United States Department of Energy

Savannah River Site

# Record of Decision Remedial Alternative Selection for the A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin / Metals Burning Pit (731-4A, -5A) Operable Unit (U)

CERCLIS Numbers: 19, 28

WSRC-RP-2005-4095

Revision 1.1

February 2007

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

# RECORD OF DECISION
# REMEDIAL ALTERNATIVE SELECTION (U)

## A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit (U)

**CERCLIS Numbers: 19, 28**

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**Savannah River Site**
**Aiken, South Carolina**

**Prepared by:**

**Washington Savannah River Company LLC**
**for the**
**U. S. Department of Energy under Contract DE-AC09-96SR18500**
**Savannah River Operations Office**
**Aiken, South Carolina**

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## DECLARATION FOR THE RECORD OF DECISION

### *Unit Name and Location*

A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Numbers: OU- 19, 28

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 Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) (ABRP) and Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) (MCB/MBP) Operable Units (OU) are listed as separate Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit / CERCLA units in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). To achieve final closure, the individual units have been consolidated to form the ABRP/MCB/MBP OU.

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 the regulated entity [United States Department of Energy (USDOE)] that establishes the responsibilities and schedules for the comprehensive remediation of the SRS. The ABRP/MCB/MCP OU includes the A-Area Ash Pile (788-2A). The media associated with this OU are surface and vadose zone soils. Groundwater is not considered part of the scope for the ABRP/MCB/MBP OU. Any groundwater contamination resulting from the ABRP/MCB/MBP OU is regulated by the SRS RCRA Part B Permit and addressed by the requirements of the M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Groundwater Monitoring and Corrective Action agreements.

***Statement of Basis and Purpose***

This decision document presents the selected remedy for the ABRP/MCB/MBP OU, located at the SRS near 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. USEPA, SCDHEC and USDOE concur with the selected remedy.

***Assessment of the Site***

There has been a release of hazardous and radioactive substances at the ABRP/MCB/MBP OU to the environment. The response actions selected in this Record of Decision (ROD) are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances to the environment.

***Description of the Selected Remedy***

The ABRP/MCB/MBP OU is comprised of the following subunits:

*ABRP OU*

- Burning/Rubble Pit 731-A Subunit
- Burning/Rubble Pit 731-1A Subunit
- Rubble Pit 731-2A Subunit
- Potential Pit Subunit
- Depressional Area Subunit
- Ash Scatter Area/Ditch Subunit

- Trench Subunit (includes vadose zone soil)
- 788-2A A-Area Ash Pile Subunit

*MCB/MBP OU*

- MCB Surface Soil Subunit
- MCB Vadose Zone Subunit
- MBP Surface Soil Subunit

For the ABRP/MCB/MBP OU, no action is required for the following subunits:

- Burning/Rubble Pits 731-A and 731-1A
- Depressional Area
- Potential Pit
- Ash Scatter Area/Ditch

This decision is based on a hypothetical future resident scenario i.e., unrestricted land use. These subunits do not require any surficial land use controls as part of the final remedy.

As per the respective Interim Records of Decision (IROD), final actions have been completed for the following subunits and no further action is required:

- Rubble Pit 731-2A
- MCB/MBP surface soils

The decisions for the Rubble Pit and MCB are based on the future industrial worker scenario; these subunits require land use controls as part of the final remedy. The MBP does not require

surface land use controls (based on a hypothetical future resident scenario, i.e., unrestricted land use) as part of the final remedy since it only had an ecological risk driver.

A final action for the MCB vadose zone is on-going and will continue. The final action is the continued passive operation of soil vapor extraction (SVE) BaroBall™ wells. The future land use for ABRP/MCB/MBP OU is anticipated to be industrial. Due to groundwater contamination, institutional controls to prevent access or use of groundwater until cleanup levels are met under the RCRA program are required for all of the subunits in this operable unit. Groundwater contamination in the vicinity of the ABRP/MCB/MBP OU is being addressed under the 2000 RCRA Part B Permit Renewal Application for M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Postclosure.

Based on the detailed evaluation of alternatives performed in the Corrective Measures Study/Feasibility Study (CMS/FS), the selected remedies for final remedial actions for the ABRP/MCB/MBP OU include the following:

***Trench Subunit***

**Alternative AT-3 - Operation of SVE and Institutional Controls:** This alternative involves operating an SVE system and implementing institutional controls until the vadose zone RAOs have been achieved. This alternative has been selected because it effectively removes volatile organic compounds (VOCs) from the vadose zone and protects groundwater by depleting the source. The final SVE system would be an expansion of the existing Interim Remedial Action (IRA) well network. The existing system consists of three MicroBlower™ and one BaroBall™ vapor-extraction wells to target contamination in the vadose zone beneath the Trench. The expanded system would include installation of up to an additional 11 SVE wells. System air emissions do not require treatment and are vented to the atmosphere. The ABRP and MCB SVE systems received an Air Quality Control (AQC) permit exemption because of the expected (and demonstrated) low exhaust emissions. SRS plans to pursue a similar strategy for future SVE systems in the area.

USDOE, USEPA, and SCDHEC have agreed to jointly decide on significant changes in the operation of the SVE system (typically transitioning from active to passive extraction) taken to maintain the efficiency of the remedial system. This process for transition from active to passive SVE technology will be discussed in detail in the Corrective Measures Implementation (CMI)/Remedial Action Implementation Plan (RAIP).

The purpose of institutional controls for the vadose zone is to prevent potential exposure by limiting excavation of soil at depth. Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to contaminated soil.

***A-Area Ash Pile Subunit***

**Alternative AP-3 - Soil Cover and Institutional Controls:** This alternative involves the installation of a soil cover over the A-Area Ash Pile and implementation of institutional controls to prevