.

Piles Area

The Piles Area is made of many small mounds of construction debris 0.6 to 1.5 m (2 to 5 ft) high covering a total area of 1.6 acres. The debris primarily consists of construction materials that were disposed of directly on the ground surface. This material includes shingles and siding, concrete, brick, electrical boxes, roofing and wall board materials, empty paint cans, empty drums and buckets, building materials, scrap metal, insulation, tar, plastic, glass, timbers, and transite containing non-friable asbestos.

Ash Area

The Ash Area is located in the south-central portion of the unit and is approximately 1.4 acres. Boreholes drilled in this area encountered buried construction debris (including transite) and an ash layer. The ash layer was primarily in the upper 1.2 m (4 ft) and consisted of a dark-gray, low-density material that was physically distinct from the orange sandy silts of the native soils.

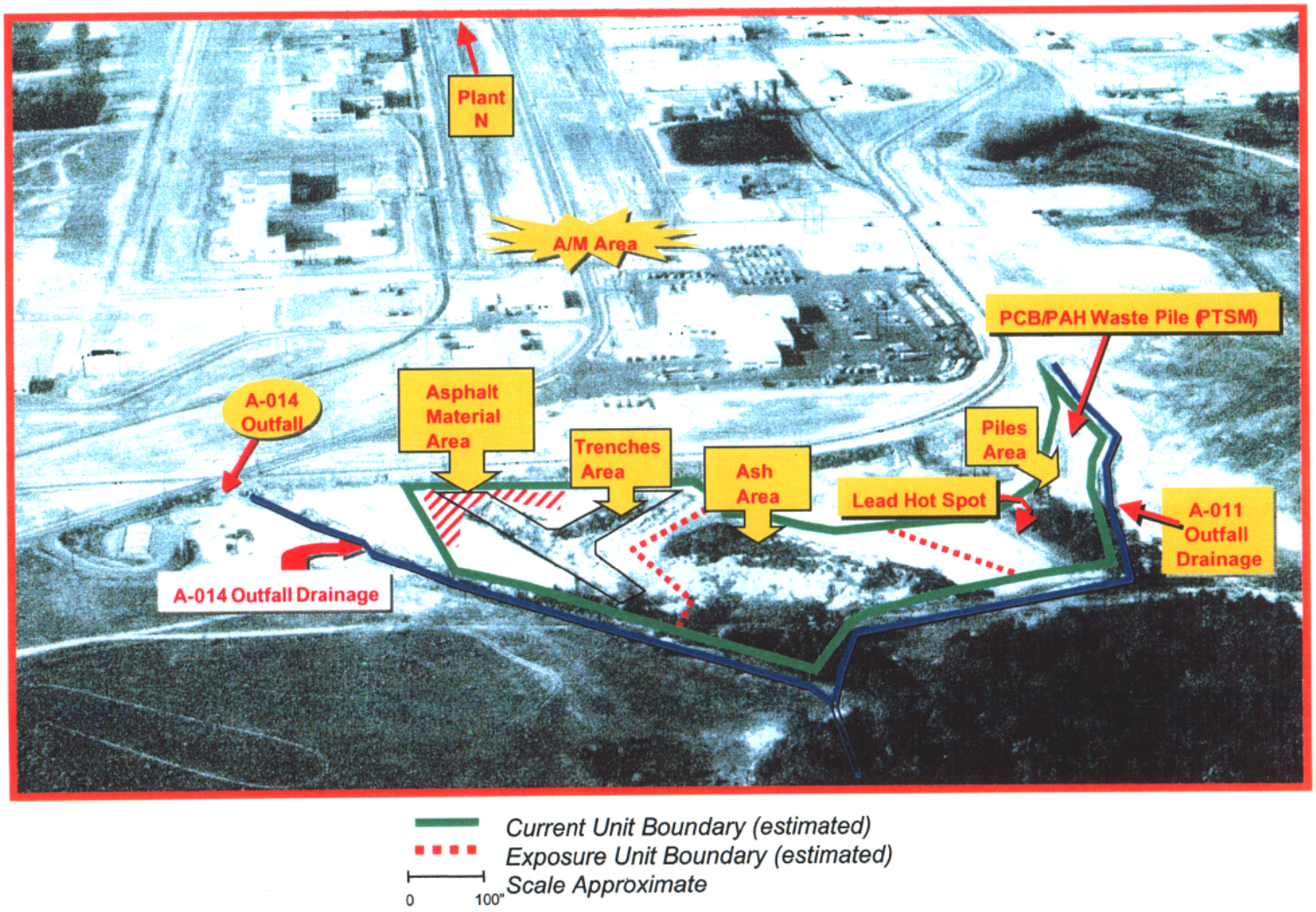


Figure 5. 1953 Aerial Photograph Showing Trenches

Trenches Area

The Trenches Area is approximately 1.9 acres located in the westernmost portion of the ARP OU. It consists of two distinct sub-areas: a wooded area, which covers an area approximately 61.0 by 30.5 m (200 by 100 ft), and a grassy area, which covers the remainder of the Trenches Area. The wooded area is located in the northwest portion of the Trenches Area. Debris piles, consisting of the same types of material found in the Piles Area, are scattered throughout this area. The T-shaped trench that distinguishes the Trenches Area was identified from a 1953 aerial photograph and is shown in Figure 5. The T-shaped trench is approximately 2.4 to 3.6 m (8 to 12 ft) deep.

Ground surface elevation at the ARP OU varies between 94 and 108 m (310 and 355 ft) above mean sea level (msl). In general, the surface slopes gently to the south over most of the unit; at the southern tip, the surface drops off more sharply to the south. In the far southern portion of the unit, near the confluence of the drainage, the slope steepens significantly. The ground surface at the unit is irregular due to the presence of debris piles. Figure 6 shows the surface topography at the ARP OU.

Soils encountered during characterization activities were described as tan to yellow-brown silty sand and orange-pink sandy silt. Surface soils comprise fine-to-medium grained, moderately to well-sorted silty sand and clayey sand. A decrease in sand and an increase in fine-grained material were observed with depth; the soil is generally comprised of clayey silts below 1.5 m (5 ft) deep. Near the ground surface, soils in the Piles Area are predominately tan silty sands, while soils in the Ash and Trenches Areas are predominately orange sandy clayey silts.

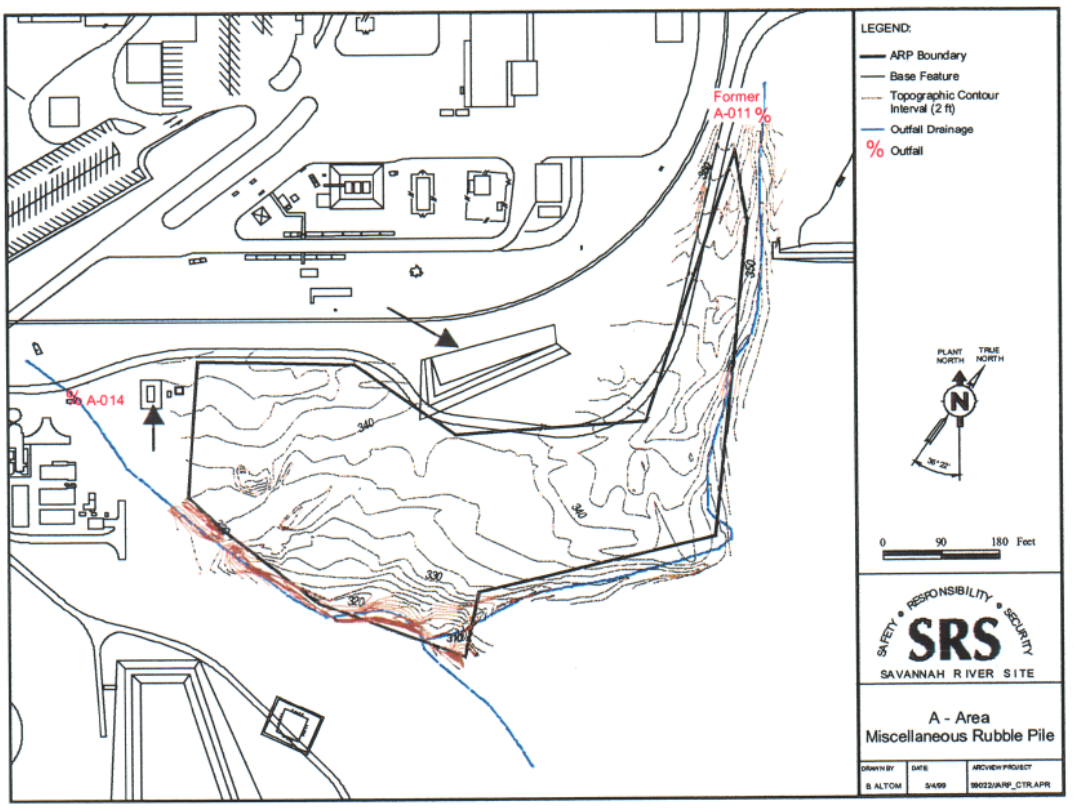


Figure 6. **Surface Topography of the A-Area Miscellaneous Rubble Pile Operable Unit (731-6A)**

The ARP OU is located in the Upper Three Runs watershed (see Figure 1). A small drainage feature runs along the eastern side of the ARP OU. The headwater is the former location of an NPDES permitted outfall, Outfall A-011 (see Figure 4.) This drainage feature turns southwest and bounds the unit on the south. The ARP OU is bounded on the southwest and southeast by outfall drainage emanating from NPDES Outfall A-014 and the former Outfall A-011, respectively. The source of water for both outfalls is predominantly industrial with a natural component limited to stormwater runoff. The two outfall drainages coalesce on the south side of the unit and flow southeast from the unit and into Tims Branch, which is located approximately 914 m (3,000 ft) southeast of the unit. Tims Branch discharges into Upper Three Runs Creek, which is located 5.6 km (3.5 mi) to the southeast.

Water level data indicate that the unsaturated zone is approximately 30.5 m (100 ft) thick at the ARP OU. The unsaturated zone is composed primarily of inter-bedded sands, silty sands, sandy silts, and clays of the Tobacco Road and overlying Altamaha Formations. The water table aquifer is approximately 6.1 m (20 ft) thick and extends from the water table to a locally continuous clay layer ("green clay") at a depth of approximately 36.6 m (120 ft) bls.

The M-Area RCRA Part B permit addresses ongoing corrective actions for A/M Area groundwater. No unit-related groundwater contaminants are present in the aquifers. The general groundwater flow direction at the ARP OU is toward the west.

Based on field observations and literature review, major vegetative community types have been identified within the study area. As noted in a previous study that describes the major plant communities of SRS (Workman and McLeod 1990), vegetative community type patterns are dependent on topography, soil type, moisture, and degree of disturbance. The land surrounding the ARP OU offers habitats supportive of a limited diversity of flora and fauna. Three plant community types were identified in the vicinity of the ARP OU.

Vegetation at the unit includes pines, various shrubs, woody vines such as poison ivy (*Rhus radicans*), briars (*Smilax* spp.), grape (*Vitis* spp.), blackberry (*Rubus* spp.), ferns, and grasses. Ground cover in the forested area consists mainly of pine needles.

Observations of animal species inhabiting the ARP OU and surrounding area were made during ecological surveys conducted in January 1997 and February 1998 and during development of the work plan addendum. The area has been subject to physical disturbance, which has impacted the character of the habitats available to wildlife in the vicinity of the ARP OU. The principal disturbed areas, including roadways, power line rights-of-way, and the surrounding old field community, provide habitat for small mammals and, to a limited extent, their mammalian, avian, and reptilian predators.

Animal species frequenting the area may include white-tailed deer (*Odocoileus virginianus*), cottontail rabbit (*Sylvilagus floridanus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), opossum (*Didelphis marsupialis*), various birds, various small mammals, and snakes. Frogs have been observed near the outfall drainage adjacent to the ARP OU. Bird species potentially present in the vicinity of the unit include the common bobwhite quail (*Colinus virginianus*), mockingbird (*Mimus polyglottos*), eastern meadowlark (*Sturnella magna*), Carolina wren (*Thryothorus Iudovicianus*), field sparrow (*Spizella pusilla*), and American crow (*Corvus brachyrhynchos*).

A threatened and endangered (T&E) and sensitive species survey was conducted in the vicinity of the ARP OU by the Savannah River Forest Station (SRFS) of the United States Forest Service in February 1997 (Imm 1997). The survey found that habitat conditions, or the potential for habitat conditions, appropriate for the establishment of T&E species do not exist in the vicinity of the ARP OU.

The ARP OU does not contain wetlands or water wells that could be used as a drinking water supply.

No removal action or remedial action has been conducted at ARP OU under CERCLA or other authorities.

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 ARP OU 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 (SB/PP) for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit* (U) (WSRC 2001b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the ARP OU. However, as agreed to by the Core Team on January 24, 2002, the selected remedy was changed to Active Soil Vapor Extraction (ASVE). The basis for this decision is provided in Section XIII.

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

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

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

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

The South Carolina Department of
Health and Environmental Control
Bureau of Land and Waste
Management
8901 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

Lower Savannah District
Environmental Quality Control Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 641-7670

The public was notified of the public comment period through 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 September 21, 2001, and ended on November 4, 2001. A Responsiveness Summary, prepared to address any comments received during the public comment period, is provided in Appendix A of this Record of Decision (ROD). Due to a change in the selected remedy for the Trenches Area subunit (see Section XIII. Explanation of Significant Changes) after the initial public comment period, a second 45-day public comment period was held for the draft RCRA Permit Modification from September 25, 2002 to November 8, 2002. The final RCRA permit and its associated Responsiveness Summary, which included no public comments, were issued by the SCDHEC on February 4, 2003. The RCRA permit became effective on March 4, 2003.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the ARP OU) at SRS are subject to a multi-stage RI process that integrates the requirements of RCRA and CERCLA as outlined in the FFA (FFA 1993). The RCRA/CERCLA processes are summarized below:

- investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste site and surrounding areas
- evaluation of risk to human health and the local ecological community
- screening of possible remedial actions to identify the technology selected to protect human health and the environment
- implementation of the selected alternative
- documentation that the remediation has been performed competently
- evaluation of the effectiveness of the technology

The steps of this process are iterative in nature and include decision points that require concurrence between USDOE as owner/manager, USEPA and SCDHEC as regulatory oversight agencies, and the public. Figure 7 is a flow chart presenting the process logic and documentation.

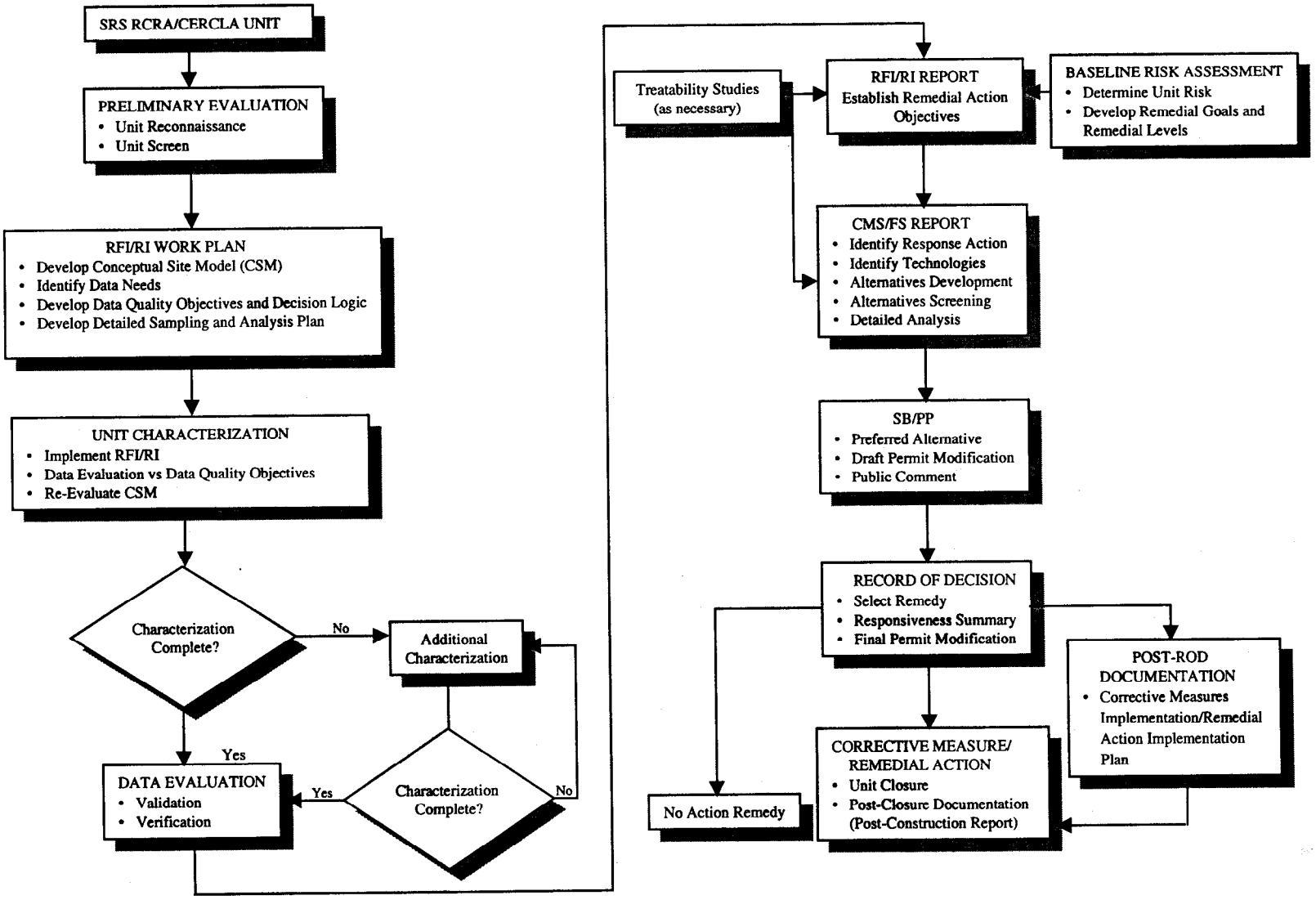


Figure 7. RCRA/CERCLA Logic and Documentation

Operable Unit Remedial Strategy

The overall strategy for addressing the ARP OU was to (1) characterize the waste unit, delineating the nature and extent of contamination and identifying the media of concern (perform the RCRA Facility Investigation/Remedial Investigation [RFI/RI]); (2) perform a Baseline Risk Assessment (BRA) to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The ARP OU is located within the Upper Three Runs watershed. In addition to the ARP OU, there are many OUs within the watershed. All the source control and groundwater OUs located within the watershed will be evaluated to determine their impacts, if any, to the associated streams and wetlands.

SRS will manage all source control units to prevent impact to groundwater and the watershed. Upon disposition of all source control and groundwater OUs within the watershed, a final comprehensive ROD for the Upper Three Runs watershed will be pursued.

The results of the field investigations and soil samplings conducted during Phase I and Phase II of the development of the RFI/RI/BRA report (WSRC 2000) have indicated that surface soil and shallow subsurface soil (to a depth of 12 ft) are contaminated. The contaminant migration analysis identified two refined CMCOCs, trichloroethylene and tetrachloroethylene (TCE and PCE), associated with shallow subsurface soils in the Trenches area that may impact the groundwater above the maximum contaminant level (MCL) in 200-500 years. However, the deep vadose zone data (greater than 12 ft bls) demonstrate that the ARP OU has not contributed to the groundwater contamination in this area. Thus, the groundwater adjacent to and underneath the ARP OU has not been impacted by the activities related to the ARP OU.

The groundwater contamination present in wells by the ARP OU is related to discharges associated with the A-014 Outfall which is being remediated under an ongoing RCRA corrective action as documented in the SRS RCRA Part B Permit. Therefore, the ARP OU groundwater will not be addressed in this ROD. The groundwater does not outcrop in the vicinity of the ARP OU.

The contaminated soils associated with ARP OU are being addressed in this ROD. Soil remediation activities at the ARP OU will not impact the response actions of other OUs at SRS.

V. OPERABLE UNIT CHARACTERISTICS

This section presents the conceptual site model (CSM) for the ARP OU, provides an overview of the characterization activities conducted at ARP, presents the characterization results and COCs, and provides an overview of the contaminant transport analysis.

Conceptual Site Model for the ARP OU

The CSM for the ARP OU is presented in Figure 8, which represents the CSM in a schematic cross section across the three subunits (Piles Area, Ash Area, and Trenches Area). Detailed CSM diagrams for each of the subunits supporting the baseline risk assessment are provided in Section VII. The CSM identifies the known and suspected sources of contamination, the known and potential routes of migration and the types of contaminants and potentially affected media. The exposure routes and the known and potential human and ecological receptors will be presented in the summary of operable unit risks in Section VII.

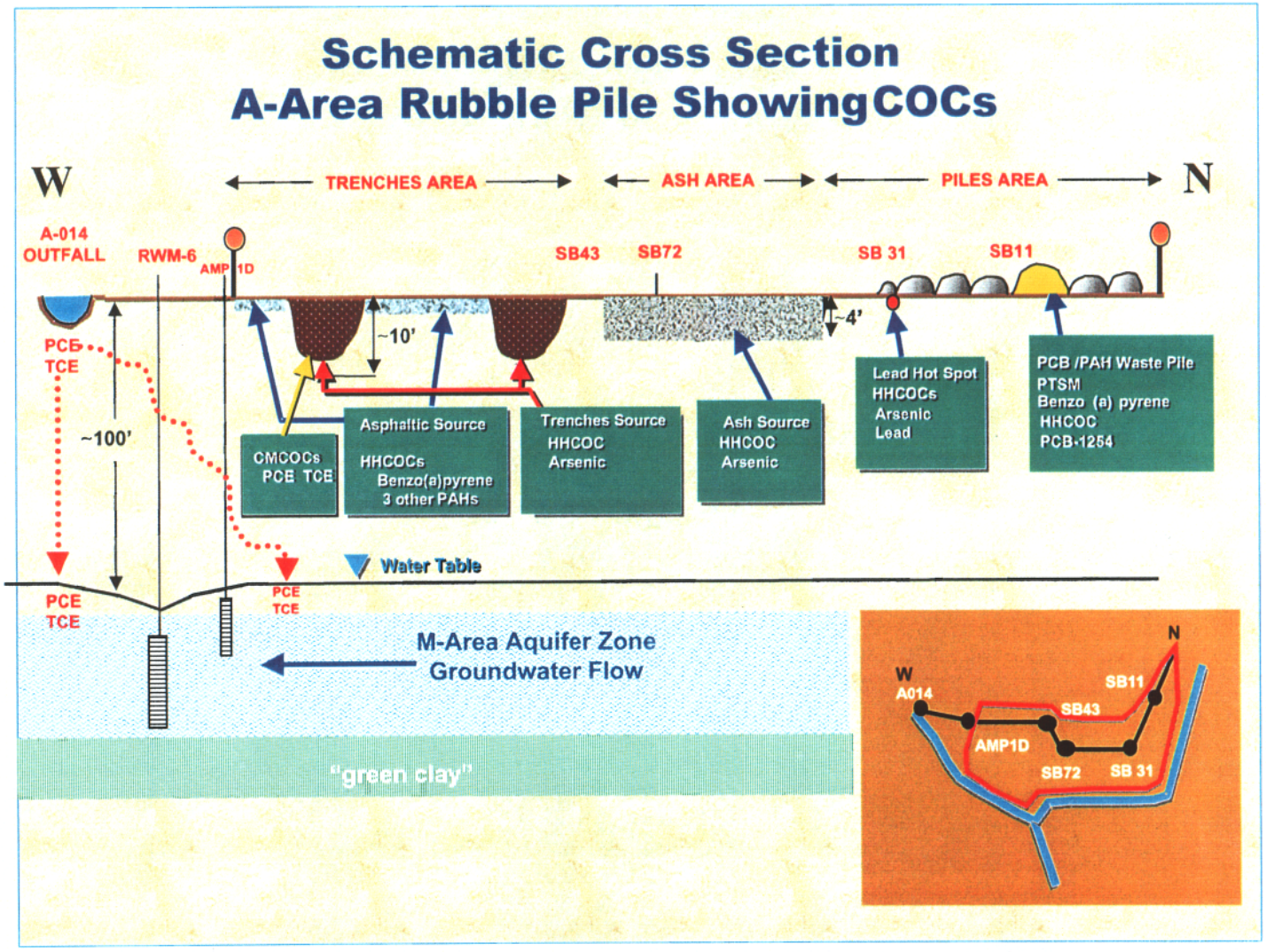


Figure 8. **Revised Conceptual Site Model for the ARP OU**

Primary Sources of Contamination

The field investigation conducted at the ARP OU reveal that the primary sources of contamination are two hot spots within the Piles Area, a shallow subsurface ash layer in the Ash Area, and an asphaltic debris source and materials placed in the T-shaped disposal trench in the Trenches Area. The construction debris pile is approximately 1.5 m (5 ft) high. Figure 9 identifies the major debris types and their locations across the ARP OU.

The ash layer extends from the surface to about 1.2 m (4 ft) in depth and also contains some buried construction debris such as transite. The asphaltic debris layer is located in the northwestern portion of the Trenches Area (Figure 5) and is intermixed with soil to a depth of up to 1.2 m (4 ft). The distinctive T-shaped trench (Figure 5) contains ash and construction debris to a depth of up to 3.6 m (12 ft) bls.

Construction debris for Trenches Area and Piles Area includes shingles and siding, concrete, paint cans, drums, general building materials, scrap metal, electrical boxes, insulation, tar, rock, soil, gravel, styrofoam, roofing and wall board material, brick tile, asphalt, plastic, glass, timbers, ash, empty 5-gallon buckets, and transite containing non-friable asbestos.

Primary Sources Mechanisms

Contaminants may have been released from the primary sources at each of the ARP OU subunits by the following primary mechanisms:

- Deposition of the contaminants on surface soil in or near each primary source
- Infiltration/percolation of water through the waste constituents at each primary source into subsurface soils.

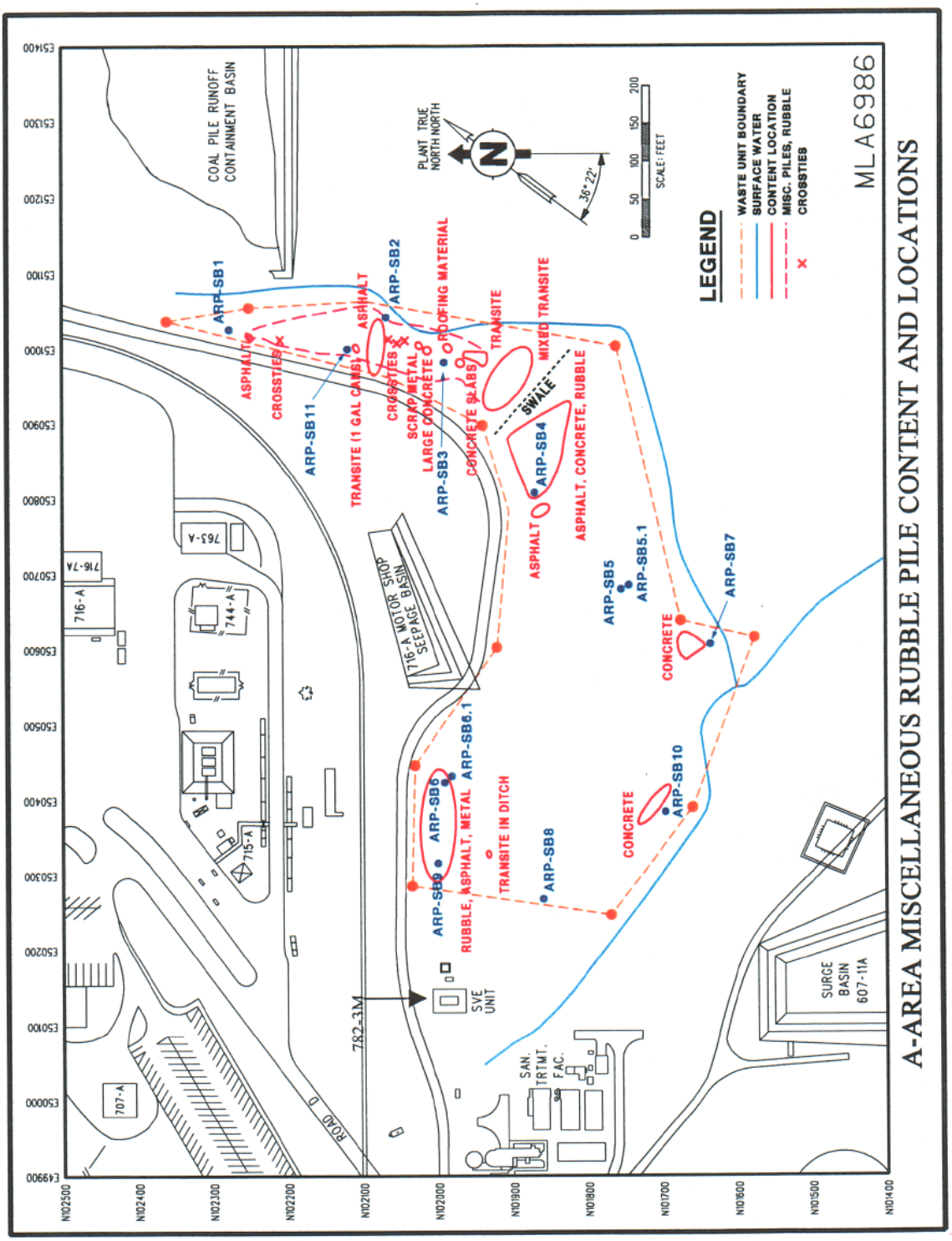


Figure 9. A-Area Miscellaneous Rubble Pile and Phase I Soil Boring Location

Secondary Sources of Contamination

Surface and subsurface soils to a depth of 3.6 m (12 ft) have been impacted by contaminants associated with the primary sources. In the Piles Area, two areas of impact were identified, a waste and soil pile contaminated with aroclor-1254 and polychlorinated aromatic hydrocarbons (PAHs), and a small surface soil area contaminated with lead and arsenic. In the Ash Area, the surface and shallow subsurface soils mixed with ash are contaminated with arsenic. In the Trenches Area, the soils to a depth of 4 feet are contaminated with PAHs and arsenic, and trench fill to a depth of 12 feet is contaminated with TCE and PCE.

Secondary Release Mechanisms

The contaminated surface and subsurface soils at ARP serve as a reservoir for potential secondary release of contaminants. Secondary environmental release mechanisms that were evaluated at ARP OU include the following:

- Stormwater runoff, erosion, and seepage
- Release of volatile constituents from the soil
- Generation of contaminated fugitive dust by wind or other surface soil disturbance
- Biotic uptake
- Leaching from subsurface soil to groundwater

Exposure Media

Contact with contaminated environmental media creates the exposure pathways to human and ecological receptors that are evaluated in the BRA.

Sampling of surface water and sediments from the two outfall-derived drainages adjacent to ARP OU determined that contaminated soils at the unit had not impacted these drainages. Monitoring wells in the M-Area (water table) aquifer near the unit and vadose zone soils beneath the unit were sampled to determine if contaminants had impacted groundwater. The results indicated that the unit had not contributed to existing groundwater contamination but could potentially impact groundwater in the future through leaching of TCE and PCE from the Trenches Area.

Media Assessment

The RFI/RI/BRA report (WSRC 2000) contains the detailed information and analytical data for all the investigations conducted and samples taken in the media assessment of the ARP OU. This document is available in the Administrative Record File (see Section III of this document).

The investigations conducted to characterize ARP OU soils and groundwater are summarized in Table 1.

Background Investigation

Background soil samples and upgradient surface water, sediment and groundwater samples were obtained to establish baseline concentrations for evaluation of potential contaminants and pathway information.

Locations of the background soil borings are shown on Figure 10. Data for the 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft) intervals were collected as part of the A-Area Motor Shop Seepage Basin (MSSB) investigation. Six background borings (ABK-SB01

through ABK-SB06) were sampled during the ARP OU Phase 1 activities. Data from the 1.2 to 3 m (4 to 10 ft) interval was collected from these six borings. Additionally, a seventh background boring (ABK-SB11) was sampled at six depth intervals.

Table 1. History of Environmental Activities Performed at the ARP OU

Investigation Dates	Media Sampled or Activity	Locations	Description
1990 – 1991	Soil Gas	ARP OU	268 samples
Phase 1 Background: 1997	Soil	716-A Motor Shop Seepage Basin (MSSB) RI	12 samples
Phase I: 1997	Soil	ARP OU	7 samples (>1.2 m (4 ft) at MSSB locations, and ABK-SB11)*
Phase I: 1997	Surface Water/ Sediment	Outfall drainages to Tims Branch	1 pair
Phase I. 1997	Groundwater	ACB-3A	1 sample
Phase 1: 1997	Soil	ARP OU	65 samples
	Surface Water/ Sediment pairs	Outfall drainages to Tims Branch	11 surface water and 9 sediment samples
Phase 2: 1998	Soil	ARP OU	573 samples
	Groundwater	ACB-3A, AOB-1 through 3, AMP-1D	2 samples per well (10 samples)
	Biota	ARP OU and reference/background areas	Small mammal trap lines across the unit and reference areas. Six unit soil samples, one background soil sample, and one reference soil (8 samples).

*For sample locations, refer to Figure 10.

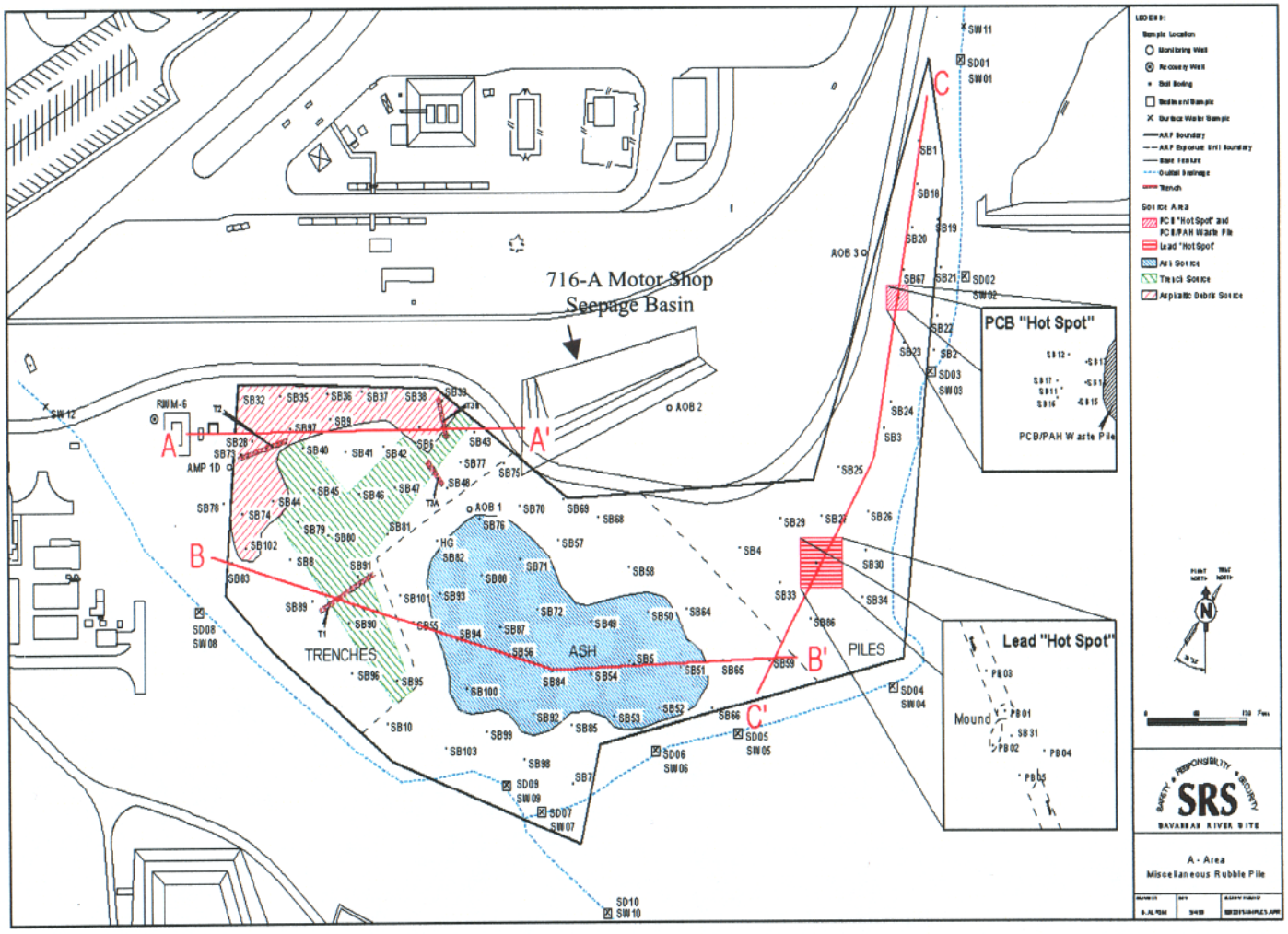


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Figure 10. Sampling Locations, Exposure Units, Source Areas, and Lines of Cross-Sections for the ARP

All of these samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), Target Analyte List (TAL) inorganics, pesticides, dioxins/furans, gross alpha, and nonvolatile beta.

Soil Gas Investigation

A soil gas survey was performed for the ARP OU in 1991 (Pirkle and Masdea 1993). Additional soil gas locations were sampled during the 1990 vadose zone characterization (WSRC 1992). The following compounds were analyzed:

- C_1-C_4 hydrocarbons
- C_5-C_{10} normal paraffins
- Aromatic hydrocarbons
- Benzene, toluene, ethylbenzene, and xylenes
- Selected chlorinated hydrocarbons
- Mercury

The results indicated an area of elevated TCE and PCE concentrations in the western portion of the unit over the Trenches Area subunit.

Phase 1 Background Investigation

During 1997, Phase 1 characterization soil sampling at ARP OU was conducted (for soil boring locations, see Figure 10). The sampling and analysis plan was biased to target "worst case" areas identified by observation of potential contamination associated with

the debris piles and by the previous soil gas survey (Pirkle and Masdea 1993, WSRC 1992). This approach was also used to provide site-specific background data.

Phase 2 Investigation

Phase 2 sampling was conducted at ARP OU in 1998 to determine the lateral and vertical extent of contaminant migration. An expedited site characterization approach was applied with one-day turnaround on soil samples analyzed at the SRS onsite mobile laboratory. The mobile lab conducted analyses for TAL inorganics, TCL VOCs, TCL SVOCs, and PCBs; analyses for pesticides, total organic carbon, and dioxins/furans were conducted at an offsite laboratory. If contamination was detected in any sample, another borehole was positioned laterally to define the lateral extent of contamination. A total of 573 soil samples were collected during Phase 2 sampling.

Phase 2 investigation also included groundwater sampling and biota sampling.

Based on Phase 2 investigations, the soil exposure unit was subdivided into three areas (Piles Area, Ash Area, and Trenches Area) for the purposes of human health risk assessment. The ecological risk assessment was conducted for the combined soil exposure unit.

Exposure Media Investigations

The schematic CSM, as shown in Figure 8, identifies pathways potentially impacted by previous activities at the ARP OU. These pathways include the following: air, surface soil, subsurface soil, sediment and surface water in the two outfall drainages adjacent to the unit, biota and groundwater. Soil sampling activities within and adjacent to the ARP OU are described above. Air sampling was not conducted as part of the characterization efforts. Biota sampling was conducted to determine the bioaccumulation of selected metals and PCBs in small mammals and earthworms.

The sampling activities for surface water, sediment, groundwater, soil, and biota are discussed in subsequent sections.

Surface Water and Sediment Characterization

Ten surface water and sediment pairs were collected from the outfall drainages bounding the ARP OU (for sample locations, see Figure 10). Additionally, a surface water sample was collected at the locations of the A-014 Outfall and the former A-011 Outfall. All of these samples were analyzed for the following constituents:

- TAL inorganics
- TCL VOCs
- TCL SVOCs
- TCL PCBs/pesticides and dioxin/furan

Sediment samples were analyzed for total organic carbon, grain size, gross alpha, and nonvolatile beta in addition to the analytes listed.

Groundwater

Five water table aquifer groundwater-monitoring wells (ACB-3A, AOB-1, -2, -3, and AMP-1D) were sampled as part of the ARP OU groundwater investigation. One well, AMP-1D, was installed as part of the Phase 2 characterization (for sample locations, see Figure 10). Well AOB-1 is located within the unit boundaries. The remaining wells are located around the perimeter of the unit.

Samples collected from both rounds of sampling were analyzed for TAL inorganics, TCL VOCs, TCL SVOCs, and TCL PCBs/pesticides and dioxin/furan.

Assessment Investigation Results

Soils

The COCs associated with the ARP OU soils were determined using standard SRS risk assessment protocols. CMCOCs were identified through contaminant fate and transport analyses using a CSM to assess the potential for adverse health effects to humans and the environment. The schematic CSM is depicted in Figure 8. The results of the characterization and assessment have been summarized in the RFI/RI/BRA report (WSRC 2000).

Tables 2 through 7 provide an overview of the process employed in determining the refined COCs to be retained for further remedial evaluation of the ARP OU subunits (i.e., the Piles Area, Ash Area, Trenches Area), sediment, surface water, and groundwater. The process entailed several steps. First, from the detected constituents, unit-specific constituents (USCs) were identified. USCs were determined by comparing each detected constituent concentration found in the soil against its respective twice-average background concentration for all depth intervals. Second, the USCs were further screened to reflect risk to human health or the environment and thereby determine preliminary COCs. The preliminary COCs, in addition to risk-based COCs, included applicable or relevant and appropriate requirement (ARAR) based COCs, CMCOCs, and principal threat source material (PTSM). Risk-based COCs (human health and ecological COCs) were determined in accordance with CERCLA guidance. Finally, all the preliminary COCs were carried into a formal uncertainty analysis for which the refined COCs were determined. The refined COCs are those constituents for which remediation may be warranted pending a detailed corrective measure study/feasibility study (CMS/FS). Soil was the only medium for which refined COCs were identified at the ARP OU. There are no refined COCs for surface water, sediment or groundwater. No refined ecological COCs are identified for any medium.

Table 2. Overview of the COC Process – Piles Area

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Aluminum	X				X				
Antimony	X								
Arsenic	X		X		X	X	X		HH_{ind}
Barium	X				X				
Cadmium	X						X		
Calcium	X								
Chromium	X								
Copper	X						X		
Cyanide	X								
Iron	X				X				
Lead	X	X	X	X	X	X	X		ARAR, HH_{ind}
Magnesium	X								
Mercury	X								
Potassium	X								
Selenium	X								
Silver	X								
Sodium	X								
Thallium	X				X				
Vanadium	X				X				
Zinc	X						X		
TCL Semivolatiles									
2-Methylnaphalene	X								
Acenaphthene	X								
Acenaphthylene	X								
Anthracene	X								
Benzo(a)anthracene	X				X				
Benzo(a)pyrene	X				X				PTSM
Benzo(a)fluoranthene	X				X				
Benzo(g,h,i)perylene	X								
Benzo(k)fluoranthene	X				X				
Benzoic acid	X								
Bis(2-ethylhexyl)phthalate	X								
Carbazole	X								
Chrysene	X								
Di-n-butyl phthalate	X				X				
Di-n-octyl phthalate	X								
Dibenzo(a,h)anthracene	X				X				
Dibenzofuran	X								
Fluoranthene	X								
Fluorene	X								
Indeno(1,2,3-cd)pyrene	X				X				
N-Nitrosodiphenylamine	X								
Naphthalene	X								
Phenanthrene	X								
Pyrene	X								

Table 2. Overview of the COC Process – Piles Area (Continued)

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Volatiles									
1,1,1-Trichloroethane	X				X				
1,1-Dichloroethane	X								
Acetone	X								
Dichloromethane (Methylene chloride)	X								
Ethylbenzene	X								
Toluene	X								
Xylenes (total)	X								
Pesticides/PCB and Dioxin/Furan									
Aroclor 1254	X	X	X		X	X	X		ARAR HH_{ind}
Endrin	X								
Octachlorodibenzo-p-dioxin	X								
gamma-Chlordane	X								
p,p'-DDD	X								
p,p'-DDE	X								
p,p'-DDT	X								

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Table 3. Overview of the COC Process – Ash Area

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Aluminum	X				X				
Antimony	X								
Arsenic	X		X		X	X	X		HH_{ind}
Barium	X								
Beryllium	X								
Cadmium	X		X		X		X		
Calcium	X								
Chromium	X								
Cobalt	X								
Copper	X						X		
Cyanide	X								
Iron	X				X				
Lead	X						X		
Magnesium	X								
Manganese	X								
Mercury	X				X				
Nickel	X								
Potassium	X								
Selenium	X								
Silver	X								
Sodium	X								
Thallium	X				X				
Vanadium	X				X				
Zinc	X						X		
TCL Semivolatiles									
2-Methylnaphalene	X								
Acenaphthene	X								
Anthracene	X								
Benzo(a)anthracene	X				X				
Benzo(a)pyrene	X				X				
Benzo(a)fluoranthene	X				X				
Benzo(g,h,i)perylene	X								
Benzo(k)fluoranthene	X				X				
Benzoic acid	X								
Bis(2-ethylhexyl)phthalate	X								
Butyl benzyl phthalate	X								
Chrysene	X				X				
Di-n-butyl phthalate	X								
Di-n-octyl phthalate	X								
Dibenzo(a,h)anthracene	X				X				
Dibenzofuran	X								
Fluoranthene	X								
Fluorene	X								
Indeno(1,2,3-cd)pyrene	X				X				
N-Nitrosodiphenylamine	X								
Naphthalene	X								
Phenanthrene	X								
Pyrene	X								

Table 3. Overview of the COC Process – Ash Area (Continued)

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Volatiles									
4-Methyl-2-pentanone	X								
Acetone	X								
Benzene	X								
Carbon disulfide	X								
Dichloromethane (Methylene chloride)	X								
Tetrachloroethylene	X								
Toluene	X								
Trichloroethylene (TCE)	X								
Xylenes (total)	X								
Pesticides/PCBs and Dioxins/Furans									
Aroclor-1254	X				X		X		
Dieldrin	X								
Endosulfan II	X								
Endosulfan sulfate	X								
Endrin	X								
Octachlorodibenzo-p-dioxin	X								
p,p'-DDE	X								
p,p'-DDT	X								

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Table 4. Overview of the COC Process – Trenches Area

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Aluminum	X				X				
Antimony	X		X		X				
Arsenic	X		X		X	X	X		HH_{ind}
Barium	X				X				
Beryllium	X								
Cadmium	X		X		X		X		
Calcium	X								
Chromium	X								
Cobalt	X								
Copper	X		X		X		X		
Cyanide	X								
Iron	X				X	X			
Lead	X		X		X		X		
Magnesium	X								
Manganese	X		X		X				
Mercury	X		X		X				
Nickel	X		X		X				
Potassium	X								
Selenium	X								
Silver	X				X				
Sodium	X								
Thallium	X		X		X				
Vanadium	X				X				
Zinc	X				X		X		
TAL Semivolatiles									
2-Methylnaphalene	X								
Acenaphthene	X								
Acenaphthylene	X								
Anthracene	X								
Benzo(a)anthracene	X		X		X	X			HH_{ind}
Benzo(a)pyrene	X		X		X	X			HH_{ind}
Benzo(b)fluoranthene	X		X		X	X			HH_{ind}
Benzo(g,h,i)perylene	X								
Benzo(k)fluoranthene	X					X			
Benzoic acid	X								
Bis(2-ethylhexyl)phthalate	X								
Carbazole	X		X						
Chrysene	X					X			
Di-n-butyl phthalate	X								
Di-n-octyl phthalate	X								
Dibenzo(a,h)anthracene	X		X		X	X			HH_{ind}
Dibenzofuran	X								
Fluoranthene	X								
Fluorene	X								
Indeno(1,2,3-cd)pyrene	X				X	X			
N-Nitrosodiphenylamine	X								
Naphthalene	X								
Phenanthrene	X								
Pyrene	X								

Table 4. Overview of the COC Process – Trenches Area (Continued)

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TCL Volatiles									
1,1,1-Trichloroethane	X								
1,1-Dichloroethene	X								
Acetone	X								
Benzene	X								
Bromomethane (Methyl bromide)	X								
Carbon disulfide	X								
Chlorobenzene	X								
Chlorodibromomehtane	X								
Chloroform	X								
Chloromethane (Methyl chloride)	X								
Tetrachloroethylene (PCE)	X		X	X					CM
Toluene	X								
Trichloroethylene (TCE)	X		X	X					CM
Xylenes (total)	X								
Pesticides/PCBs and Dioxins/Furans									
Aroclor-1254	X				X		X		
Arochlor-1260					X				
Endosulfan I	X								
Endrin	X								
Endrin ketone	X								
Heptachlor epoxide	X								
Octachlorodibenzo-p-dioxin	X								
gamma-Chlordane	X								
p,p'-DDD	X								
p,p'-DDE	X								
p,p'-DDT	X								

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Table 5. Overview of the COC Process – Sediment

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Aluminum	X				X				
Antimony	X								
Arsenic	X				X				
Barium	X								
Beryllium	X								
Cadmium	X								
Calcium	X								
Chromium	X								
Iron	X				X				
Lead	X								
Magnesium	X								
Nickel	X								
Potassium	X								
Selenium	X								
Sodium	X								
Thallium	X								
Vanadium	X								
TCL Semivolatiles									
2-Methylnaphalene	X								
Benzo(a)anthracene	X				X				
Benzo(a)pyrene	X				X	X			
Benzo(a)fluoranthene	X				X				
Benzo(g,h,i)perylene	X								
Benzo(k)fluoranthene	X				X				
Benzoic acid	X								
Bis(2-ethylhexyl)phthalate	X								
Butyl benzyl phthalate	X								
Carbazole	X								
Chrysene	X								
Dibenzo(a,h)anthracene	X				X				
Dibenzofuran	X				X				
Fluoranthene	X								
Indeno(1,2,3-cd)pyrene	X								
Naphthalene	X				X				
Pyrene	X								
TCL Volatiles									
Chloromethane (Methyl chloride)	X								
Trichloroethylene (TCE)	X								

Table 5. Overview of the COC Process – Sediment (Continued)

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
Pesticides/PCBs and Dioxins/Furans									
Aroclor-1254	X								
Arochlor-1260									
Endrin	X								
Endrin ketone	X								
alpha-Chlordane	X								
gamma-Chlordane	X								
p,p'-DDD	X								
p,p'-DDE	X								
p,p'-DDT	X								

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Table 6. Overview of the COC Process – Surface Water

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Aluminum	X	X							
Antimony	X				X				
Cadmium		X							
Chromium	X	X							
Cobalt	X								
Iron	X	X			X				
Magnesium	X								
Potassium	X								
Vanadium	X								
Zinc	X	X							
TCL Volatiles									
2-Butanone (MEK)	X								
Radionuclides									
Gross alpha	X								

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Table 7. Overview of the COC Process – Groundwater

Detected Constituent	USC	ARAR COC	Fate & Transport		Human Health		Ecological		Summary
			CM COPC	CM COC	COPC	COC	Final COPC	COC	Refined COC
TAL Inorganics									
Cadmium	X								
Chromium	X								
Copper	X								
Iron	X								
Lead		X							
Selenium	X	X			X				
Silver	X								
Thallium	X	X			X				
TCL Volatiles									
Tetrachloroethylene	X	X			X	X			
Trichloroethylene (TCE)	X	X			X	X			

Type of COC:

ARAR = Applicable Relevant and Appropriate Requirements
COPC = Constituent of potential concern
CM = Contaminant migration
PTSM = Principal threat source material
HH = Human Health – ind (industrial)
Eco = Ecological COC

Key findings for the Piles Area include two hot spots that warrant remedial actions:

PCB/PAH waste pile hot spot

- The PCB/PAH waste pile consists of approximately 7.6 m^3 (10 yd^3) of contaminated media. Aroclor-1254 (a PCB) is a human health COC and an ARAR COC in the waste pile because it exceeds 1 mg/kg. Elevated levels of other PAHs are also present in the waste pile.

- The PCB/PAH waste pile was identified as PTSM due to the high toxicity of benzo(a)pyrene and because it occupies a significant volume.

The lead hot spot

- The lead hot spot consists of approximately 1.5 m^3 (2 yd^3) of contaminated media. The lead hot spot consists of an isolated area of lead and arsenic, which are both refined human health COCs. The levels of contamination present and the associated risks are presented later in the text and in Tables 8 and 11.

- The lead hot spot is not PTSM because it was not considered a discernible source although lead concentrations are high. The lead hot spot is considered to be low-level threat source material (LLTSM).

Key findings for the Ash Area include the following:

- Soil sampling activities confirm the presence of a dark, low density ash layer remaining in place to depths of 1.5 m (5 ft) bls. This constitutes the primary source material for the exposure unit. The ash layer is LLTSM.

- The only refined human health COC for the future industrial worker is arsenic. Arsenic is associated with the portion of the exposure unit where the ash layer is observed. No other contaminant sources are identified.

Key findings for the Trenches Area include the following:

- Two areas of primary source material remain in place at the unit. Both the debris and ash that is buried to depths of 3.7 m (12 ft) within a large T-shaped trench and the asphaltic debris at and near the surface in the northwestern corner are LLTSM.

- Unlike many disposal trenches at SRS, the trench was not covered with a layer of clean fill when it was closed. Waste is present near the ground surface.

- Seven refined COCs are identified for the Trenches Area and include arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, PCE, and TCE.

- Out of seven refined COCs, five are refined human health COCs for the future industrial worker and include arsenic, benzo(a)anthracene, benzo(a) pyrene, benzo(b) fluoranthene, and dibenzo (a,h)anthracene. The arsenic is associated with trench debris and ash. The PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene) are associated with the asphaltic debris present near the surface in some parts of the unit. PCE and TCE are the two refined CMCOCs. Both of these are associated with the ash material disposed of in the western portion of the trench.

Surface Water and Sediment

The outfall drainages have been impacted by NPDES permitted process and stormwater discharges. However, no refined COCs are identified for surface water or sediment.

Groundwater

PCE and TCE were detected in groundwater monitoring wells on and adjacent to the ARP OU. However, based on the data collected in the remedial investigation and subsequent evaluation, the ARP OU has not contributed to groundwater contamination in this area. In the past, the A-014 Outfall released large amounts of wastewater contaminated with TCE/PCE. The TCE/PCE leached into the soil column and eventually leached into the groundwater adjacent to and beneath the ARP OU.

Site-Specific Factors

No site-specific factors affect the preferred remedial action for the ARP OU.

Contaminant Transport Analysis

Figure 8 presents the contaminant migration conceptual model for contaminant migration analysis performed for the ARP OU. The analysis of contaminant fate and transport was based on chemical and hydraulic conductivity data, which was collected from soil sampling investigations conducted at the ARP OU. The analysis was performed to determine the potential for each contaminant migration constituent of potential concern (CMCOPC) to leach to groundwater, to predict the migration data for each CMCOPC, and to project CMCOPC concentrations delivered to a hypothetical well located adjacent to the unit via vadose zone pore water and groundwater. The CMCOPCs were selected from the USCs by a screening process that involved a series of screening steps using conservative simplified assumptions. After CMCOPCs were identified through the soil leachability screening process, they were further evaluated using a more detailed contaminant migration conceptual model using unit-verified data. The purpose of the detailed model was to identify any constituents that could migrate from the unit through the vadose zone and impact groundwater above MCLs within 1000 years. Based on the modeling results, there are no CMCOCs associated with the following two ARP OU subunits: Piles Area and Ash Area. However, the modeling did predict that PCE and TCE would exceed their respective maximum contaminant level (MCL) of 5 μg/L in

about 500 and 200 years, respectively, in the Trenches Area subunit. Therefore, these constituents are identified as refined CMCOCs only for the Trenches Area subunit. Soil samples collected in native soils beneath the contaminated ash in the trench were clean. This indicates the PCE and TCE contamination in the trench has not migrated below the trench, which demonstrates that the ARP source unit has not contributed to the groundwater contamination in this area. The groundwater does not outcrop in the vicinity of the ARP OU. The PCE and TCE are limited to the western portion of the T-shaped trench.

Figure 8 presents a schematic cross-section and CSM of the ARP OU showing the refined human health and contaminant migration COCs.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

Current and expected future land uses are discussed in the following paragraphs.

Current Land Use

Currently the ARP OU is not in use. Access to the SRS is controlled by USDOE. General public access is prohibited and site access is limited by security personnel and fences. Once within the SRS boundaries, access to the ARP OU is not restricted. Access to the ARP OU is by an unpaved road along a utility corridor. The ARP OU is not fenced and is infrequently mowed beneath the power lines. The nearest area surrounding the unit is A-Area, which is contiguous to the north side of the ARP OU.

The only potential occasional visitors to the ARP OU would be the known on-unit workers who come to the area on an infrequent or occasional basis. The known on-unit workers are defined as SRS employees who work at or in the vicinity of the ARP OU under current land use conditions and include, but are not limited to, researchers, environmental samplers, or personnel in close proximity to the unit. However, these

receptors, which may be involved in the excavation or collection of contaminated media, would be following the SRS procedures and protocols for sampling at contaminated waste units.

Groundwater near the ARP OU is not currently used for consumption by the on-unit workers. The potentially exposed receptor evaluated for the current land use scenario is the known on-unit worker.

Future Land Use

The ARP OU is located in an area that has been recommended for future industrial use by the SRS Citizens Advisory Board (CAB). According to the *Savannah River Site: Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited. The *Savannah River Site Federal Facility Agreement Implementation Plan* (WSRC 1996) designates the ARP OU as being within an industrial use area with buffer. The report's future-use recommendation is future industrial, which is essentially unchanged from the current land use. Under industrial land use, the most likely human receptors will be industrial workers. Although residential development is unlikely, a hypothetical residential exposure scenario for both adults and children has been evaluated to allow comparison in accordance with USEPA - Region IV guidance (USEPA 1995). However, future use of the land is not likely to change from current use.

Groundwater Uses/Surface Water Uses

SRS does not use the water table (Steed Pond) aquifer for drinking water or irrigation purposes and currently controls any drilling in this area. Therefore, as long as USDOE maintains control of SRS, the aquifer beneath the ARP OU will not be used as a potential drinking water source or for irrigation.

Surface runoff from the unit may enter the two drainages that bound the unit. However, these drainages are not being used for irrigation or other beneficial uses.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment

As a component of the RFI/RI process, a BRA was performed for the ARP OU. The BRA included human health and ecological risk assessments. The exposure routes and receptors are discussed below.

Exposure Routes

Exposure routes for human and ecological receptors at the ARP OU may include the following:

- Ingestion of contaminated media, including soil, sediment, surface water, groundwater, biota, and homegrown produce
- Inhalation of volatile emissions and particulates
- Dermal contact with contaminated media, including soil, sediment, surface water, and groundwater

Receptors (Human and Ecological)

Human and ecological receptors are identified based on physical and operational knowledge of the site and local demographics, as well as known and hypothetical land uses.

Human receptors may include the following:

- Known on-unit workers
- Hypothetical industrial workers

- Hypothetical on-unit residents (adolescent for evaluation of surface water and sediment and adult and child for evaluation of other media)

Since the ARP OU is located within the controlled boundaries of SRS, trespassers are not considered to be potential receptors.

The hypothetical on-unit industrial worker exposure scenario addresses long-term risks to workers who are exposed to unit-related constituents while working within an industrial setting. The hypothetical on-unit industrial worker is an adult who works in an outdoor industrial setting in direct proximity to the contaminated media for the majority of the time.

The hypothetical on-unit resident exposure scenario evaluates the long-term risks to individuals expected to have unrestricted use of the unit. It assumes that residents live on-unit and are chronically exposed (both indoors and outdoors) to unit-related constituents. The hypothetical on-unit resident includes adults and children who are exposed to all the contaminated media. The residential scenario assumes the possible exposure to soil from a depth of 0 to 0.3 m (0 to 1 ft). For all noncarcinogenic exposures to residents, a child and an adult are the receptors that are evaluated. For all carcinogenic exposures to residents, a weighted average child/adult is evaluated. This assumes that a portion of the overall lifetime exposure to carcinogens occurs at a higher level of intensity during the first six years of a child's life.

Ecological receptors may include the following:

- Terrestrial ecological receptors (e.g., soil dwelling invertebrates, omnivorous birds, and herbivorous and insectivorous mammals)

- Aquatic and semi-aquatic biota (e.g., benthic invertebrates, amphibians, fish, and top predators that feed on these species)

Summary of the Human Health Risk Assessment

Based on the existing analytical data, an evaluation was conducted to estimate the human health and environmental problems that could result from the current physical and waste characteristics of the ARP OU. Figures 11 through 13 present the detailed CSMs used for each of the three subunits on which to base the risk assessment. The risks associated with each subunit are presented in the following paragraphs.

Piles Area

At the Piles Area, two very small localized areas of concern were identified:

- the PCB/PAH waste pile, and
- the lead hot spot.

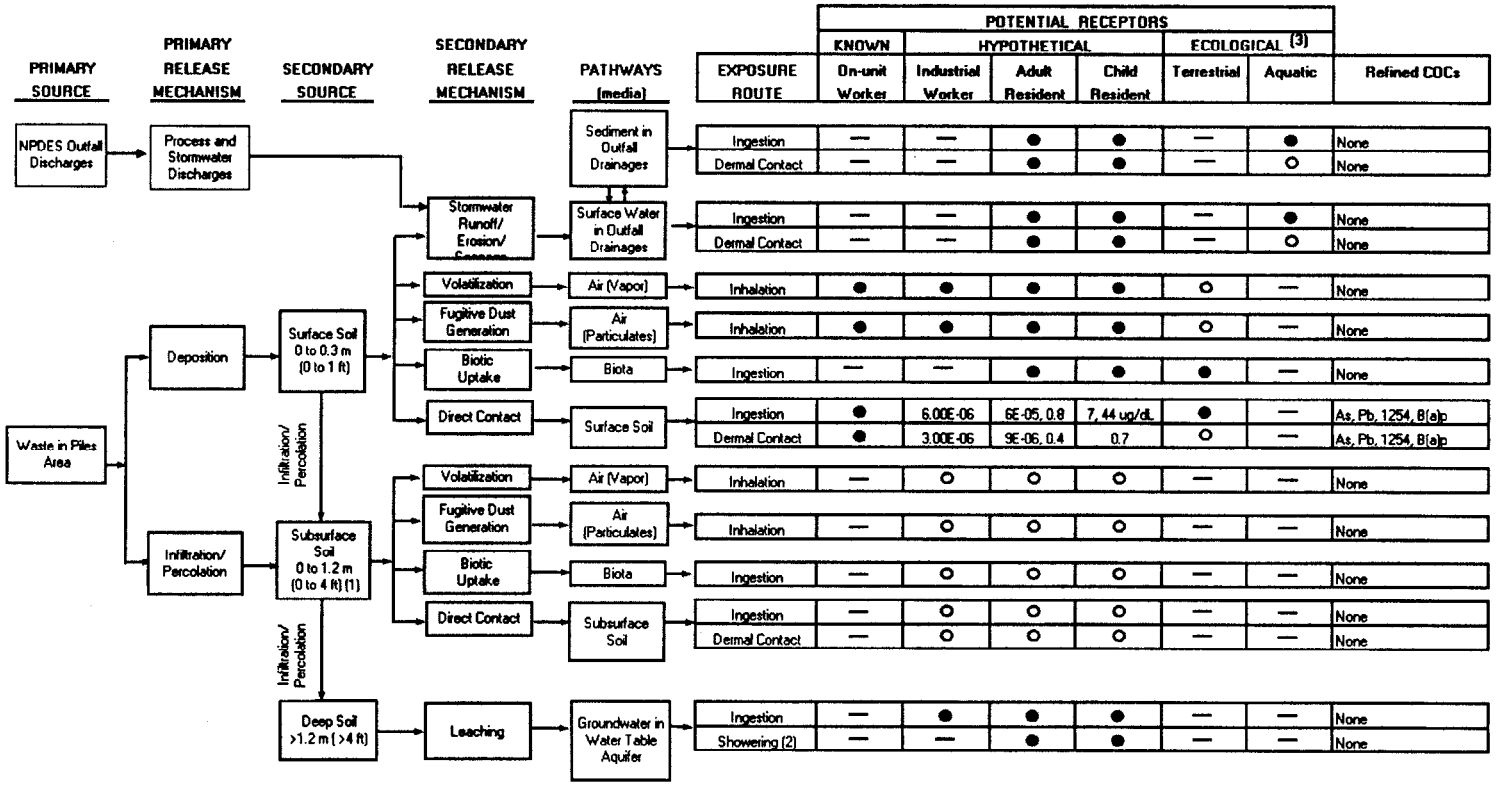
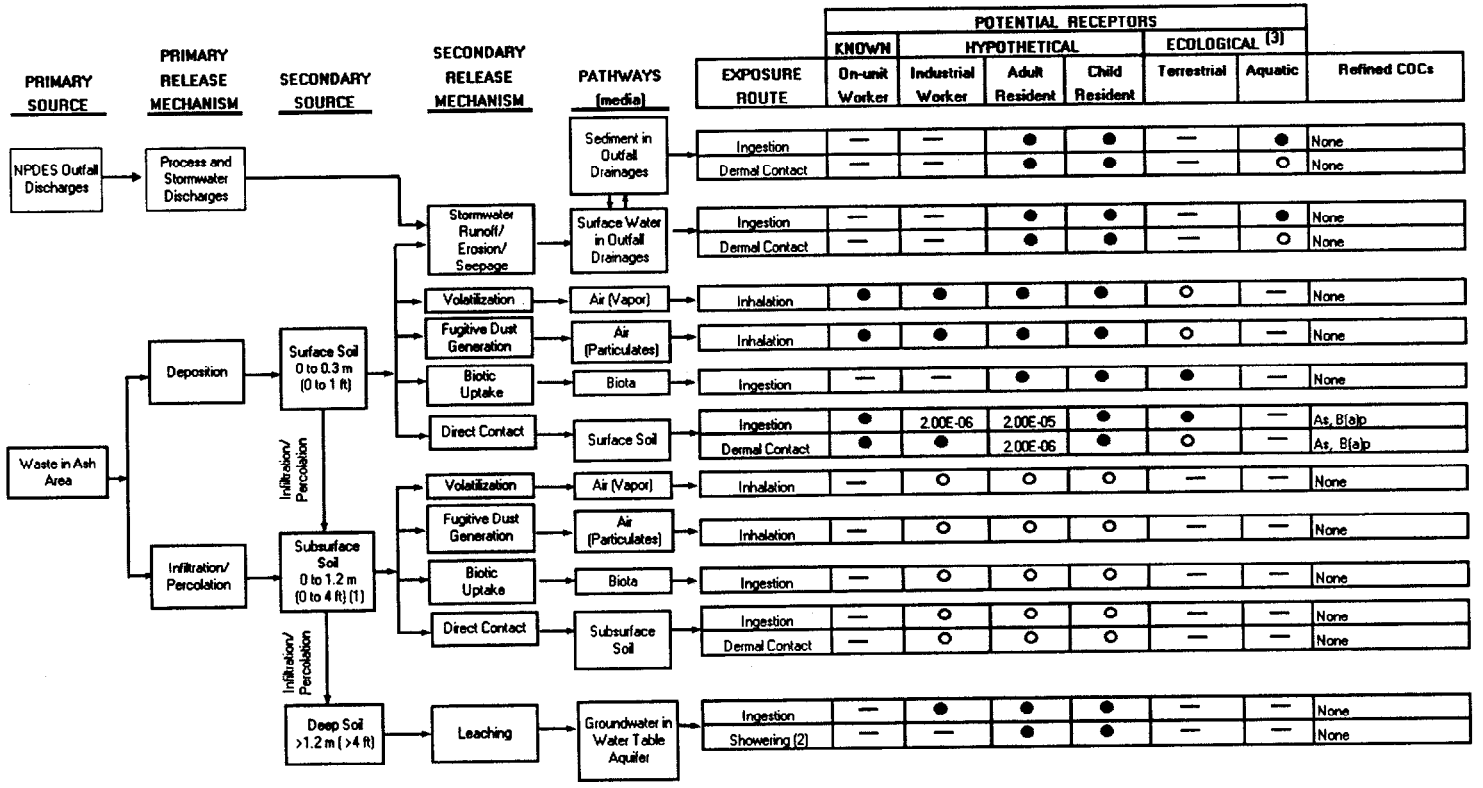


Figure 11. Revised Conceptual Site Model for the Piles Area Subunit



LEGEND

→ = Pathways, current, historical and future
● = Principal pathways quantitatively evaluated; no refined COCs warranting remedial action were identified.
○ = Principal pathways qualitatively evaluated; no refined COCs warranting remedial action were identified.
— = Incomplete pathways

(1) Conditions at this unit preclude excavation and bioturbation at depths >1' in the surface soil; therefore, all subsurface soil pathways are evaluated qualitatively only.
(2) Showering scenario includes both inhalation and dermal contact pathways.
(3) Ecological risk assessment performed on unit as a whole.

Refined COC Abbreviations

As - Arsenic

B(a)p - Benzo(a)pyrene

Figure 12. Revised Conceptual Site Model for the Ash Area Subunit

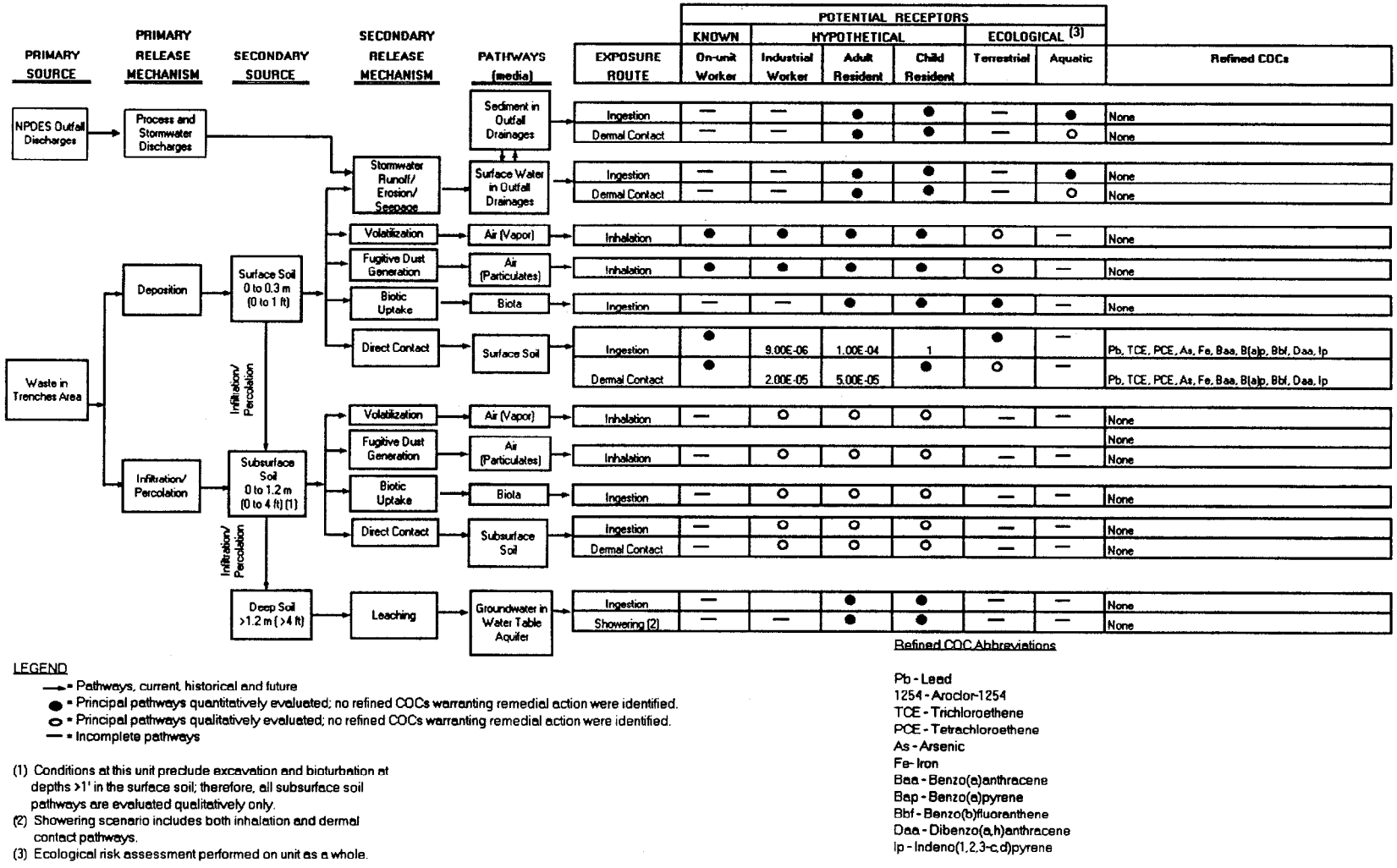


Figure 13. Revised Conceptual Site Model for the Trenches Area Subunit

The arsenic and aroclor-1254 (a PCB) associated with these two small hot spots in the Piles Area pose potential carcinogenic risks of 9 $x10^{-6}$ and $7x10^{-5}$ to future industrial workers and residents, respectively. The risks associated with the PAHs in the waste pile were not quantified in the baseline risk assessment because composite samples from the waste pile were not included in the 0 to 0.3 m (0 to 1 ft) exposure data set. The waste pile in question was created during the characterization by physically pushing soil and debris aside to allow for 0-1 foot soil samples to be collected adjacent to the debris piles. Based on the physical shape of the pile, it was not appropriate to designate 0-1 foot samples. Grab and composite samples were taken from the pile by auguring into the side of the pile at several locations. These data were used to determine if the waste pile is PTSM. The lead hot spot contains elevated levels of lead that contribute to unacceptable levels of the potential non-carcinogenic risk. The PCB/PAH waste pile contains levels of aroclor-1254 (greater than 1 mg/kg) and benzo(a)pyrene (a PAH) that contribute to the potential risk. Aroclor-1254, arsenic, and lead (human-health COCs) are present in the Piles Area at acceptable risk levels (less than $1x10^{-6}$ under a hypothetical future residential scenario) if the two hot spots are removed.

The PCB/PAH waste pile was identified as PTSM due to the high toxicity of benzo(a)pyrene and because it occupies a significant volume. The lead hot spot is not PTSM because it was not considered a discernible source although lead concentrations are high.

Ash Area

In the Ash Area, arsenic was identified as a human-health COC for the future industrial worker and resident exposed to surface soil (ingestion risk $2x10^{-6}$ and $2x10^{-5}$, respectively).

Average arsenic concentrations are approximately two-times higher than average unit-specific background concentrations. The source material in the Ash Area is considered LLTSM.

Trenches Area

In soil at the Trenches Area, human-health COCs include arsenic and the following PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h) anthracene. The total carcinogenic risks associated with exposure to soil for a future industrial worker and resident are 3×10^{-5} and 2×10^{-4}, respectively. The primary contaminants are benzo(a)pyrene (associated with the asphaltic debris source area) and arsenic (throughout the subunit). Risks from benzo(a)pyrene for the future industrial worker exposed to surface soil are 5×10^{-6} (ingestion risk) and 1×10^{-5} (dermal risk); and for the future resident adult are 5×10^{-5} (ingestion risk) and 3×10^{-5} (dermal risk). Risks from arsenic for the future industrial worker and resident exposed to surface soil are 3×10^{-6} and 3×10^{-5}, respectively (ingestion risk). The source material in the Trenches Area is considered as LLTSM.

Summary of ARP OU COCs and Risks

Table 8 summarizes the refined COCs for the future industrial workers associated with surface soils pertaining to the Piles Area, Ash Area, and Trenches Area subunits and includes COCs maximum detected concentrations, detection frequencies, and exposure point concentrations at 95% upper confidence level (UCL).

Tables 9 and 10 summarize the cancer and non-cancer toxicity data associated with soils pertaining to ARP OU.

Table 11 summarizes the risk to future industrial workers exposed to COCs present in the surface soils pertaining to the Piles Area, Ash Area, and Trenches Area.

Table 8. Summary of Refined Constituents of Concern and Their Medium Specific Exposure Point Concentrations

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
A-Area Miscellaneous Rubble Pile OU – Piles Area

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Soil Onsite – Direct Contact	Arsenic	0.21	84.6	mg/kg	20/23	8.77	mg/kg	95% UCL
	Lead	1.60	96000	mg/kg	21/23	11400	mg/kg	95% UCL
	Aroclor-1254	0.055	94.5	mg/kg	3/22	11.7	mg/kg	95% UCL

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
A-Area Miscellaneous Rubble Pile OU – Ash Area

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Soil Onsite – Direct Contact	Arsenic	0.88	34.2	mg/kg	32/34	7.05	mg/kg	95% UCL

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
A-Area Miscellaneous Rubble Pile OU – Trenches Area

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Soil Onsite – Direct Contact	Arsenic	0.49	37.4	mg/kg	31/31	13.1	mg/kg	95% UCL
	Benzo(a)anthracene	0.0382	23.3	mg/kg	15/34	5.07	mg/kg	95% UCL
	Benzo(a)pyrene	0.0228	19.0	mg/kg	18/34	4.23	mg/kg	95% UCL
	Benzo(b)fluoran-thene	0.0207	34.8	mg/kg	20/34	5.74	mg/kg	95% UCL
	Dibenzo(a,h)anthra-cene	0.0555	3.31	mg/kg	12/34	0.685	mg/kg	95% UCL

Key
95% UCL: 95% Upper Confidence Limit

Table 9. Cancer Toxicity Data Summary

Pathway: Oral, Dermal						
Constituent of Concern	**Oral Cancer Slope Factor**	**Dermal Cancer Slope Factor**	**Slope Factor Units**	**Weight of Evidence/ Cancer Guideline Description**	**Source**	**Date (M/D/Y)**
Arsenic	1.5E+00	1.88E+00	kg-day/mg	A	IRIS	03/01/99
Lead	None	None	---	B2	---	---
Benzo(a)anthracene	7.3E-01	2.35E+00	kg-day/mg	B2	IRIS[1]	03/01/99
Benzo(a)pyrene	7.3E+00	2.35E+01	kg-day/mg	B2	IRIS	03/01/99
Benzo(b)fluoranthene	7.3E-01	2.35E+00	kg-day/mg	B2	IRIS[1]	03/01/99
Dibenzo(a,h)anthracene	7.3E+00	2.35E+01	kg-day/mg	B2	IRIS[1]	03/01/99
Aroclor-1254	2.0E+00	2.22E+00	kg-day/mg	B2	IRIS	03/01/99

Pathway: Inhalation							
Constituent of Concern	**Unit Risk**	**Units**	**Inhalation Cancer Slope Factor**	**Units**	**Weight of Evidence/ Cancer Guideline Description**	**Source**	**Date (M/D/Y)**
Arsenic	4.3E-03	m^3/ug	1.51E+01	kg-day/mg	A	IRIS	03/01/99
Lead	None	---	None	---	B2	---	---
Benzo(a)anthracene	8.8E-05	m^3/ug	3.08E-01	kg-day/mg	B2	IRIS[2]	10/01/95
Benzo(a)pyrene	8.8E-04	m^3/ug	3.08E+00	kg-day/mg	B2	NCEA[3]	10/01/95
Benzo(b)fluoranthene	8.8E-05	m^3/ug	3.08E-01	kg-day/mg	B2	IRIS[2]	10/01/95
Dibenzo(a,h)anthracene	8.8E-04	m^3/ug	3.08E+00	kg-day/mg	B2	IRIS[2]	10/01/95
Aroclor-1254	5.7E-04	m^3/ug	2.00E+00	kg-day/mg	B2	IRIS	03/01/99

Key
---: No information available
IRIS: Integrated Risk Information System, USEPA
NCEA: National Center for Environmental Assessment, USEPA

1- Used slope factor for benzo(a)pyrene as surrogate and adjusted using toxicity equivalency factors.
2- Inhalation slope factor of benzo(a)pyrene was taken from NCEA as cited in EPA 1995.
3- Inhalation slope factor of benzo(a)pyrene was used as a surrogate and adjusted with toxic equivalence factors, as specified by EPA Region IV (EPA 1995).

A- Human carcinogen
B2- Probable human carcinogen – indicates sufficient evidence in animals and inadequate or no evidence in humans

Table 10. Non-Cancer Toxicity Data Summary[1]

Pathway: Oral, Dermal

Constituent of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (M/D/Y)
Arsenic	Chronic	3.0E-04	mg/kg- day	2.4E-04	mg/kg - day	skin	3	IRIS	03/01/99
Lead	Chronic	None	--	None	--	CNS	---	ATSDR	12/01/97
Benzo(a)anthracene	Chronic	3.0E-2	mg/kg - day	9.3E-03	mg/kg -day	kidney	3000	IRIS[2]	03/01/99
Benzo(a)pyrene	Chronic	3.0E-2	mg/kg - day	9.3E-03	mg/kg-day	kidney	3000	IRIS[2]	03/01/99
Benzo(b)fluoranthene	Chronic	3.0E-2	mg/kg - day	9.3E-03	mg/kg-day	kidney	3000	IRIS[2]	03/01/99
Dibenzo(a,h)anthracene	Chronic	3.0E-2	mg/kg - day	9.3E-03	mg/kg- day	kidney	3000	IRIS[2]	03/01/99
Aroclor-1254	Chronic	2.0E-05	mg/kg - day	9.0E-01	mg/kg- day	eye	300	IRIS	03/01/99

Pathway: Inhalation

Constituent of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (M/D/Y)
Arsenic	Chronic	None	---	None	---	---	---	---	---
Lead	Chronic	None	---	None	---	---	---	---	---
Benzo(a)anthracene	Chronic	None	---	None	---	---	---	---	---
Benzo(a)pyrene	Chronic	None	---	None	---	---	---	---	---
Benzo(b)fluoranthene	Chronic	None	---	None	---	---	---	---	---
Dibenzo(a,h)anthracene	Chronic	None	---	None	---	---	---	---	---
Aroclor-1254	Chronic	None	---	None	---	---	---	---	---

Key

---: ***no information available***
IRIS: **Integrated Risk Information System, USEPA**
ATSDR: **Agency of Toxic Substances and Disease Registry**
RfD: **reference dose**
RfC: **reference concentration**

1 – Table provided for information purposes only, noncancer toxicity data presented for those constituents that both carcinogenic and noncarcinogenic risks were calculated. Noncarcinogenic risk thresholds for this unit were not exceeded.
2- Used the pyrene RfD as a surrogate for other PAHs.

Table 11. Risk Characterization Summary – Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult
A-Area Miscellaneous Rubble Pile OU – Piles Area

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil – Piles Area	Soil Onsite Direct Contact	Arsenic	2.30×10^{-6}	2.00×10^{-9}	1.84×10^{-7}	2.49×10^{-6}
			Aroclor-1254	4.09×10^{-6}	3.53×10^{-10}	2.91×10^{-6}	7.00×10^{-6}
			Lead[1]	---	---	---	---
						Soil Risk Total =	9.49×10^{-6}

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult
A-Area Miscellaneous Rubble Pile OU – Ash Area

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil – Ash Area	Soil Onsite-Direct Contact	Arsenic	1.85×10^{-6}	1.61×10^{-9}	1.48×10^{-7}	2.00×10^{-6}
						Soil Risk Total =	2.00×10^{-6}

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult
A-Area Miscellaneous Rubble Pile OU – Trench Area

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil – Trench Area	Soil Onsite-Direct Contact	Arsenic	3.43×10^{-6}	2.99×10^{-9}	2.75×10^{-7}	3.71×10^{-6}
			Benzo(a)anthracene	6.47×10^{-7}	2.36×10^{-11}	1.34×10^{-6}	1.99×10^{-6}
			Benzo(a)pyrene	5.40×10^{-6}	1.97×10^{-10}	1.11×10^{-5}	1.65×10^{-5}
			Benzo(b)fluoranthene	7.32×10^{-7}	2.67×10^{-11}	1.51×10^{-6}	2.24×10^{-6}
			Dibenzo(a,h)anthracene	8.74×10^{-7}	3.18×10^{-11}	1.80×10^{-6}	2.67×10^{-6}
						Soil Risk Total =	2.71×10^{-5}

Key

1- Lead toxicity criteria are not available to quantitatively address either carcinogenic or noncarcinogenic routes of exposure. Lead is a COC based on blood lead modeling. USEPA recommends the use of uptake models for evaluating lead exposures if the unit concentrations for lead exceed the 400 mg/kg OSWER screening level in soil.

Summary of Ecological Risk Assessment

The purpose of the ecological risk assessment component of the BRA is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related constituents. Based on a lines-of-evidence approach, aroclor 1254, arsenic, cadmium, copper, lead and zinc were identified as final ecological COPCs. In order to reduce critical uncertainty in the ecological risk assessment related to these constituents, site specific biological sampling was conducted. Small mammals were collected at the site and sampled for body burden analysis. Soil samples from the unit were also collected for earthworm toxicity testing and body burden analysis (bioaccumulation study). The biological analysis and toxicity testing provided additional lines of evidence to conclude that there are no unacceptable risks to ecological receptors at any of the three subunits (Piles Area, Ash Area, and Trenches Area) associated with the ARP OU.

Summary of Contaminant Fate and Transport Analysis

Modeling was performed to evaluate the potential for soil contaminants to leach to groundwater. Based on the results of the modeling, no CMCOCs are associated with the following ARP subunits: Piles Area and Ash Area. However, the modeling did predict that PCE and TCE would exceed their respective MCLs of 5 μg/L in about 500 and 200 years, respectively, in the Trenches Area. Soil samples taken from vadose zone show that PCE and TCE have not migrated from the trench. Therefore, these constituents are identified as refined CMCOCs for the Trenches Area. The PCE and TCE are limited to the western portion of the T-shaped trench.

Principal Threat Source Material

At the Piles Area, the PCB/PAH waste pile is identified as PTSM because of the high toxicity of benzo(a)pyrene, and the lead hot spot is considered LLTSM. At the Ash Area, no PTSM was identified; however, the Ash Area contains LLTSM. At the Trenches Area, the nature and extent of the trench source materials were characterized by three exploratory trenches and by soil borings across the unit. Both the trench source and asphalt debris source are considered LLTSM.

Conclusion

The findings from the risk assessment and contaminant fate and transport analysis indicate that concentrations of PAHs, PCBs, PCEs, and TCE in the soils at the ARP OU pose unacceptable risks to human health and the environment. Based on the concentration and associated toxicity of benzo(a)pyrene, the PCB/PAH waste pile is identified as PTSM. Further, the PCB concentrations in the waste pile exceed the 1 mg/kg limit for high occupancy use (ARAR level). The concentrations of PCE and TCE in fill material in the Trenches Area are predicted to impact groundwater above MCLs in the future. Hence, actual or threatened releases of hazardous substances, pollutants or contaminants from this unit, if not addressed by implementing the response actions selected in the ROD or one of the other active measures considered, will present a current or potential threat to public health, welfare, or the environment.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

Remedial action objectives (RAOs) are used as the framework for developing remedial alternatives and are put together to achieve the goal of protecting human health and the environment. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human, environmental, or ecological exposure, and ARARs. The RAOs are designed to protect human health, environmental resources, and the ecology (i.e., biota exposure) from unacceptable exposure to COCs.

The development of remedial goals (RGs) for remedial actions is intended to protect human health and the environment and to prevent further migration of contaminants. Remedial goal options (RGOs) are risk-based chemical concentration ranges that are used as target clean-up criteria. They are considered in the CMS/FS process during development and selection of remedial alternatives. RGOs are developed for all COCs. The RGs selected from the RGOs for the ARP OU are a combination of ARAR values and the lowest of the risk-based RGOs. However, if the RG is less than two times the average background concentration, two times average background is used.

For lead, USEPA has established 400 mg/kg as a to-be-considered (TBC) criteria in evaluating risk (USEPA 1994). For ARP OU, this chemical-specific value was selected as the RG. For PCBs (aroclor-1254), the Toxic Substances Control Act (TSCA) establishes a cleanup action level of 1 mg/kg at the surface in high occupancy areas (that includes future unrestricted use).

The ARP OU is located in an area that has been recommended for future industrial use by the SRS CAB. *The Savannah River Site Future Use Report Stakeholder Recommendations for SRS Land and Facilities* (USDOE 1996) includes the recommendation that "residential uses of SRS land should be prohibited," and the *Savannah River Site Federal Facility Agreement Implementation Plan* (WSRC 1996) designated the ARP OU as being within an industrial use area with buffer. The planned future use of the ARP by USDOE continues to be industrial use. Therefore, the specific RAOs and RGs identified for the ARP OU are based on the future industrial worker scenario and achieving ARARs. The RGs established for the ARP OU are provided in Table 12.

Table 12. Industrial Land Use Remedial Goals

Subunit	Remedial Action Objectives	Refined COC	Remedial Goal (mg/kg)	Basis
Piles Area	Protect the future industrial worker or resident from exposure to arsenic and lead in the lead "hot spot."	Arsenic Lead	4.4 400	2X average background USEPA TBC criteria
	Protect the future industrial worker or resident from exposure to aroclor-1254 and benzo(a)pyrene in the PCB/PAH waste pile.	Aroclor-1254 Benzo(a)pyrene	1 0.052	TSCA action level 1 x 10^{-6} risk level[a]
Ash Area	Protect the future industrial worker from exposure to elevated levels of arsenic in the surface soil.	Arsenic	4.4	2X average background
Trenches Area	Protect the future industrial worker from exposure to arsenic and PAHs in the soil.	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(a)fluoranthene Dibenzo(a,h)anthracene	4.4 2.56 0.256 2.56 0.256	2X average background 1 x 10^{-6} risk level 1 x 10^{-6} risk level 1 x 10^{-6} risk level 1 x 10^{-6} risk level
	Prevent leaching of TCE and PCE to groundwater above their respective MCLs (5 µg/L).	Tetrachloroethylene Trichloroethylene	0.656 0.0877	Contaminant migration soil cleanup level

[a] The $1x10^{-6}$ risk level is based on a resident, consistent with unrestricted use in the Piles Area.

Remedial Action Objectives for the Piles Area

Based on the human-health risks posed by contaminants in the soil in the Piles Area, the RAOs for the Piles Area are as follows:

- Protect the future industrial worker or resident from exposure to arsenic and lead in the lead hot spot above their respective RGs of 4.4 mg/kg and 400 mg/kg. For extent of soil contamination in the lead hot spot, refer to Figure 14.

PARAMETER	DEPTH (FT)	ARPPB01	ARPPB02	ARPPB03	ARPSB31	ARPPB04	ARPPB05
Lead	0-1	33.8 B	133 B	6.14	**96000 B**	3.56	6.45
	1-4	29 B	26.5 B	7.01	48.5 B	3.96	4.56
	5-7				17.2 B		
	8-10				7.92		

Concentrations outlined in bold are those which exceed the Most Restrictive RGO for Lead
Most Restrictive RGO = 400 mg/kg

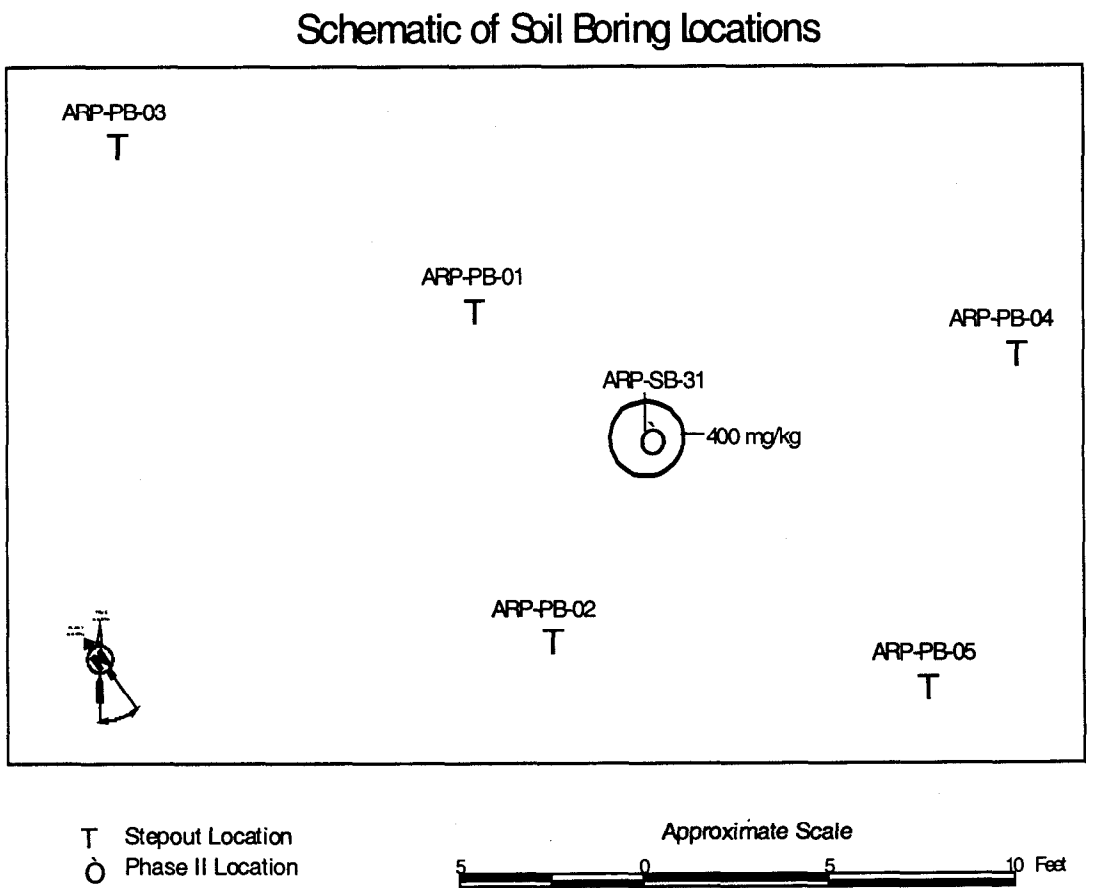


Figure 14. Extent of Soils Exceeding the RG for Lead in the Lead Hot Spot at the ARP OU

- Protect the future industrial worker or resident from exposure to aroclor-1254 (a PCB) and benzo(a)pyrene (a PAH) in the PCB/PAH waste pile above their respective RGs of 1 mg/kg and 0.052 mg/kg. The extent of the PCB/PAH soil contamination is limited to within the waste pile, which occupies about 7.6 m^3(10 yd^3).

Remedial Action Objectives for the Ash Area

Based on the human-health risks posed by contaminants in the soil in the Ash Area, the RAO for the Ash Area is the following:

- Protect the future industrial worker from exposure to elevated levels of arsenic in the surface soil above the RG of 4.4 mg/kg. For the extent of soil contamination in the Ash Area subunit, refer to Figure 15.

Remedial Action Objectives for the Trenches Area

Based on the human-health risks posed by contaminants in the soil in the Trenches Area, the RAOs for the Trenches Area are as follows:

- Protect the future industrial worker from exposure to arsenic and PAHs in the soil above their respective RGs (Table 12). For the extent of soil contamination in the Trenches Area subunit, refer to Figures 15 (for arsenic) and 16 for PAHs (benzo(a)pyrene).

- Prevent leaching of TCE and PCE to groundwater above their respective MCLs (5 μg/L). For extent of TCE contamination in ARP OU soils, refer to Figures 17 and 18.

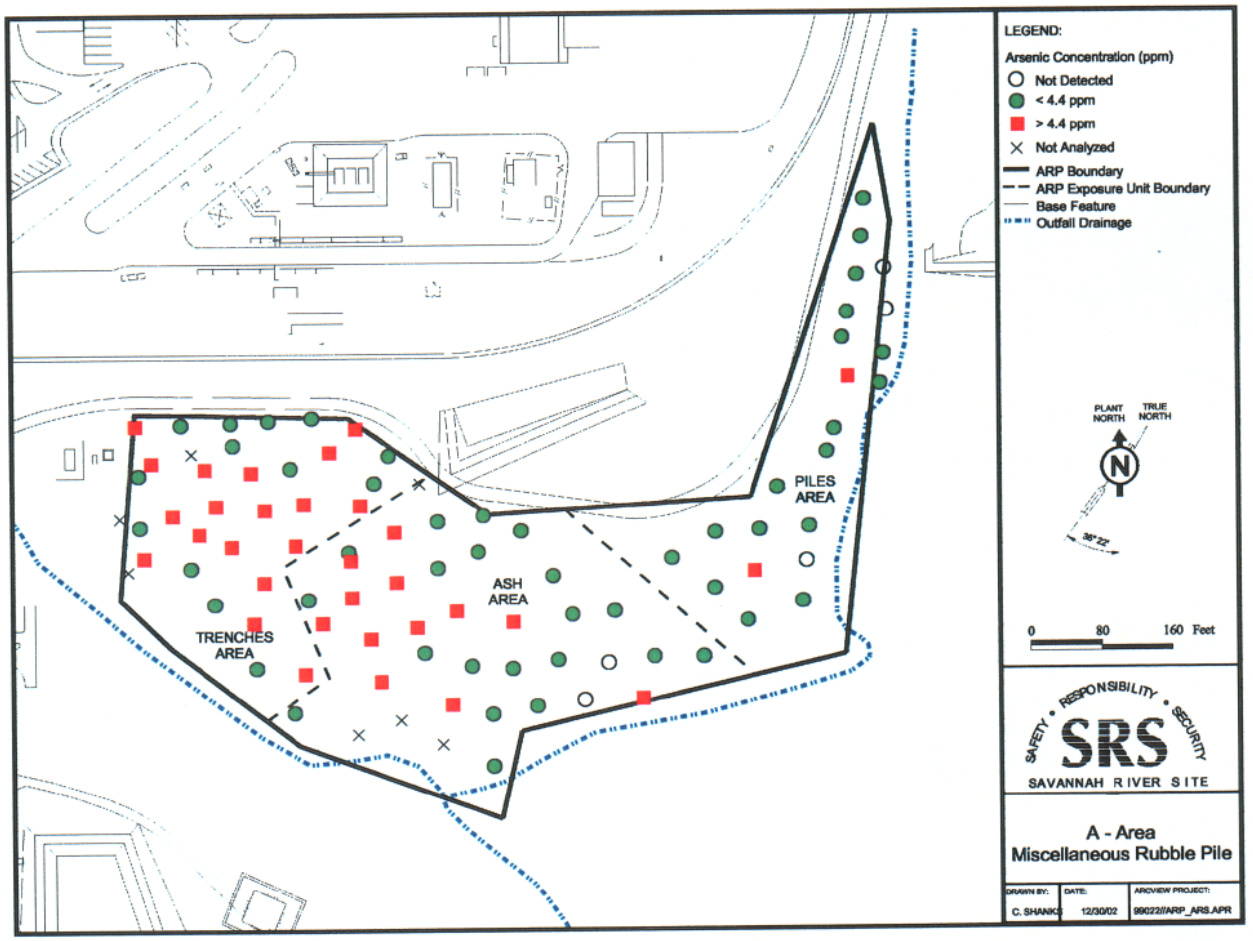


Figure 15. Extent of Soils Exceeding the RG for Arsenic from 0 to 1 ft bls at the ARP OU

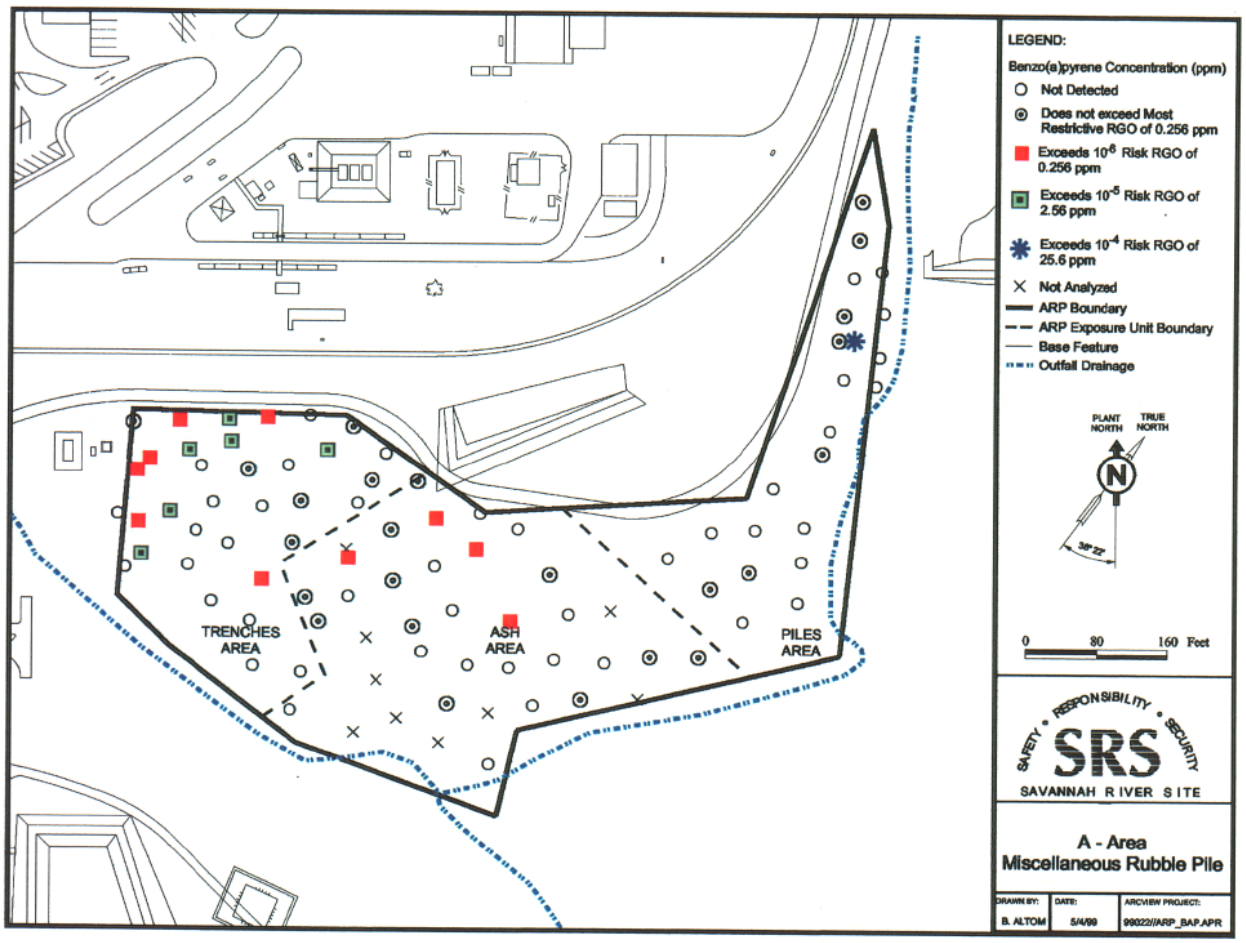


Figure 16. **Extent of Soils Exceeding the RG for Benzo(a)pyrene from 0 to 1 ft bls at ARP OU**

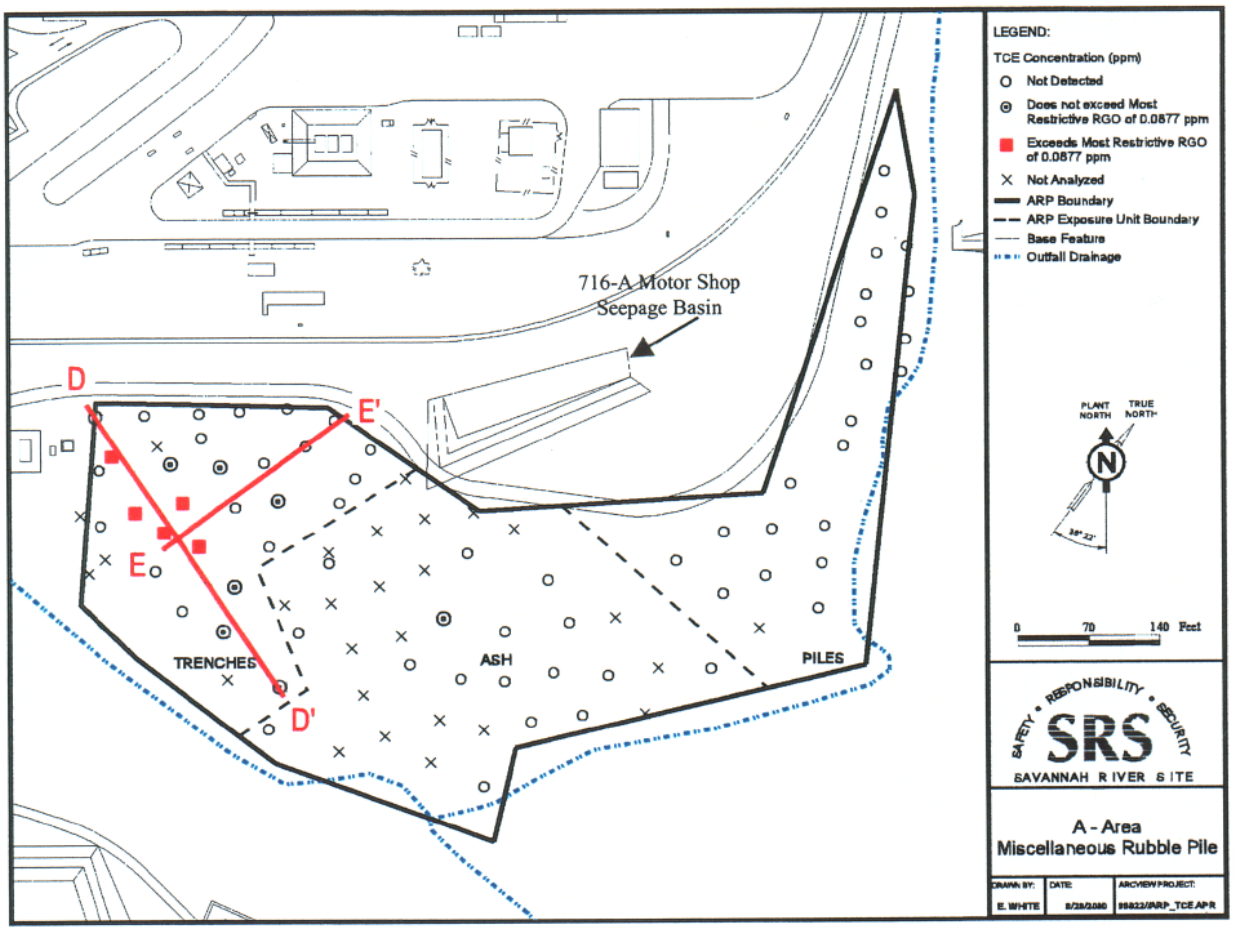


Figure 17. Extent of Soils Exceeding the RG for TCE from 0 to 1 ft bls at the ARP OU

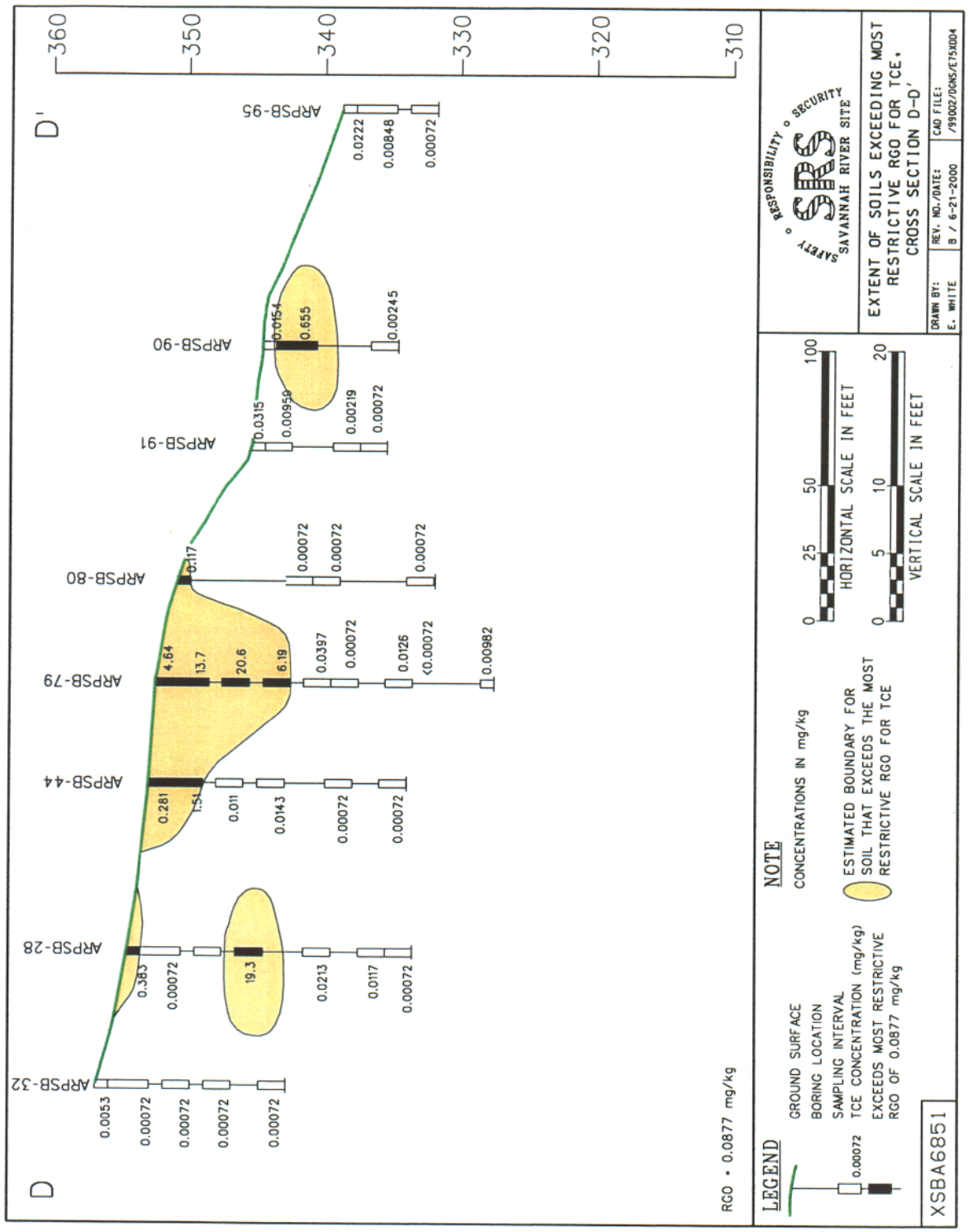


Figure 18. Extent of Soils Exceeding the RG for TCE, Cross Section D-D'

IX. DESCRIPTION OF ALTERNATIVES

A detailed analysis of the alternatives was conducted in the CMS/FS (WSRC 2001a) to determine the best set of remedial alternatives for the ARP OU. Remedial alternatives that contain institutional controls as part of the remedy are expected to continue for greater than 30 years, but for comparative purposes a 30 year present worth cost estimate was used. These alternatives are briefly discussed below:

Piles Area

Alternative 1 - No Action

The No Action alternative is required by the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The NCP requires an evaluation and presentation of the No Action alternative and serves as a baseline for comparison with other remediation alternatives.

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $0
- Estimated Annual Operations and Maintenance (O&M) Cost (includes 5-year remedy review): $5,000
- Estimated Present Worth (7% Discount Rate): $54,000
- Estimated Construction Time Frame: None

Description of Remedy Components

Treatment Components

Alternative 1, No Action, does not include treatment components.

Engineering Controls

Alternative 1, No Action, does not include engineering controls.

Administrative & Monitoring Controls

Alternative 1, No Action, requires no administrative or monitoring controls.

Operations and Maintenance

Alternative 1, No Action, requires no O&M.

Common Elements and Distinguishing Features

ARARs

Alternative 1, No Action, does not meet TSCA action level (40 CFR 781) for PCBs of 1 mg/kg for high occupancy use in the PCB/PAH waste pile. For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 1, No Action, does not protect human health and/or the environment and is not reliable.

Waste

Alternative 1 generates no wastes but leaves approximately 9.1 m^3 (12 yd^3) of untreated PCB/PAH- and lead-contaminated media in place. The PCB/PAH waste pile is considered PTSM.

Expected Outcomes of This Alternative

Land Use

Alternative 1, No Action, would not prohibit any land use.

Other Impacts and Benefits

Alternative 1, No Action, would allow unrestricted land use, which may expose future workers or residents to unacceptable health risks.

Alternative 2 - Institutional Controls

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $70,000
- Estimated Annual O&M Cost (includes 5-year remedy review): $21,000
- Estimated Present Worth (7% Discount Rate) O&M Cost: $200,000
- Estimated Total Present Worth Cost (7% Discount Rate): $320,000
- Estimated Construction Time Frame: 1 month
- Estimated Time to Achieve RAOs: 1 month

Description of Remedy Components

Treatment Components

Alternative 2, Institutional Controls, does not include treatment components.

Engineering Controls

Alternative 2, Institutional Controls, does not include engineered controls.

Administrative & Monitoring Controls

Alternative 2, Institutional Controls, requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Piles Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership.

No monitoring is required to support this alternative.

Operations and Maintenance

Alternative 2, Institutional Controls, requires periodic inspections to ensure that the required warning signs are in acceptable condition. Repairs and replacements resulting from soil erosion and/or loss of vegetation will be made on an as-needed basis.

Common Elements and Distinguishing Features

ARARs

Alternative 2, Institutional Controls, does not meet the TSCA action level (40 CFR 781) for PCBs of 1 mg/kg for high occupancy use in the PCB/PAH waste pile. For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 2, Institutional Controls, protects human health for as long as the controls are enforced.

Wastes

Alternative 2, Institutional Controls, generates no wastes but leaves approximately 9.1 m^3 (12 yd^3) of untreated PCB, PAH- and lead-contaminated media in place. The PCB/PAH waste pile is considered PTSM.

Expected Outcomes of This Alternative

Land Use

Within a month, Alternative 2, Institutional Controls, would prohibit future residential land use and restrict future industrial land use to prevent exposure to the waste left in place. Current workers are protected by SRS work control procedures.

Other Impacts and Benefits

Alternative 2, Institutional Controls, would prevent human exposure to the contaminants but is only effective for as long as the institutional controls are enforced.

Alternative 3- Removal and Disposal of the Lead Hot Spot and PCB/PAH Waste Pile

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $97,000
- Estimated Annual O&M Cost: $0
- Estimated Present Worth (7% Discount Rate) O&M Cost: $0

- Estimated Total Present Worth Cost (7%Discount Rate): $97,000
- Estimated Construction Time Frame: 1 month
- Estimated Time to Achieve RAOs: 1 month

Description of Remedy Components

Treatment Components

Alternative 3, Removal and Disposal, does not include treatment components.

Engineering Controls

Under Alternative 3, Removal and Disposal, the lead hot spot and PCB/PAH waste pile and underlying soil will be excavated and transported from SRS to a permitted offsite disposal facility. The lead hot spot will be excavated to a depth of approximately 1 foot below the land surface while the PCB/PAH waste pile will be excavated to native soil. Removal will continue until the remedial goals shown in Table 12 are achieved. The excavation will be backfilled with clean soil from an SRS borrow pit, graded, and revegetated.

Administrative & Monitoring Controls

Upon completion of Alternative 3, Removal and Disposal, no refined COCs will remain and, therefore, no administrative controls will be required.

No monitoring is required.

Operations and Maintenance

Upon completion of this alternative, no O&M are required.

Common Elements and Distinguishing Features

ARARs

Alternative 3, Removal and Disposal, meets the 400 mg/kg by USEPA 1994 screening level for lead and the TSCA action level (40 CFR 781) for PCBs. Removal of aroclor-1254 (a PCB) will achieve the TSCA action level of 1 mg/kg at depths less than 1 foot or of 10 mg/kg at depths greater than 1 foot from the land surface. This alternative would comply with the protection of the environment under the South Carolina Pollution Control Act (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control. For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 3, Removal and Disposal, removes all contamination and places it in a permitted offsite disposal facility. Once the contamination is removed, unrestricted land use is possible.

Wastes

Alternative 3, Removal and Disposal, would result in the removal and disposal of approximately 9.1 m^3 (12 yd^3) of untreated media contaminated with PCB/PAHs and lead. Once the contaminated media is removed, no unacceptable risks remain in the Piles Area. This will eliminate all PTSM from the subunit.

Expected Outcomes of This Alternative

Land Use

If the Piles Area is transferred to nonfederal ownership, unrestricted land use is possible.

Other Impacts and Benefits

Alternative 3, Removal and Disposal, permanently removes unacceptable levels of contamination present in the Piles Area and places it in a secure permitted disposal facility. Although planned future use of the Piles Area is industrial, removal of the hot spots would allow for potential unrestricted land use in the future.

Ash Area

Alternative 1 - No Action

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $0
- Estimated Annual O&M Cost (includes 5-year remedy review): $5,000
- Estimated Present Worth (7% Discount Rate): $54,000
- Estimated Construction Time Frame: None

Description of Remedy Components

Treatment Components

Alternative 1, No Action, does not include treatment components.

Engineering Controls

Alternative 1, No Action, does not include engineering controls.

Administrative & Monitoring Controls

Alternative 1, No Action, requires no administrative or monitoring controls.

Operations and Maintenance

Alternative 1, No Action, requires no O&M.

Common Elements and Distinguishing Features

ARARs

No ARARs (i.e., chemical-specific, location specific, or action specific) have been promulgated for the arsenic contamination present in the Ash Area soil. For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 1, No Action, is not effective or permanent.

Wastes

Alternative 1, No Action, leaves approximately 6,900 m^3 (9,000 yd^3) of untreated ash material contaminated with low-levels of lead in place. Residual risks are low due to the low-levels of the lead contamination present. There is no PTSM at this unit.

Expected Outcomes of This Alternative

Land Use

Alternative 1, No Action, would not prohibit any future land use.

Other Impacts and Benefits

Alternative 1, No Action, would allow unrestricted future land use, which may expose future workers or residents to unacceptable health risks.

Alternative 2 - Institutional Controls

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $70,000
- Estimated Annual O&M Cost (includes 5-year remedy review): $21,000
- Estimated Present Worth (7% Discount Rate) O&M Cost: $200,000
- Estimated Total Present Worth Cost (7% Discount Rate): $320,000
- Estimated Construction Time Frame: 1 month
- Estimated Time to Achieve RAOs: 1 month

Description of Remedy Components

Treatment Components

Alternative 2, Institutional Controls, does not include treatment components.

Engineering Controls

Alternative 2, Institutional Controls, does not include engineered controls.

Administrative & Monitoring Controls

Alternative 2, Institutional Controls, requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Ash Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership.

No monitoring is required.

Operations and Maintenance

Alternative 2, Institutional Controls, requires periodic inspections to ensure that the required warning signs are in acceptable condition. Repairs and replacements resulting from soil erosion and/or loss of vegetation will be made on an as-needed basis.

Common Elements and Distinguishing Features

ARARs

No ARARs (i.e., chemical-specific, location specific, or action-specific) have been promulgated for the arsenic contamination present in the Ash Area soil. For additional information regarding ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 2, Institutional Controls, protects human health for as long as the controls are enforced.

Waste

Alternative 2, Institutional Controls, leaves approximately 6,900 m^3 (9,000 yd^3) of untreated ash material contaminated with low-levels of arsenic in place. There is no PTSM at this subunit.

Expected Outcomes of This Alternative

Land Use

Alternative 2, Institutional Controls, would prohibit future residential land use and restrict future industrial land use to prevent future worker exposure to the waste left in place. Current workers are protected by SRS work control procedures.

Other Impacts and Benefits

Alternative 2, Institutional Controls, would prevent exposure to low-level arsenic contamination, but is effective only for as long as the institutional controls are enforced.

Trenches Area

Alternative 1 - No Action

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $0
- Estimated Annual O&M Cost (includes 5-year remedy review): $5,000
- Estimated Present Worth (7% Discount Rate): $54,000
- Estimated Construction Time Frame: None

Description of Remedy Components

Treatment Components

Alternative 1, No Action, does not include treatment components.

Engineering Controls

Alternative 1, No Action, does not include engineering controls

Administrative & Monitoring Controls

Alternative 1, No Action, no administrative or monitoring controls.

Operations and Maintenance

Alternative 1, No Action, requires no O&M.

Common Elements and Distinguishing Features

ARARs

For the no action alternative, no ARARs (i.e., chemical-specific, location-specific, or action-specific) have been promulgated for the Trenches Area. For additional information regarding ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 1, No Action, does not protect human health and/or the environment and is not reliable.

Waste

Alternative 1, No Action, would leave approximately 17,000 m^3 (22,000 yd^3) of untreated contaminated ash and soil in place. There is no PTSM at the subunit.

Expected Outcome of This Alternative

Land Use

Alternative 1, No Action, would not prohibit any future land use.

Other Impacts and Benefits

Alternative 1, No Action, would allow unrestricted land use, which may expose future workers or residents to unacceptable health risks.

Contaminant migration modeling indicates that TCE and PCE will leach to the groundwater above their respective MCLs (5 µg/L) in the future.

Alternative 2 - Institutional Controls

Cost, Construction Times, and Time to Achieve Remedial Action Objections

- Estimated Capital Cost: $90,000
- Estimated Annual O&M Cost (includes 5-year remedy review): $29,000
- Estimated Present Worth (7% Discount Rate) O&M Cost: $300,000
- Estimated Total Present Worth Cost (7% Discount Rate): $440,000
- Estimated Construction Time Frame: 1 month

- Estimated Time to Achieve RAOs: 1 month

Description of Remedy Components

Treatment Components

Alternative 2, Institutional Controls, does not include treatment components.

Engineering Controls

Alternative 2, Institutional Controls, does not require engineering controls.

Administrative & Monitoring Controls

Alternative 2, Institutional Controls, requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Trenches Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership. Pore water will be periodically collected and tested from lysimeters placed beneath the contaminated media in the Trenches Area to determine if TCE/PCE are migrating to the groundwater above their respective MCLs (5.0 μg/L). Groundwater data would be used in the preparation of the 5-year remedy reviews.

Operations and Maintenance

Alternative 2, Institutional Controls, requires periodic inspections to ensure that the required warning signs are in acceptable condition. Repairs and replacement resulting from soil erosion and/or loss of vegetation will be made on an as needed basis.

Common Elements and Distinguishing Features

ARARs

For the institutional controls alternative, no ARARs (i.e. chemical-specific, location-specific, or action-specific) have been promulgated for the Trenches Area. For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 2, Institutional Controls, is protective of human health for as long as the controls are enforced. However, institutional controls are not protective of the environment because leaching of TCE and PCE to the groundwater above their respective MCLs (5 μg/L) is expected to occur in the future.

Waste

Alternative 2, Institutional Controls, would leave approximately 17,000 m^3 (22,000 yd^3) of untreated contaminated ash and soil in place. There is no PTSM at the subunit.

Expected Outcome of This Alternative

Land Use

Institutional controls would prohibit future residential use and restrict industrial land use.

Other Impacts and Benefits

Alternative 2, Institutional Controls, is protective of human health but is not protective of the groundwater because contaminant transport modeling indicates that TCE and PCE will leach to the groundwater above their respective MCLs (5 μg/l) in the future.

Alternative 3a - Passive Soil Vapor Extraction (PSVE), Institutional Controls, and 1-Foot Soil Cover

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $520,000
- Estimated Annual O&M Cost (1^{st}-10^{th} year, includes 5-year remedy review): $38,000
- Estimated Annual O&M Cost (11^{th} – 30^{th} year, includes 5-year remedy review): $22,400
- Estimated Present Worth (7% Discount Rate) O&M Cost: $330,000
- Estimated Total Present Worth Cost (7% Discount Rate): $900,000
- Estimated Construction Time Frame: 1 year
- Estimated Time to Achieve RAOs: 10 years

Description of Remedy Components

Treatment Components

PSVE removes TCE and PCE from the soil by withdrawing vaporized TCE and PCE and releasing it to the atmosphere where it is broken down by sunlight. PSVE uses barometric pumping to remove volatile organic compounds from the soil. About 60 PSVE wells, with a one-way control valve called a Baroball™, will be installed. The Baroball™ allows VOC laden air to leave the PSVE wells but does not let air enter the PSVE wells. When the atmospheric pressure is greater than the air pressure in the soil, air enters the soil. When the atmospheric pressure is less than the air pressure in the soil, air vents to the atmosphere via the PSVE wells, removing TCE and PCE from the soil column. Ultimately, TCE and PCE are removed from the soil column to the point where

they no longer pose a migration threat to the groundwater. It is estimated that it would take about 10 years to achieve the remedial goals for TCE and PCE, which are shown in Table 12.

Engineering Controls

A 1-foot soil cover will be added prior to installation and operation of the PSVE well system to reduce the exposure of current remedial workers and future workers to residual surface contaminants. The cover will extend over the entire Trenches Area.

Administrative & Monitoring Controls

Alternative 3a requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Trenches Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership.

Quarterly sampling and monitoring will be performed for as long as the PSVE wells are operating, which is estimated to be 10 years.

Periodic monitoring will be conducted to assess the PSVE well system performance and to determine when the remedial goals for TCE and PCE are achieved.

Operations and Maintenance

O&M periodic facility inspections will be performed to ensure the soil cover, signs and PSVE are in good condition. Repairs or replacement will be made on an as-needed basis.

Common Elements and Distinguishing Features

ARARs

Chemical-Specific ARARs

No chemical-specific ARARs are associated with the COCs detected in the Trenches subunit.

Location-Specific ARARs

Alternative 3a, PSVE, Institutional Controls, and a 1-Foot Soil Cover, would comply with protection of the environment under the South Carolina Pollution Control Act (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control.

Action-Specific ARARs

Alternative 3a must comply with federal and state air emissions requirements. South Carolina Air Pollution Control Regulation No. 62.1, Section II, F.2.g, requires an air emissions permit for VOC emissions of over 1,000 lb/month. TCE and PCE are considered air toxics under the SCDHEC Air Toxic Regulations (R.61-62.5, Standard No. 8). This regulation requires SRS to evaluate compliance with air toxic regulations, considering SRS as one source. Actual emission rates, air emissions, modeling, and permitting requirements would be determined during the remedial design phase.

For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 3a, PSVE, Institutional Controls and a 1-Foot Soil Cover, is protective of human health because it prevents human exposure to the COCs. The alternative is

protective of the environment because it removes TCE and PCE from the soil column, thus removing the threat of future groundwater contamination.

Wastes

Alternative 3a will treat approximately 4,600 m^3 (6,000 yd^3) of TCE- and PCE-contaminated media and leave approximately 12,400 m^3 (16,200 yd^3) of soil and ash contaminated with low-levels of arsenic and PAHs. There is no PTSM at this subunit.

Expected Outcomes of This Alternative

Land Use

Residential land use will be prohibited and industrial land use will be restricted by the institutional controls element of Alternative 3a.

Other Impacts and Benefits

The effectiveness of PSVE technology is well demonstrated at SRS.

Alternative 3b - Active Soil Vapor Extraction (ASVE,) Institutional Controls, and a 1-Foot Soil Cover.

Cost, Construction Times, and Time to Achieve Remedial Action Objections

- Estimated Capital Cost: $316,000
- Estimated Annual O&M Cost (1^{st} - 5^{th} years, includes 5-year remedy review): $38,000
- Estimated Annual O&M Cost (6^{th}-30^{th} year, includes 5-year remedy review): $22,400
- Estimated Present Worth (7% Discount Rate) O&M Cost: $280,000

- Estimated Total Present Worth Cost (7% Discount Rate): $650,000
- Estimated Construction Time Frame: 1 year
- Estimated Time to Achieve RAOs: 5 years

Description of Remedy Components

Treatment Components

Alternative 3b, ASVE, Institutional Controls, and a 1-Foot Soil Cover, includes ASVE for removal of TCE and PCE from the soil by drawing air through the contaminated soil column. Air is pulled into the soil column by applying a vacuum to approximately 10 ASVE wells located in the contaminated soil. As the air flows through the contaminated soil, TCE and PCE are vaporized from the soil, drawn up the ASVE wells, and released to the atmosphere where TCE and PCE are broken down by sunlight. Ultimately, ASVE will remove the TCE and PCE from the soil column, which will protect the groundwater from future contamination. The existing SVEU (782-3M) adjacent to the ARP OU will be used as a component of this remedy. The SRS RCRA Part B Permit Application will be revised to include the connection of the 10 ASVE wells to the 782-3M SVEU. This revision will be submitted to the SCDHEC for their approval prior to connection and operation of the SVE wells.

Engineering Controls

A 1-foot soil cover will be added prior to installation and operation of the well system to reduce the exposure of current remedial workers and future workers to residual surface contaminants. The cover will extend over the entire Trenches Area.

Administrative & Monitoring Controls

Alternative 3b ASVE requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under

this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Trenches Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowner's use to industrial use only if the property is transferred to nonfederal ownership.

Sampling and monitoring will be performed for as long as the ASVE wells are operating, which is estimated to be 5 years.

Periodic monitoring will be conducted to assess the ASVE well system performance and to determine when the remedial goals for TCE and PCE are achieved.

Operations and Maintenance

O&M periodic facility inspections will be performed to ensure the soil cover, signs, and ASVE system is in good condition. Repairs or replacements will be made on an as-needed basis.

Common Elements and Distinguishing Features

ARARs

Chemical-Specific ARAR

No chemical-specific ARARs are associated with the COCs detected in the Trenches subunit.

Location-Specific ARARs

Alternative 3b, ASVE, Institutional Controls, and a 1-Foot Soil Cover, would comply with protection of the environment under the South Carolina Pollution Control Act (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control.

Action-Specific ARARs

Alternative 3b must comply with federal and state air emissions requirements. South Carolina Air Pollution Control Regulation No. 62.1, Section II, F.2.g, requires an air emissions permit for VOC emissions of over 1,000 lb/month. TCE and PCE are considered air toxics under the SCDHEC Air Toxic Regulations (R.61-62.5, Standard No. 8). This regulation requires SRS to evaluate compliance with air toxic regulations, considering SRS as one source. Actual emission rates, air emissions, modeling, and permitting requirements would be determined during the remedial design phase.

For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 3b, ASVE, Institutional Controls and a 1-Foot Soil Cover, is protective of human health because it prevents human exposure to the COCs. The alternative is protective of the environment because it removes TCE and PCE from the soil column, thus removing the threat of future groundwater contamination.

Waste

Alternative 3b, ASVE, Institutional Controls and a 1-Foot Soil Cover, will treat approximately 4,600 m^3 (6,000 yd^3) of TCE- and PCE-contaminated media and leave approximately 12,400 m^3 (16,200 yd^3) of soil and ash contaminated with low levels of arsenic and PAHs. There is no PTSM at this subunit.

Expected Outcomes of This Alternative

Land Use

Future residential land use would be prohibited and future industrial land use will be restricted by the institutional controls element of Alternative 3b.

Other Impacts and Benefits

The time to achieve the remedial goals for TCE and PCE is reduced by utilizing ASVE as compared to using PSVE (Alternative 3a).

Alternative 4 - Mechanical Aeration, Institutional Controls and 1-Foot Soil Cover

Cost, Construction Times, and Time to Achieve Remedial Action Objections

- Estimated Capital Cost: $270,000
- Estimated Annual O&M Cost (1st year): $46,000
- Estimated Annual O&M Cost (2nd-30th year, includes 5-year remedy review): $21,000
- Estimate Present Worth (7% Discount Rate) O&M Cost: $300,000
- Estimated Total Present Worth Cost (7% Discount Rate): $570,000
- Estimated Construction Time Frame: 1 year
- Estimated Time to Achieve RAOs: 1year

Description of Remedy Components

Treatment Components

Alternative 4, Mechanical Aeration, Institutional Controls and 1-Foot Soil Cover, includes the excavation of contaminated soil. The contaminated soil will be placed on top of areas in the Trenches Area that are not impacted by TCE and PCE. This soil will be mechanically aerated by tilling in the Trenches Area to promote volatilization of TCE and PCE to the atmosphere, where PCE and TCE will be broken down by sunlight. The

tilling process would continue until the TCE and PCE concentrations are reduced to acceptable levels, at which point the treated soil would be returned to the excavation.

Engineering Controls

Prior to the operation of the mechanical aeration, a 1-foot cover would be added to the unexcavated area of the Trenches Area. The purpose of this cover is to prevent exposure of remedial and future workers to residual contaminants in the surface soil.

Administrative & Monitoring Controls

Alternative 4 requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Trenches Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership.

Sampling and monitoring will be performed for as long as the mechanical aeration is in operation, which is estimated to be less than 1 year.

Monitoring of the treated soil will be performed to determine when the remedial goals for TCE and PCE are achieved.

Operations and Maintenance

O&M include periodically tilling of fine soils until the remedial goals are achieved. O&M also include periodic facility inspections to ensure the soil cover remains in good repair and signs are legible. Repairs or replacement will be made on an as-needed basis.

Common Elements and Distinguishing Features

ARARs

Chemical-Specific ARARs

No chemical-specific ARARs are associated with the COCs detected in the Trenches Areas.

Location-Specific ARARs

Alternative 4, Mechanical Aeration, Institutional Controls and a 1-Foot Soil Cover, would comply with protection of the environment under the South Carolina Pollution Control Act, (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control.

Action-Specific ARARs

Alternative 4, Mechanical Aeration, Institutional Controls and a 1-Foot Soil Cover, must comply with federal and state air emissions requirements. South Carolina Air Pollution Control Regulation No. 62.1, Section II, F.2.g, requires an air emissions permit for VOC emissions of over 1,000 lb/month. TCE and PCE are considered air toxics under the SCDHEC Air Toxic Regulations (R.61-62.5, Standard No. 8). This regulation requires SRS to evaluate compliance with air toxic regulations, considering SRS as one source. Actual emission rates, air emissions, modeling, and permitting requirements would be determined during the remedial design phase.

If the contaminated media is found to be hazardous waste, Alternative 4 must comply with the Hazardous Solid Waste Act Land Disposal Restrictions (South Carolina Hazardous Waste Management Regulations, Title 48, Section 61-79.268) that are applicable to the PAHs and VOCs (e.g., TCE & PCE).

For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 4, Mechanical Aeration, Institutional Controls and a 1-Foot Soil Cover, is protective of human health because it prevents human exposure to the COCs. The alternative is protective of the environment because it removes TCE and PCE from the soil column, thus removing the threat of future groundwater contamination.

Wastes

Alternative 4, Mechanical Aeration, Institutional Controls and a 1-Foot Soil Cover, will treat approximately 4,600 m^3 (6,000 yd^3) of TCE and PCE contaminated media and leave approximately 12,400 m^3 (16,200 yd^3) of soil and ash contaminated with low-level of arsenic and PAHs. There is no PTSM at this subunit.

Expected Outcomes of This Alternative

Land Use

Residential land use would be prohibited and industrial land use will be restricted by the institutional control element of Alternative 4.

Other Impacts and Benefits

Alternative 4, Mechanical Aeration, Institutional Controls and a 1-Foot Soil Cover, achieves the remedial goals for TCE and PCE faster than Alternative 3a and Alternative 3b.

Soils contaminated with TCE and PCE will be spread out over soils that were not contaminated by TCE or PCE.

Alternative 5 - Remove TCE- PCE-, and PAH- Contaminated Media for Off-Unit Disposal and Institutional Controls.

Cost, Construction Times, and Time to Achieve Remedial Action Objectives

- Estimated Capital Cost: $1,100,000
- Estimated Annual O&M Cost (includes 5-year remedy review): $21,000
- Estimate Present Worth (7% Discount Rate) O&M Cost: $300,000
- Estimated Total Present Worth Cost (7% Discount Rate): $1,400,000
- Estimated Construction Time Frame: 1 month
- Estimated Time to Achieve RAOs: 1 month

Description of Remedy Components

Treatment Components

Alternative 5, Removal and Disposal, does not include any treatment component.

Engineering Controls

Alternative 5, Removal and Disposal, would excavate soil contaminated with TCE, PCE, and PAH and dispose of it in a permitted offsite disposal facility. The soil contaminated with TCE and PCE would be excavated to a depth of 13 feet below the surface. Areas contaminated with PAHs will be excavated to a depth of approximately 2 feet below the land surface. The excavated areas will be backfilled with clean soil and regraded.

Administrative & Monitoring Controls

Alternative 5 requires administrative controls that would prohibit future residential land use, and restrict access and activities by future industrial workers. Under this alternative, warning signs would be used to restrict access and minimize exposure of the future industrial workers to the Trenches Area. Current workers are protected by SRS work control procedures. Additionally, deed restrictions and notifications will be obtained to limit future landowners' use to industrial use only if the property is transferred to nonfederal ownership.

Sampling would be conducted for all contaminated media exceeding their respective remedial goals. All samples will be analyzed.

Operations and Maintenance

O&M will include periodic facility inspections to ensure the signs are in acceptable condition. Repairs or replacement resulting from soil erosion and/or loss of vegetation will be made on an as needed basis.

Common Elements and Distinguishing Features

ARARs

Chemical-Specific ARARs

No chemical-specific ARARs are associated with the COCs detected in the Trenches subunit.

Location-Specific ARARs

Alternative 5, Removal and Disposal, would comply with protection of the environment under the South Carolina Pollution Control Act, (South Carolina Code Section 48.14.1-

170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control.

Action-Specific ARARs

Alternative 5 must comply with federal and state air emissions requirements. South Carolina Air Pollution Control Regulation No. 62.1, Section II, F.2.g, requires an air emissions permit for VOC emissions of over 1,000 lb/month. TCE and PCE are considered air toxics under the SCDHEC Air Toxic Regulations (R.61-62.5, Standard No. 8). This regulation requires SRS to evaluate compliance with air toxic regulations, considering SRS as one source. Actual emission rates, air emissions, modeling, and permitting requirements would be determined during the remedial design phase.

If the contaminated media is found to be hazardous waste, Alternative 5 must comply with the Hazardous Solid Waste Act Land Disposal Restrictions (South Carolina Hazardous Waste Management Regulations, Title 48, Section 61-79.268) that are applicable to the PAHs and VOCs (e.g., TCE & PCE).

In addition, Alternative 5 requires shipping of excavated material to an permitted offsite disposal facility. Transportation of this material must comply with USDOE Order 460.2 Departmental Materials Transportation and Packaging Management, and U. S. Department of Transportation requirements under 49 CFR 172-203.

For additional information regarding the ARARs, refer to Table B-1 (Appendix B).

Long-Term Reliability/Effectiveness

Alternative 5, Removal and Disposal, is protective of human health because it prevents human exposure to the COCs. The alternative is protective of the environment because it removes TCE and PCE from the soil column, thus removing the threat of future groundwater contamination.

Wastes

Alternative 5, Removal and Disposal, will excavate approximately 5,000 m^3 (6,500 yd^3) of untreated ash and soil contaminated with TCE, PCE, and PAHs and dispose of it in an offsite permitted disposal facility. The residual hazard remaining after removal consists of low-level arsenic contamination. There is no PTSM in this subunit.

Expected Outcomes of This Alternative

Land Use

Future residential land use would be prohibited and future industrial land use will be restricted by the institutional control element of Alternative 5.

Other Impacts and Benefits

Alternative 5 achieves the remedial goals for TCE and PCE in the least amount of time for the alternatives considered for this subunit.

It minimizes the amount of residual contamination in the Trenches Area, reducing overall risks about one order of magnitude to about 3×10^{-6} for the industrial worker. However, institutional controls would still be required.

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

All the remedial alternatives identified for the ARP have been evaluated against the nine CERCLA criteria that provide the basis for selecting the best remedial alternatives. The nine CERCLA criteria are subdivided into three groups: the Threshold Criteria, the Balancing Criteria, and the Modifying Criteria. These are discussed in Table 13.

Table 13. CERCLA Evaluation Criteria for the ARP Remedial Alternatives

Threshold Criteria
Overall Protection of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
Balancing Criteria
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume Through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to –30 percent.
Modifying Criteria
State Acceptance considers whether the state agrees with the analyses and recommendations, as described in the CMS/FS and SB/PP.
Community Acceptance considers whether the local community agrees with the analyses and the preferred alternative. Comments received on the SB/PP are an important indicator of community acceptance.

A detailed evaluation of each remedial alternative is documented in the CMS/FS (WSRC 2001a). Remedial alternatives that contain institutional controls as part of the remedy are expected to continue for greater than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

A brief discussion summarizing the overall conclusions resulting from the detailed CERCLA nine-criteria evaluation for each of ARP OU subunits is provided below. A relative comparison of the alternatives for each subunit including Piles Area, Ash Area, and Trenches Area is provided. In these tables, the Threshold Criteria are evaluated based on whether the alternative does or does not meet the requirement and is indicated by a "yes" or "no." For the Balancing Criteria, the numbers indicate a qualitative evaluation of the alternatives, with 1 being good and 3 being poor.

Piles Area

An alternative evaluation summary for the Piles Area is presented in Table 14 below.

Table 14. Alternative Evaluation Summary for the Piles Area

	Threshold		Balancing[3]				
Alternative	**Overall Protection of Human Health & Environment**	**Compliance with ARARS**	**Long-Term Effectiveness & Permanence**	**Reduction of Toxicity, Mobility, or Volume through Treatment**	**Short-Term Effectiveness**	**Implement ability**	**Present Worth Cost**
No Action	No	No	3	3	1	1	$54,000
Institutional[1] Controls	Yes	No	2	3	1	1	$320,000
Preferred Alternative: Hot Spot[2] Removal	Yes	Yes	1	3	1	1	$97,000

Notes:

[1] Implementation of appropriate institutional controls will prevent human exposure to the contaminated piles for as long as they are enforced.

[2] The removal and disposal alternative will allow for unrestricted land use once the groundwater has been cleaned up.

[3] For the Balancing Criteria, the numbers indicate a qualitative evaluation of the alternatives with 1 being good and 3 being poor.

Overall Protection of Human Health and the Environment

Alternative 3 (Removal and Disposal) and Alternative 2 (Institutional Controls) are protective of human health because they prevent human exposure to the contaminants present in the soil. However, Alternative 3 permanently removes PTSM and other high-level risk drivers and places the waste in a permitted disposal facility while Alternative 2 does not remove PTSM from the unit. The No Action alternative is not protective of human health because it does not prevent human exposure to the COCs.

Compliance with ARARs

Alternative 3 complies with the USEPA lead guidance (400 mg/kg lead screening level) and the TSCA (40 Code of Federal Regulations (CFR) 761) action level for PCBs (1 mg/kg). Alternative 3 also complies with the protection of the environment under the South Carolina Pollution Control Act (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents the spread of contamination by requiring controls, such as erosion control. Specifically, aroclor-1254 exceeds the TSCA action level of 1 mg/kg at depths less than 1 foot or 10 mg/kg at depths greater than 1 foot from the land surface.

Alternatives 1 and 2 do not comply with ARARs for PCBs.

Long-Term Effectiveness and Permanence

Alternatives 2 and 3 both permanently protect human health and the environment for as long as the institutional controls are enforced. Alternative 1 is not effective or permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 3 removes contaminated soil and places it in a permitted offsite disposal facility thereby reducing its toxicity, mobility or volume indirectly. Alternatives 1 and 2 do not reduce toxicity, mobility, or volume through treatment.

Short-Term Effectiveness

Alternative 2 would require remedial workers to install signs and barriers. Remedial workers would perform all work in accordance with a health and safety plan that minimizes all risks associated with this alternative to acceptable levels. Alternative 2 has no potential to endanger the public. Alternative 3 presents potentially higher risks for the remedial workers due to the nature of excavating and loading contaminated soil. However, all work would be conducted in accordance with a health and safety plan that minimizes all risks associated with implementation of this alternative to acceptable levels. Transportation of soils from SRS to a permitted offsite disposal facility has inherent risks to the community from potential traffic accidents. However, transportation planning will minimize these risks. Short-term effectiveness is not applicable to Alternative 1, No Action.

Implementability

All alternatives are implementable; however, in Alternative 3, transportation of contaminated soil is involved.

Cost

The cost for each Piles Area alternative is provided in Table 14.

State Acceptance

SCDHEC prefers Alternative 3, Removal and Disposal.

Community Acceptance

The SB/PP public comment period began on September 21, 2001, and ended on November 4, 2001. There were no public comments received; therefore, community acceptance of the alternative has been granted.

Ash Area

An alternative evaluation summary for the Ash Area is presented in Table 15 below.

Table 15. Alternatives Evaluation Summary for the Ash Area

	Threshold		Balancing[2]				
Alternative	Overall Protection of Human Health & Environment	Compliance with ARARS	Long-Term Effectiveness & Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implement ability	Present Worth Cost
No Action	No	Yes	3	3	1	1	$54,000
Preferred Alternative: Institutional[1] Controls	Yes	Yes	2	3	1	1	$320,000

Notes:
[1] Implementation of appropriate institutional controls prevents human exposure to the contaminated media for as long as they are enforced.
[2] For the Balancing Criteria, the numbers indicate a qualitative evaluation of the alternatives with 1 being good and being poor.

Overall Protection of Human Health and the Environment

Alternative 2 (Institutional Controls) is protective of human health because it prevents human exposure to the COCs for as long as the controls are enforced. Alternative 1, No Action, is not protective of human health because it does not prevent human exposure to COCs.

Compliance with ARARs

No ARARs (i.e., chemical-specific, location-specific, or action-specific) have been promulgated for the arsenic contamination present in the Ash Area soil.

Long-Term Effectiveness and Permanence

Alternative 2 is effective in protecting human health by reducing exposure to low levels of arsenic in the soil for as long as the institutional controls are enforced. Alternative 1 is not effective or permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment

Neither alternative reduces toxicity, mobility, or volume through treatment.

Short-Term Effectiveness

Alternative 2 requires remedial workers to install signs and barriers. Remedial workers would perform all work in accordance with a health and safety plan that minimizes all risks associated with this alternative to acceptable levels. Short-term effectiveness is not applicable to the Alternative 1, No Action.

Implementability

Both of the Ash Area alternatives are straightforward to implement.

Cost

The cost for each Ash Area alternative is provided in Table 15.

State Acceptance

SCDHEC prefers Alternative 2, Institutional Controls.

Community Acceptance

The SB/PP public comment period began on September 21, 2001, and ended on November 4, 2001. There were no public comments received; therefore, community acceptance of the alternative has been granted.

Trenches Area

An alternative evaluation summary for the Trenches Area is presented in Table 16 below.

Table 16. Alternatives Evaluation Summary for Trenches Area

	Threshold		Balancing				
Alternative	Overall Protection of Human Health & Environment	Compliance with ARARS	Long-Term Effective-ness & Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implement ability	Present Worth Cost
No Action	No	No	3	3	1	1	54,000
Institutional[1] Controls	No	No	3	3	1	1	$442,000
Passive SVE, Soil Cover, and Institutional Control	Yes	Yes	1	1	1	1	$900,000
Preferred Alternative: ASVE, Soil Cover and Institutional Control	Yes	Yes	1	1	2	1	$650,000
Removal & Disposal of TCE/PCE, PAH, Institutional Controls	Yes	Yes	1	3	3	1	$1,400,000
Mechanical Aeration Institutional Controls	Yes	Yes	1	1	2	1	$570,000

Notes:

[1] Implementation of appropriate institutional controls will prevent human exposure to the contaminated media for as long as they are enforced.

[2] For the Balancing Criteria, the numbers indicate a qualitative evaluation of the alternatives with 1 being good and 3 being poor.

Overall Protection of Human Health and the Environment

Alternatives 2, 3a, 3b, 4, and 5 (Institutional Controls, PSVE, ASVE, Mechanical Aeration, and Removal and Disposal, respectively) are all protective of human health because they prevent exposure to the COCs present in the soil through institutional controls. Alternatives 3a, 3b, 4, and 5 are also protective of the groundwater because

they remove TCE and PCE from the soil and hence reduce the risk of TCE and PCE migrating to groundwater. Alternative 2 is not protective of the groundwater because it does not prevent TCE and PCE from leaching to the soil. Alternative 1 is not protective of human health because it neither prevents human exposure to the COCs present in the soil nor prevents TCE and PCE leaching to the groundwater.

Compliance with ARARs

Chemical-Specific ARARs. No chemical-specific ARARs are associated with the COCs detected in the Trenches Area.

Location-Specific ARARs. Alternatives 2, 3a, 3b, 4, and 5 would comply with protection of the environment under the South Carolina Pollution Control Act, (South Carolina Code Section 48.14.1-170) and its supporting regulation (SC 72-300), which prevents spread of contamination by requiring controls such as erosion control. Location-specific ARARs are not applicable to Alternative 1.

Action-Specific ARARS. No action-specific ARARs are associated with Alternatives 1 and 2.

Alternatives 3a, 3b, 4, and 5 will comply with South Carolina regulation R.61-62.6, *Control of Fugitive Particulate Matter,* which requires dust suppression during activities such as digging or earth moving. Alternatives 3a, 3b, and 4 must comply with federal and state air emissions requirements. South Carolina Air Pollution Control Regulation No. 62.1, Section II, F.2.g, requires an air emissions permit for VOC emissions of over 1,000 lb/month. An initial conservative estimate (WSRC 2001a) of the potential VOC emissions from these alternatives concluded that the 1,000 lb/month criteria cannot be reached. However, a more rigorous analysis during the remedial design phase will be conducted to determine if a permit is needed. TCE and PCE are considered air toxins under the SCDHEC Air Toxic Regulations (R.61-62.5, Standard No. 8). This regulation requires SRS to evaluate compliance with air toxic regulations, considering the SRS as

one source. Actual emission rates, air emissions modeling, and permitting requirements would be determined during the remedial design phase.

If the contaminated media is found to be hazardous waste, Alternatives 4 and 5 will comply with the Hazardous Solid Waste Act Land Disposal Restrictions (SCHWMR, Title 48, Section 61-79.268) that are applicable to the PAHs and VOCs present in the Trenches subunit.

An initial calculation (WSRC 2001a) concluded that the average concentrations for the PAHs and VOCs are well below their respective land disposal restriction limits. However, waste characterization for disposal or replacement will be conducted to ensure compliance with this regulation.

Alternative 5 requires excavated material to be transported off SRS to an offsite permitted disposal facility. Transportation of this material must comply with USDOE Order 460.2, *Departmental Materials Transportation and Packaging Management*, and U.S. Department of Transportation requirements under 49 CFR 172-203.

Long-Term Effectiveness and Permanence

Alternatives 3a, 3b, 4, and 5 would be permanently effective in protecting the environment (groundwater). However, institutional controls are a part of Alternatives 3a, 3b, 4, and 5 and will be effective in protecting human health from PAHs contamination in the soil for as long as they are enforced. Alternative 2 is an alternative that is protective of human health for as long as the controls are enforced but not effective in protecting the environment (groundwater). Alternative 1 is not effective in protecting human health or the environment (groundwater).

Alternatives 3a, 3b, 4, and 5 would permanently reduce the amount of contaminants present at the Trenches Area by removing TCE and PCE. Additionally, Alternative 5 would remove PAHs found in the asphalt material area.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 3a, 3b, and 4 result in reduction of toxicity through breakdown of TCE and PCE by sunlight. Alternatives 1, 2, and 5 result in no reduction in toxicity or mobility.

Short-Term Effectiveness

Alternatives 2, 3a, 3b, and 4 would pose ordinary industrial and construction risks to remedial workers that would be minimized by strict compliance with a health and safety plan and other USDOE safety requirements. Alternative 5 poses ordinary industrial and community risks due to the potential for traffic accidents. Transportation planning would minimize risk to the public. Short-term effectiveness is not applicable to Alternative 1, No Action. Alternative 3b, ASVE, is expected to achieve RAOs in half the time that Alternative 3a, PSVE, is expected to take.

Implementability

All the Trenches Area alternatives are straightforward to implement; however, in Alternative 5, transportation of contaminated soil is involved. If air permits are required for Alternatives 3a, 3b, 4 and 5, these are readily available.

Cost

The cost for each Trenches Area alternative is provided in Table 16.

State Acceptance

SCDHEC prefers Alternative 3b, ASVE, Institutional Controls, and 1-Foot Soil Cover.

Community Acceptance

The SB/PP public comment period began on September 21, 2001, and ended on November 4, 2001. There were no public comments received. The preferred alternative

for the Trenches Area during the public comment period was PSVE, Based on the pre-design study, the preferred alternative has been changed to ASVE (see Section XIII. Explanation of Significant Changes). ASVE was described in the SB/PP; therefore, the community was able to review this alternative. A second 45-day public comment period was held for the draft RCRA Permit Modification from September 25, 2002 to November 8, 2002. Comments received during this public comment period will be available with the final RCRA permit.

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

A focused set of remedial alternatives was developed for the ARP OU based on site characterization and evaluation of risks documented in the RFI/RI/BRA (WSRC 2000). Each alternative underwent a detailed comparative evaluation to determine the best remedial alternative for each ARP OU subunit. Each selected alternative is discussed below.

The selected remedy, comprised of one selected alternative for each ARP OU subunit, will be the final action for ARP OU; however, the remedy may change as a result of the remedial design or construction processes. Any changes to the remedy described in the ROD will be documented in the Administrative Record utilizing a memo, an Explanation of Significant Difference (ESD), or a ROD amendment. The groundwater contamination present below the ARP OU is related to discharges associated with the A-014 Outfall, which is being remediated under an ongoing RCRA corrective action as documented in the SRS RCRA Part B permit. Therefore, groundwater is not addressed by the selected remedy.

Piles Area

The selected alternative for the Piles Area is Alternative 3, Removal and Disposal, because it removes all unacceptable risk (PTSM) from the two very small-localized hot spots. The two hot spots will be transported off SRS to a permitted offsite disposal facility. Alternative 2 (Institutional Controls) leaves a high level of risk in place associated with PTSM in the PCB/PAH waste pile and Alternative 1 (No Action) is not effective.

The selected alternative for the Piles Area provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria.

The selected alternative satisfies the statutory requirements in CERCLA Section 121(b). It is protective of human health and the environment.

It complies with ARARs and is cost-effective. It utilizes permanent solutions but does not utilize alternative treatment technologies because the contaminants can be removed more cost effectively by standard technologies; therefore, treatment is not warranted. Resource recovery technologies are not used because the contaminants do not have value. Although the preferred alternative does not satisfy the preference for treatment, it places the contaminated soil in a permitted off-unit disposal facility. The selected remedy achieves the RAOs to protect the future industrial worker or resident from exposure to lead, arsenic, benzo(a)pyrene, and aroclor-1254 above their respective RGs of 4.4 mg/kg, 400 mg/kg, 0.052 mg/kg, and 1 mg/kg by removing the contaminants from the site. The lead hot spot and PCB/PAH waste pile and underlying soil will be excavated and transported from SRS to a permitted offsite disposal facility.

Ash Area

The selected alternative for the Ash Area is Alternative 2, Institutional Controls, which achieves the RAO to protect future industrial workers from exposure to elevated levels of arsenic above the RG of 4.4 mg/kg by restricting their access and activities. The

alternative also prohibits future residential land use and is effective for as long as the controls are enforced.

Institutional controls will be implemented by:

- Providing access controls for on-site workers via the Site Use Program, Site Clearance Program, work control, worker training, worker briefing of health and safety requirements and identification signs located at the waste unit boundaries.

- Notifying the USEPA and SCDHEC in advance of any changes in land use or excavation of waste.

- Providing access controls against trespassers as described in the 1992 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Per the USEPA – Region IV Land Use Controls (LUCs) Policy, a LUC Assurance Plan (LUCAP) for SRS has been developed and approved by the regulators. In addition, a LUCIP for the ARP OU will be developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the land use control elements of the ARP OU preferred alternative to ensure that the remedy remains protective of human health and the environment. Specifically, onsite workers entering the area will be required to notify the Environmental Restoration Division and meet administrative use requirements.

The SRS, specifically the Environmental Protection Department and the Site Development, Planning, and Mapping Department, is responsible for updating, maintaining, and reviewing site maps, including CERCLA site identifications. The SRS also has a Site Use/Site Clearance Program, which states that no use of land shall be undertaken without prior approval documented by a Site Use Permit. In addition, all

work at SRS that adds to or modifies features or facilities portrayed on the site maps is authorized by an approved Site Clearance Permit. Any Site Use/Site Clearance requests that impact Environmental Restoration Division waste units must be reviewed and approved by the appropriate waste unit personnel before the Site Use/Site Clearance is granted.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

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

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

It is believed that the preferred alternative for the Ash Area provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria.

The preferred alternative satisfies the statutory requirements in CERCLA Section 121(b). It is protective of human health and the environment. It complies with ARARs, is cost-effective, and utilizes permanent solutions. It does not use alternative treatment technologies because the contaminant levels are close to background levels and treatment is not warranted. Resource recovery technologies are not used because the only contaminant (arsenic) is not a valued resource. Although the preferred alternative does not satisfy the preference for treatment, the contaminant left in place is immobile, at very low levels, and easy to control through institutional controls.

Trenches Area

The selected alternative for the Trenches Area is Alternative 3b, ASVE, Institutional Controls, and 1-foot soil cover.

Alternative 3b, ASVE is protective of the environment and human health. TCE and PCE are transferred to the atmosphere and degraded by sunlight, thus achieving the RAO to permanently protect the groundwater from leaching of these contaminants above their respective MCLs (5 μg/l). The 1-foot soil cover and institutional controls achieves the RAO to protect remedial workers and future industrial workers from unacceptable exposure to arsenic and PAHs (benzo(a)pyrene) in the surface soil.

SRS has successfully utilized ASVE on several cleanup projects and pre-design testing of a pilot-scale PSVE system have demonstrated that ASVE will be effective in removing TCE/PCE from the ash in the Trenches Area. Therefore, ASVE is judged to be a low-risk, cost-effective alternative that can be effectively implemented in the field.

The USEPA – Region IV LUCs policy, including development of a unit-specific LUCIP, and the institutional controls components of the remedy are discussed as part of the Ash Area subunit preferred alternative. These same requirements will be implemented as part of the Trenches Area subunit preferred alternative.

The selected alternative for the Trenches Area provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. Alternative 4, Mechanical Aeration, is less expensive but has not been implemented at SRS and exposes contaminated media to the elements, which runs the risk of inadvertent releases of contamination. Alternative 5, Removal and Disposal, is considerably more expensive than ASVE.

The selected alternative satisfies the statutory requirements in CERCLA Section 121(b). It is protective of human health and the environment. It complies with the ARARs, utilizes permanent solutions and satisfies the preference for treatment. It uses an alternative treatment technology (ASVE) because it is cost effective and meets remedial goals. Resource recovery technologies are not used because the contaminants have no recovery value.

Cost Estimates for the Selected Remedies

Estimated costs associated with the selected remedies are summarized below:

Piles Area – Removal and Disposal of Lead Hot Spot and PCB/PAH Waste Pile

- Total Capital Costs: $97,000
- Total O&M Costs: $0
- Total Present Worth Cost (7% Discount Rate): $97,000

Ash Area – Institutional Controls

- Total Capital Costs: $70,000
- Total O&M Costs: $250,000

- Total Present Worth Costs (7% Discount Rate): $320,000

Trenches Area – ASVE, 1-Foot Soil Cover and Institutional Controls

- Total Capital Costs: $320,000
- Total O&M Costs: $330,000
- Total Present Worth Costs (7% Discount Rate): $650,000

Total Estimated Costs for the ARP OU

- Total Capital Costs: $487,000
- Total O&M Costs: $580,000
- Total Present Worth Costs (7% Discount Rate): $1,067,000

Detailed cost estimates for each of the three areas are presented in Appendix C of this document. The total present worth costs are calibrated using a 7% discount rate over a 30-year time frame. The 30-year time frame was selected for cost estimating purposes only. There is no time limit on the requirement to provide 5-year remedy reviews.

XII. STATUTORY DETERMINATIONS

Based on the RFI/RI/BRA for the ARP OU report (WSRC 2000), the ARP OU poses risks to human health and the environment. Therefore, Alternatives 3, 2, and 3b have been identified as the preferred remedies for the ARP OU subunits Pile Area, Ash Area, and Trenches Area, respectively.

The selected remedies are protective of human health and environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. Because the selected remedy for the Trenches

Area treats PCE and TCE in soil through ASVE, this remedy does satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Per the USEPA-Region IV LUCs Policy, a LUCAP for SRS has been developed and approved by the regulators. In addition, a LUCIP for the ARP OU will be developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the land use control elements of the ARP OU preferred alternative to ensure that the remedy remains protective of human health and the environment.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

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

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

The selected remedies for the Ash and the Trenches subunits leave hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As negotiated with the USEPA, and in accordance with USEPA – Region IV Policy (*Assuring Land Use Controls of Federal Facilities*, April 21, 1998), SRS has developed a LUCAP to ensure that land use restrictions are maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide details and specific measures required for the LUCs selected as a part of the remedies. The USDOE is responsible for implementing, maintaining, monitoring, and reporting upon and enforcing the LUCs selected under this ROD. The LUCIP, developed as a part of this action, will be submitted concurrently with the Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP), as required in the FFA for review and approval by the USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approval LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect until modified as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes made to the ROD based on the comments received during the public comment period for the SB/PP. No comments were received during the public comment period.

Alternative 3a, PSVE, was selected as the preferred alternative in the SB/PP (WSRC 2001b). PSVE was selected primarily based on its lower cost as compared to ASVE, which was costed at $2,200,000 in the SB/PP. PSVE was comparable for the other

criteria and has been successfully deployed at other operable units at SRS. However, PSVE deployment in shallow trenches containing ash has not been demonstrated at SRS. To reduce the uncertainty associated with the remedy, the Core Team agreed that pre-design testing of a pilot-scale PSVE well system was warranted.

Pre-design testing of the PSVE was carried out in the fourth quarter of calendar year 2001 and the first quarter of calendar year 2002. The testing concluded that TCE/PCE could not be removed at acceptable rates because adequate differential pressure could not be achieved between the surface and the screen zone of the PSVE wells. The lack of adequate differential pressure is attributed to the high permeability of the ash material in the Trenches Area. In addition, due to the high permeability of the ash, the zone of influence for each well is much higher (greater than 25 feet) than typically found in vadose zone soils, even at significantly lower flow rates than used for ASVE systems. Based on these findings, it was concluded that a modified version of the ASVE alternative originally evaluated in the SB/PP should be selected as the preferred alternative. Originally, ASVE was developed on the basis that it would need to be a stand-alone system because the nearby SVEU (782-3M) did not have the sufficient capacity to support an ASVE system placed in the Trenches Area (Figure 19). Due to the significant capital costs in constructing a SVEU, the estimated cost for this alternative was $2,200,000.

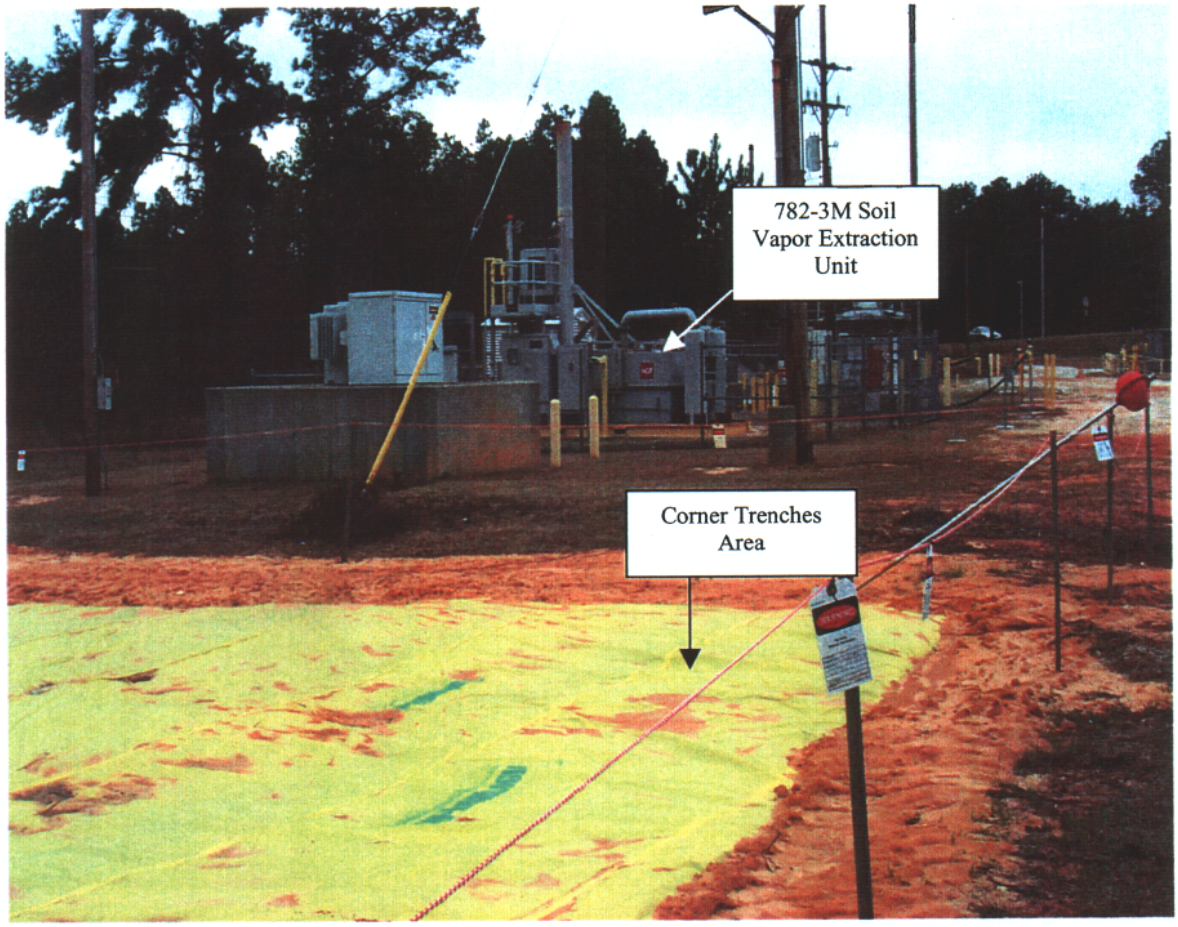


Figure 19. 731-6A Trenches Area and 782-3M Soil Vapor Extraction Unit

However, based on the information obtained from the pre-design testing of the PSVE alternative, it was concluded that 10 or fewer ASVE wells would be needed and that the existing 782-3M SVEU would have sufficient air handling capacity to support the scaled down ASVE system at the ARP OU.

By significantly reducing the number of wells (60 PSVE to 10 ASVE) and by using the existing 782-3M soil vapor extraction unit the estimated cost of the modified ASVE alternative is $650,000, which is about $250,000 less than the present worth cost for the PSVE alternative. Estimated costs associated with the modified ASVE alternative is summarized below:

Trenches Area –ASVE, 1-Foot Soil Cover and Institutional Controls

- Estimated Total Capital Costs: $316,000
- Estimated Total O&M Cost (1^{st} –5^{th} year): $38,000/year
- Estimated Total O&M Cost (6^{th} –30^{th} year): $22,400/year
- Estimated Total Present Worth Cost O&M (7% Discount Rate): $334,000
- Estimated Total Present Worth Cost for the Alternative3b, ASVE 7% Discount Rate): $650,000

Table C-3 provides a detailed cost estimate for PSVE. Table C-4 provides a detailed cost estimate for ASVE using the 782-3M SVEU. Table C-5 provides the cost estimate for the ASVE system proposed originally in the SB/PP. The total present worth costs are calculated using a 7% discount rate over a 30-year time frame. The 30-year time frame was selected for cost estimating purposes only. There is no time limit on the requirement to provide 5-year remedy reviews.

Based on the enhanced effectiveness of ASVE as compared to PSVE, and considering an estimated reduction in cost, the Core Team decided to select the modified ASVE alternative for deployment at the ARP OU.

XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary is provided in Appendix A of this document.

XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

A detailed schedule for the ROD and post-ROD activities is shown in Figure 20.

The ROD for the ARP OU will be prepared after receipt of, and response to, public and regulatory comments on the SB/PP. The Revision 0 ROD was submitted to USEPA and SCDHEC for review and comment in November 2001. The final ROD, which responds to regulatory agency comments, has been approved by the regulators and is scheduled for issuance in 4Q FY 2003. The schedule for the post-ROD documentation is as follows:

- The Revision 0 CMI/RAIP was submitted to the regulators on February 14, 2003.

- Regulatory comments were received within the 90 calendar day review schedule. USEPA comments were received on April 22, 2003 and SCDHEC comments were received on May 15, 2003.

- SRS revision of the CMI/RAIP will be completed 60 calendar days after receipt of all regulatory comments (i.e., by July 14, 2003).

- The Remedial Action start date is scheduled for 4Q FY 2003. The remedial action is scheduled for completion in 4Q FY 2004.

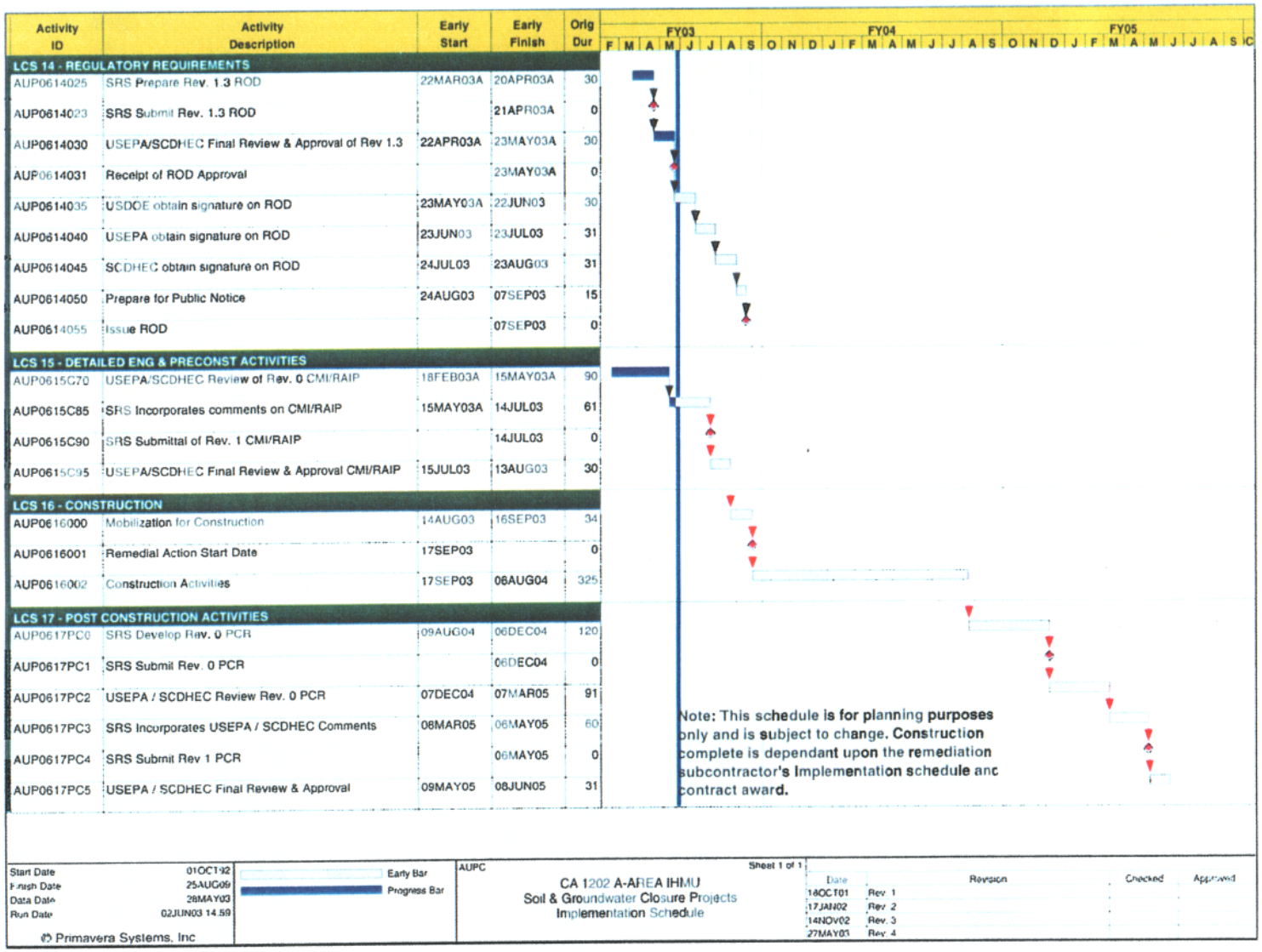


Figure 20. Post-ROD Schedule for A-Area Miscellaneous Rubble Pile OU (731-6A)

XVI. REFERENCES

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WSRC, 2001b. *Statement of Basis/Proposed Plan for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit (U),* WSRC-RP-2000-4051, Revision 1, August 2001, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

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APPENDIX A -
RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

The 45-day public comment period for the *Statement of Basis/Proposed Plan for A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit* began on September 21, 2001, and ended on November 4, 2001.

Due to a change in the selected remedy for the Trenches Area subunit (see Section XIII. Explanation of Significant Changes) after the initial public comment period, a second 45-day public comment period was held for the draft RCRA Permit Modification from September 25, 2002 to November 8, 2002. The final RCRA permit and its associated Responsiveness Summary, which included no public comments, were issued by SCDHEC on February 4, 2003. The RCRA permit became effective on March 4, 2003.

Public Comment

No comments were received from the public.

APPENDIX B –
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

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Table B-1. Chemical-, Action-, Location-Specific ARARS – ARP OU

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Chemical				
40 CFR 761, TSCA	Relevant and Appropriate	Identifies cleanup levels and disposal requirements for cleaning, decontaminating, or removing PCB remediation waste.	USEPA directive identifies 10-25 ppm PCB as the cleanup levels for industrial areas.	1,2,3 (P)*
40 CFR 761, TSCA	Applicable	Notification requirements for shipping bulk PCB remediation waste	§761.61(a)(5)(i)(B)(2) or §761.61(b)(2)(i)	3 (P)
40 CFR 261 and SC R 61-79.261. Identification and Listing of RCRA Hazardous Waste	Applicable	Defines criteria for determining whether a waste is RCRA hazardous waste.	Any waste media that are actively managed or shipped offsite must be TCLP tested to determine if the media meets the hazardous waste definition.	3 (P)
40 CFR 263 and SC R.61-79.263, Standards Applicable to Transporters of Hazardous Waste	Applicable	Identifies transporter requirements including manifests, record keeping, and actions for accidental waste discharges.	Applicable to offsite transportation of RCRA hazardous waste.	3 (P)
40 CFR 268, Land Disposal Restrictions (LDRs) (RCRA)	Applicable	Prohibits land disposal and specifies treatment standards for specific RCRA hazardous wastes.	Movement of excavated materials from their original location triggers the RCRA LDRs*.	3 (P)
USEPA Lead Guidance	Applicable	Identified cleanup levels for lead contaminated soil.	USEPA established a 400 ppm screening level for lead contamination in soil to expedite evaluation and cleanup of lead contaminated areas.	3 (P)
Action				
40 CFR 50.6	Applicable	The concentration of particulate matter (PM_{10}) in ambient air shall not exceed 50 ug/m^3 (annual arithmetic mean) or 150 ug/m^3 (24-hour average concentration	Earth-moving activities will generate airborne dust that will have the potential to exceed the levels specified. Dust suppression will likely be required to minimize dust emissions.	3 (P) 5 (T)
40 CFR 107, 171-179 DOT Hazardous Materials Transportation Regulations	Applicable	Specifies requirements for handling, packaging, labeling, and transporting wastes containing DOT hazardous substance.	Applicable to contaminated soil or investigation-derived wastes shipped offsite.	3 (P) 5 (T)
SC R.61-9 NPDES Permits	Applicable	Requires notification of intent to discharge storm water from construction associated with industrial activity that will result in a land disturbance of 5 acres or more and/or industrial activities and sets the requirements for the control of storm water discharges.	Potentially applicable if stormwater is discharged during construction activities.	3 (P) 2 (A) 3a,3b,4,5 (T)

*P – Piles Area subunit; A – Ash Area subunit; T – Trenches Area subunit
LDRs – Land Disposal Restrictions

Table B-1. Chemical-, Action-, Location-Specific ARARS – ARP OU (Continued)

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
SC R.72-300 Standards for Stormwater Management and Sediment Reduction disturbing activities.	Applicable	Stormwater management and sediment control plan for land disturbances	Excavation activities will require an erosion control plan.	3 (P) 3a, 3b, 4, 5 (T)
29 CFR 1910 Occupational Worker Safety (OSHA)	Applicable	Identifies health and safety requirements for remediation workers.	Worker activities involving hazardous materials must be conducted according to a project-specific health and safety plan.	2,3 (P) 2 (A) 2, 3a, 3b,4, 5 (T)
SC Pollution/Control Act to Action Specific South Carolina Code Section 48.14.1-170	Applicable	The act requires protection for the environment during cleanup action.	Excavation activities will require protection of the environment	3 (P) 3a, 3b, 4, 5 (T)
SC R.61-62.5 and 62.6, Air Pollution Control Standards to Action Specific	Applicable	TCE/PCE emissions are regulated by the state.	TCE/PCE emissions generated during soil vapor extraction and excavation activities will require controls.	3a, 3b, 4, 5 (T)
Location				
16 USC 1531	Applicable	The remedial action must be conducted in a manner to conserve endangered or threatened species.	There are threatened and endangered species at the SRS; however, this action will not affect these species.	2, 2 (A), 3 (P) 2, 3a, 3b, 4, 5 (T)
16 USC 661	Applicable	The remedial action must be conducted in a manner to protect fish or wildlife.	This remedial action has no potential to affect wildlife in the vicinity of the ARP OU. The action will not affect fish located at the SRS or in nearby bodies of water.	2, 2 (A), 3 (P) 2, 3a, 3b, 4, 5 (T)
16 USC 703	Applicable	The remedial action must be conducted in a manner that minimizes impacts to migratory birds and their habitats.	Migratory bird populations may be present in the vicinity of the SRS. However, this action will not impact the migratory birds and their habitats.	2, 3 (P) 2 (A), 2, 3a, 3b, 4, 5 (T)
Executive Order 11990	Applicable	The remedial action must minimize the destruction, loss, or degradation of wetlands.	Wetlands are located in the vicinity of the SRS; however, they will be unaffected by this action.	2, 2 (A), 3 (P) 2, 3a, 3b, 4, 5 (T)

*P – Pile Area subunit; A – Ash Area subunit; T – Trenches Area subunit

APPENDIX C –
COST ESTIMATE FOR THE SELECTED REMEDY

Table C-1. Detailed Cost Estimate for Alternative 3 – Removal and Disposal of the Lead Hot Spot and PCB/PAH Waste Pile, A-Area Miscellaneous Rubble Pile, Piles Area

ITEM	Comments	Quantity	Units	Unit Cost	Total Cost
DIRECT CAPITAL COSTS					
SITE WORK					
Work Plan	4 FTEs @ $125/hour	240	Hours	$125	$30,000
Mobilization/Demobilization		1	LS	$5,000	$5,000
Equipment Decontamination		1	LS	$2,000	$2,000
Decontamination Pad		1	LS	$250	$250
Clearing & Grubbing		0.50	Acre	$1,500	$750
Remove and Dispose of Debris		20	CY	$45	$900
Excavation		15	CY	$4	$66
TRANSPORTATION & DISPOSAL					
Soil Sampling	Oversight Geologist @ $65/hour	24	Hours	$65	$1,560
Soil Analyses	Assume 1 sample per 100 CY				
VOCs		1	EA	$200	$200
TCLP Metals		1	EA	$190	$190
Paint Filter		1	EA	$28	$28
pH		1	EA	$18	$18
PCBs		1	EA	$200	$200
Transportation	Vendor Quote	2	Load	$56	$112
Landfill (1.6 tons/cu yd)	RCRA Subtitle C	24	TON	$250	$6,000
SITE RESTORATION					
Clean Fill		6,000	CY	$1	$5,760
Seeding Including. Installation		2,420	SY	$1	$2,420
	TOTAL DIRECT COST				**$55,454**
INDIRECT CAPITAL COSTS					
Health & Safety @ 5% of Direct Capital Cost					$2,773
Bonds & Insurance @ 5% of Direct Capital Cost					$2,773
Contingency @ 20% of Direct Capital Cost					$11,091
Eng. & Const. Mgt. @ 15% of Direct Capital Cost					$8,318
Prime Contractor Overhead. & Profit @ 30% of Direct Capital Cost					$16,636
	TOTAL INDIRECT COST				**$41,591**
	TOTAL CAPITAL COST				***$97,045***
TOTAL PRESENT WORTH COST					**$97,045**

Table C-2. Detailed Cost Estimate for Alternative 2 – Institutional Controls, A-Area Miscellaneous Rubble Pile, Ash Area

Item	Comments	Quantity	Unit	Unit Cost	Total Cost
Direct Capital Cost					
Remedy Review					
Review Regulations	4FTEs @ 125/hr	32	Hours	$125	$4,000
Develop 5-Year Remedy Review	4FTEs @ 125/hr	120	Hours	$125	$15,000
Attend Rgulatory Meeting	6FTEs @ 125/hr	48	Hours	$125	$6,000
Cost Per Remedy Review Period					**$25,000**
Site Work					
Fence Installation		1120	LF	$15	$16,800
Gate Installation		2	EA	$750	$1,500
Deed Restriction	1 Attorney @ $200/hr.	16	Hours	$200	$3,200
Develop LUCIP	4FTEs@$125/hr	200	Hours	$125	$25,000
Total Direct Capital Cost	Not Including Remedy Review				**$46,500**
INDIRECT CAPITAL COSTS					
Health & Safety @ 5% of Direct Capital Cost					$2,325
Bonds & Insurance @ 5% of Direct Capital Cost					$2,325
Contingency @ 15% of Direct Capital Cost					$6,975
Prime Contractor Ovrhd & Prft. @ 30% of Direct Capital Cost					$13,950
Total Indirect Capital Cost					**$25,575**
Total Capital Cost	Not including Remedy Review				**$72,075**
ANNUAL OPERATING AND MAINTENANCE Cost					
INSTITUTIONAL CONTROLS AND MONITORING					
Institutional Controls Inspections	2 Technicians @ $50/hr	16	Hours	$50	$800
Develop LUC Monitoring Report	4FTE @ $125/hour	120	Hours	$125	$15,000
Estimated Annual Operating And Maintenance Cost					**$15,800**

Note: The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Table C-2. Detailed Cost Estimate for Alternative 2 – Institutional Controls, A-Area Miscellaneous Rubble Pile, Ash Area (Continued)

Year	Capital Cost	Annual O&M Cost	5-Year Remedy Review Cost	Discount Factor (7%)	Present Worth O&M Cost	Present Worth Remedy Review Cost
0	$72,025	$0	$0	1.000	$0	$0
1	$0	$15,800	$0	0.935	$14,767	$0
2	$0	$15,800	$0	0.873	$13,800	$0
3	$0	$15,800	$0	0.816	$12,898	$0
4	$0	$15,800	$0	0.763	$12,054	$0
5	$0	$15,800	$25,000	0.713	$11,265	$17,825
6	$0	$15,800	$0	0.666	$10,528	$0
7	$0	$15,800	$0	0.623	$9,839	$0
8	$0	$15,800	$0	0.582	$9,196	$0
9	$0	$15,800	$0	0.544	$8,594	$0
10	$0	$15,800	$25,000	0.508	$8,031	$12,708
11	$0	$15,800	$0	0.475	$7,507	$0
12	$0	$15,800	$0	0.444	$7,015	$0
13	$0	$15,800	$0	0.415	$6,557	$0
14	$0	$15,800	$0	0.388	$6,127	$0
15	$0	$15,800	$25,000	0.362	$5,726	$9,060
16	$0	$15,800	$0	0.339	$5,351	$0
17	$0	$15,800	$0	0.317	$5,002	$0
18	$0	$15,800	$0	0.296	$4,675	$0
19	$0	$15,800	$0	0.277	$4,369	$0
20	$0	$15,800	$25,000	0.258	$4,083	$6,460
21	$0	$15,800	$0	0.242	$3,816	$0
22	$0	$15,800	$0	0.226	$3,566	$0
23	$0	$15,800	$0	0.211	$3,332	$0
24	$0	$15,800	$0	0.197	$3,114	$0
25	$0	$15,800	$25,000	0.184	$2,910	$4,605
26	$0	$15,800	$0	0.172	$2,721	$0
27	$0	$15,800	$0	0.161	$2,542	$0
28	$0	$15,800	$0	0.150	$2,376	$0
29	$0	$15,800	$0	0.141	$2,221	$0
30	$0	$15,800	$25,000	0.131	$2,076	$3,285
				Total Present Worth Cost for O&M =	**$196,057**	
				Total Present Worth Cost for 5-Year Remedy Reviews =	**$53,943**	
				Total Capital Cost =	**$72,025**	
				Total Present Worth Cost the Ash Area Selected Remedy =	**$322,025**	

Note: The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Table C-3. Detailed Cost Estimate for Alternative 3a – Passive Soil Vapor Extraction, Institutional Controls, and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area

Item	Comments	Quantity	Unit	Unit Cost	Total Cost
Direct Capital Cost					
Remedy Review					
Review Regulations	4FTEs @ 125/hr	32	Hours	$125	$4,000
Develop 5-Year Remedy Review	4FTEs @ 125/hr	120	Hours	$125	$15,000
Attend Rgulatory Meeting	6FTEs @ 125/hr	48	Hours	$125	$6,000
Cost Per Remedy Review Period					$25,000
Site Work					
Deed Restrictions	1 Attorney @ $200/hr	16	Hours	$200	$3,200
Develop LUCIP	4FTE @ $125/hr	200	Hours	$125	$25,000
Work Plan/Soil and Sediment Erosion Control Plan	4FTE @ $125/hr	320	Hours	$125	$40,000
Clearing and Grubbing		2	Acres	$1,500	$3,000
Surveying		1	LS	$5,000	$5,000
Vent Equimpment & Installation					
Mobilization/Demobilization	Includes all Contrators	1	LS	$8,000	$8,000
Decontamination Pad		1	EA	$250	$250
Equipment Decontamination		1	LS	$2,000	$2,000
Vent Piping (perforated PVC)	60 Well @ 15'/Well	900	LF	$3	$2,700
Sand Packing		150	CY	$15	$2,250
Bentonite Seal		30	CY	$20	$600
Vent Well Installation		900	LF	$100	$90,000
Surface Seal (6" Bentonite @ 2 SY)		90	SY	$3	$270
Oversight Geologist	1FTE @ $65/hr	80	Hours	$65	$5,200
Split Spoon Samples	1 Sample per 4 feet	225	EA	$250	$56,250
Soil Cover Installation					
Common Fill		3281	CY	$10	$32,810
Proof Roll Site		2	Acres	$150	$300
Seeding Including Installation		9680	SY	$1	$9,680
Fence Construction		630	LF	$15	$9,450
Fence Gate		2	EA	$750	$1,500
	TOTAL DIRECT CAPITAL COST Not Including Remedy Review				$297,460
INDIRECT CAPITAL COSTS					
Health & Safety @ 5% of Direct Capital Cost					$14,873
Bonds & Insurance @ 5% of Direct Capital Cost					$14,873
Contingency @ 20% of Direct Capital Cost					$59,492
Engr. & Const. Mgt. @ 15% of Direct Capital Cost					$44,619
Prime Contractor Ovrhd & Prft. @ 30% of Direct Capital Cost					$89,238
	Total Indirect Capital Cost Not including Remedy Review				$223,095
Total Capital Cost					$520,555
ANNUAL OPERATING AND MAINTENANCE Cost					
Maintenance and Sampling					
Grass Cutting	4 times per year	32	Hours	$50	$1,600
Air Monitoring					
Collection Efforts	4 times per year	128	Hours	$50	$6,400
VOC Analysis	TCE/PCE COCs	60	EA	$125	$7,500
	Estimated Annual Maintenance and Sampling Cost				$15,500
	Maintenance and Sampling will Continue for 10 Years				
INSTITUTIONAL CONTROLS AND MONITORING					
Institutional Controls Inspections	2 Technicians @ $50/hr	16	Hours	$50	$800
Develop LUC Monitoring Report	4FTE @ $125/hour	120	Hours	$125	$15,000
Fence Repair	4 Times per year	32	Hours	$50	$1,600
	Estimated Annual Institutional Control Cost				$17,400

Note 1 The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Note 2 Highlighted cells show corrections made per SCDHEC Comment #5. Highlighted cells will be un-highlighted in clean copy of the ROD.

Table C-3. Detailed Cost Estimate for Alternative 3a – Passive Soil Vapor Extraction, Institutional Controls, and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area (Continued)

Year	Capital Cost	Annual O&M Cost (10 years)	5-Year Remedy Review Cost	Institutional Controls Cost (30 years)	Total O&M Cost	Discount Factor (7%)	Present Worth O&M	Present Worth Remedy Review
0	$520,555	$0	$0	$0	$0	1.000	$0	$0
1	$0	$15,500	$0	$17,400	$32,900	0.9346	$30,748	$0
2	$0	$15,500	$0	$17,400	$32,900	0.8734	$28,735	$0
3	$0	$15,500	$0	$17,400	$32,900	0.8163	$26,856	$0
4	$0	$15,500	$0	$17,400	$32,900	0.7629	$25,099	$0
5	$0	$15,500	$25,000	$17,400	$32,900	0.713	$23,458	$17,825
6	$0	$15,500	$0	$17,400	$32,900	0.6663	$21,921	$0
7	$0	$15,500	$0	$17,400	$32,900	0.6227	$20,487	$0
8	$0	$15,500	$0	$17,400	$32,900	0.582	$19,148	$0
9	$0	$15,500	$0	$17,400	$32,900	0.5439	$17,894	$0
10	$0	$15,500	$25,000	$17,400	$32,900	0.5083	$16,723	$12,708
11	$0	$0	$0	$17,400	$17,400	0.4751	$8,267	$0
12	$0	$0	$0	$17,400	$17,400	0.444	$7,726	$0
13	$0	$0	$0	$17,400	$17,400	0.415	$7,221	$0
14	$0	$0	$0	$17,400	$17,400	0.3878	$6,748	$0
15	$0	$0	$25,000	$17,400	$17,400	0.3624	$6,306	$9,060
16	$0	$0	$0	$17,400	$17,400	0.3387	$5,893	$0
17	$0	$0	$0	$17,400	$17,400	0.3166	$5,509	$0
18	$0	$0	$0	$17,400	$17,400	0.2959	$5,149	$0
19	$0	$0	$0	$17,400	$17,400	0.2765	$4,811	$0
20	$0	$0	$25,000	$17,400	$17,400	0.2584	$4,496	$6,460
21	$0	$0	$0	$17,400	$17,400	0.2415	$4,202	$0
22	$0	$0	$0	$17,400	$17,400	0.2257	$3,927	$0
23	$0	$0	$0	$17,400	$17,400	0.2109	$3,670	$0
24	$0	$0	$0	$17,400	$17,400	0.1971	$3,430	$0
25	$0	$0	$25,000	$17,400	$17,400	0.1842	$3,205	$4,605
26	$0	$0	$0	$17,400	$17,400	0.1722	$2,996	$0
27	$0	$0	$0	$17,400	$17,400	0.1609	$2,800	$0
28	$0	$0	$0	$17,400	$17,400	0.1504	$2,617	$0
29	$0	$0	$0	$17,400	$17,400	0.1406	$2,446	$0
30	$0	$0	$25,000	$17,400	$17,400	0.1314	$2,286	$3,285
						Total Present Worth Cost for O&M =	**$324,774**	
						Total Present Worth Cost for 5-year ROD Reviews =	**$53,943**	
						Total Capital Cost =	**$520,555**	
						Total Present Worth Cost the Trenches Area Selected Alternative =	**$899,272**	

Note: The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Table C-4. Detailed Cost Estimate for Alternative 3b - Active Soil Vapor Extraction, Institutional Controls and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area

Item	Comments	Quantity	Unit	Unit Cost	Total Cost
Direct Capital Cost					
Remedy Review					
Review Regulations	4FTEs @ 125/hr	32	Hours	$125	$4,000
Develop 5-Year Remedy Review	4FTEs @ 125/hr	120	Hours	$125	$15,000
Attend Rgulatory Meeting	6FTEs @ 125/hr	48	Hours	$125	$6,000
Cost Per Remedy Review Period					**$25,000**
Site Work					
Deed Restrictions	1 Attorney @ $200/hr	16	Hours	$200	$3,200
Develop LUCIP	4FTE @ $125/hr	200	Hours	$125	$25,000
Work Plan/Soil and Sediment Erosion Control Plan	4FTE @ $125/hr	320	Hours	$125	$40,000
Clearing and Grubbing		2	Acres	$1,500	$3,000
Surveying		1	LS	$5,000	$5,000
Vent Equimpment & Installation					
Mobilization/Demobilization	Includes all Contrators	1	LS	$16,000	$16,000
Decontamination Pad		1	EA	$250	$250
Equipment Decontamination		1	LS	$2,000	$2,000
Vacuum Hoses & Hardware		1	EA	$5,000	$2,000
Vent Piping (perforated PVC)	10 Wells @ 15'/Well	150	LF	$3	$450
Sand Packing		25	CY	$15	$375
Bentonite Seal		5	CY	$20	$100
Vent Well Installation		150	LF	$100	$15,000
Surface Seal (6" Bentonite @ 2 SY)		15	SY	$3	$45
Oversight Geologist	1FTE @ $65/hr	80	Hours	$65	$5,200
Split Spoon Samples	1 Sample per 4 feet	38	EA	$250	$9,500
Soil Cover Installation					
Common Fill		3281	CY	$10	$32,810
Proof Roll Site		2	Acres	$150	$300
Seeding Including Installation		9680	SY	$1	$9,680
Fence Construction		630	LF	$15	$9,450
Fence Gate		2	EA	$750	$1,500
	TOTAL DIRECT CAPITAL COST Not Including Remedy Review				**$180,860**
INDIRECT CAPITAL COSTS					
Health & Safety @ 5% of Direct Capital Cost					$9,043
Bonds & Insurance @ 5% of Direct Capital Cost					$9,043
Contingency @ 20% of Direct Capital Cost					$36,172
Engr. & Const. Mgt. @ 15% of Direct Capital Cost					$27,129
Prime Contractor Ovrhd & Prft. @ 30% of Direct Capital Cost					$54,258
	Total Indirect Capital Cost Not including Remedy Review				**$135,645**
Total Capital Cost					**$316,505**
ANNUAL OPERATING AND MAINTENANCE Cost					
Maintenance and Sampling					
Grass Cutting	4 times per year	32	Hours	$50	$1,600
Air Monitoring					
Collection Efforts	4 times per year	128	Hours	$50	$6,400
VOC Analysis	TCE/PCE COCs	60	EA	$125	$7,500
	Estimated Annual Maintenance and Sampling Cost				**$15,500**
	Maintenance and Sampling will Continue for 5 Years				
INSTITUTIONAL CONTROLS AND MONITORING					
Institutional Controls Inspections	2 Technicians @ $50/hr	16	Hours	$50	$800
Develop LUC Monitoring Report	4FTE @ $125/hour	120	Hours	$125	$15,000
Fence Repair	4 Times per year	32	Hours	$50	$1,600
	Estimated Annual Institutional Control Cost				**$17,400**

Note: The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Table C-4. Detailed Cost Estimate for Alternative 3b - Active Soil Vapor Extraction, Institutional Controls and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area (Continued)

Year	Capital Cost	Annual O&M Cost (5 years)	5-Year Remedy Review Cost	Institutional Control Cost (30 years)	Total O&M	Discount Factor (7%)	Present Worth O&M	Present Worth Remedy Review
0	$316,505	$0	$0	$0	$0	1.000	$0	$0
1	$0	$15,500	$0	$17,400	$32,900	0.9346	$30,748	$0
2	$0	$15,500	$0	$17,400	$32,900	0.8734	$28,735	$0
3	$0	$15,500	$0	$17,400	$32,900	0.8163	$26,856	$0
4	$0	$15,500	$0	$17,400	$32,900	0.7629	$25,099	$0
5	$0	$15,500	$25,000	$17,400	$32,900	0.713	$23,458	$17,825
6	$0	$0	$0	$17,400	$17,400	0.6663	$11,594	$0
7	$0	$0	$0	$17,400	$17,400	0.6227	$10,835	$0
8	$0	$0	$0	$17,400	$17,400	0.582	$10,127	$0
9	$0	$0	$0	$17,400	$17,400	0.5439	$9,464	$0
10	$0	$0	$25,000	$17,400	$17,400	0.5083	$8,844	$12,708
11	$0	$0	$0	$17,400	$17,400	0.4751	$8,267	$0
12	$0	$0	$0	$17,400	$17,400	0.444	$7,726	$0
13	$0	$0	$0	$17,400	$17,400	0.415	$7,221	$0
14	$0	$0	$0	$17,400	$17,400	0.3878	$6,748	$0
15	$0	$0	$25,000	$17,400	$17,400	0.3624	$6,306	$9,060
16	$0	$0	$0	$17,400	$17,400	0.3387	$5,893	$0
17	$0	$0	$0	$17,400	$17,400	0.3166	$5,509	$0
18	$0	$0	$0	$17,400	$17,400	0.2959	$5,149	$0
19	$0	$0	$0	$17,400	$17,400	0.2765	$4,811	$0
20	$0	$0	$25,000	$17,400	$17,400	0.2584	$4,496	$6,460
21	$0	$0	$0	$17,400	$17,400	0.2415	$4,202	$0
22	$0	$0	$0	$17,400	$17,400	0.2257	$3,927	$0
23	$0	$0	$0	$17,400	$17,400	0.2109	$3,670	$0
24	$0	$0	$0	$17,400	$17,400	0.1971	$3,430	$0
25	$0	$0	$25,000	$17,400	$17,400	0.1842	$3,205	$4,605
26	$0	$0	$0	$17,400	$17,400	0.1722	$2,996	$0
27	$0	$0	$0	$17,400	$17,400	0.1609	$2,800	$0
28	$0	$0	$0	$17,400	$17,400	0.1504	$2,617	$0
29	$0	$0	$0	$17,400	$17,400	0.1406	$2,446	$0
30	$0	$0	$25,000	$17,400	$17,400	0.1314	$2,286	$3,285
						Total Estimated Present Worth Cost for O&M =	**$279,464**	
						Total Present Worth Cost for 5-Year ROD Reviews =	**$53,943**	
						Total Capital Cost =	**$316,505**	
						Total Present Worth Cost of the Trenches Area Selected Remedy =	**$649,912**	

Note: The selected remedy is expected to continue for more than 30 years, but for comparative purposes a 30 year present worth cost estimate was used.

Table C-5. Detailed Cost Estimate for the Original Active Soil Vapor Extraction, Institutional Controls, and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area

Item	Comments	Quantity	Units	Unit Cost	Total Cost
DIRECT CAPITAL COSTS					
REMEDY REVIEW					
Review Regulations	4 FTEs @ $125/hr	32	Hours	$125	$4,000
Develop 5-Year Remedy Review Report	4 FTEs @ $125/hr	120	Hours	$125	$15,000
Attend Regulatory Meeting	6 FTEs @ $125/hr	48	Hours	$125	$6,000
Cost Per Remedy Review Period					$25,000
SITE WORK					
Deed Restriction	1 Attorney @ $200/hour	16	Hours	$200	$3,200
Develop LUCIP	4 FTEs @ $125/hr	200	Hours	$125	$25,000
Work Plan/Soil and Sediment Erosion Control Plan	4 FTEs @ $125/hour	320	Hours	$125	$40,000
Clearing & Grubbing		2	Acres	$1,500	$3,000
Surveying		1	LS	$5,000	$5,000
VENT EQUIPMENT & INSTALLATION					
Mobilization/Demobilization (Includes All Contractors)		1	LS	$8,000	$8,000
Decontamination Pad		1	EA	$250	$250
Equipment Decontamination		1	LS	$2,000	$2,000
Vent Piping (perforated PVC) (20 wells @ 15'/well)		300	LF	$3	$900
Sand Packing		150	CF	$15	$2,250
Bentonite Seal		30	CY	$20	$600
Vent Well Installation		300	LF	$100	$30,000
Surface Seal	6" Bentonite @ 2 SY	90	SY	$3	$270
Oversight Geologist	1 FTE @ $65/hour	80	Hours	$65	$5,200
Split Spoon Samples	1 Sample per 4-feet	75	EA	$250	$18,750
Ancillary Piping (PVC)		1200	LF	$3	$3,600
Ancillary Piping (CPVC)		400	LF	$8	$3,200
Centrifugal Blower (25 hp)		20	EA	$12,000	$240,000
Power Line		1	LS	$10,000	$10,000
Vacuum Guage (magnehelic)		22	EA	$75	$1,650
Flow Meter (annubar)		22	EA	$300	$6,600
Sampling Port (brass T)		22	EA	$30	$660
Pressure Release Valve		1	EA	$225	$225
Heat Exchanger		1	EA	$1,400	$1,400
Air/Water Separator	800 gallon	1	EA	$11,600	$11,600
Carbon Vapor Treatment System	2 x 2500 cfm	2	EA	$13,750	$27,500
Fiberglass Shed	8' x 10'	1	EA	$8,500	$8,500
Oversight Engineer	1 FTE @ $125/hour	120	Hours	$125	$15,000
SOIL COVER INSTALLATION					
Common Fill		3,281	CY	$10	$32,810
Proof Roll Site		2	Acres	$150	$300
Seeding Including. Installation		8,090	SY	$1	$8,090
Fence Construction		630	LF	$15	$9,450
Fence Gate		2	EA	$750	$1,500
Oversight Geologist	1 FTE @ $65/hour	80	Hours	$65	$5,200
	TOTAL DIRECT CAPITAL COST Not Including Remedy Review				$531,705

Table C-5. Detailed Cost Estimate for the Original Active Soil Vapor Extraction, Institutional Controls, and 0.3-m (1-ft) Soil Cover, A-Area Miscellaneous Rubble Pile, Trenches Area (Continued)

Item	Comments	Quantity	Units	Unit Cost	Total Cost
Health & Safety @ 5% of Direct Capital Cost					$26,585
Bonds & Insurance @ 5% of Direct Capital Cost					$26,585
Contingency @ 20% of Direct Capital Cost					$106,341
Eng. & Const. Mgt. @ 15% of Direct Capital Cost					$79,756
Prime Contractor Ovrhd & Prft @ 30% of Direct Capital Cost					$159,512
	TOTAL INDIRECT CAPITAL COST				**$398,779**
	TOTAL CAPITAL COST Not Including Remedy Review				**$930,484**
ANNUAL OPERATING AND MAINTENANCE COSTS					
POWER, SAMPLING, AND MAINTENANCE					
Power	134,000 kWhr/mo @ $.20/kWhr	12	MO	$26,800	$321,600
Operator	20 hrs/wk @ $50/hr	12	MO	$4,000	$48,000
Grass Cutting (4 times per year)	1 Technician @ $50/hour	32	Hours	$50	$1,600
Air Monitoring					
Collection Efforts (once per month)	2 Technicians @ $50/hour	384	Hours	$50	$19,200
Volatile Organic Compounds Analysis	TCE/PCE COCs	20	EA	$125	$2,500
	Estimated Annual Operating (1st 3 years) and Maintenance Cost				**$392,900**
INSTITUTIONAL CONTROLS MONITORING					
Fence Repair (4 times per year)	2 Technicians @ $50/hour	32	Hours	$50	$1,600
Institutional Controls Inspection	2 Technicians @ $50/hr	16	Hours	$50	$800
Develop LUC Monitoring Report	4 FTEs @ $125/hr	120	Hours	$125	$15,000
	Estimated Annual Operating and Maintenance Cost				**$17,400**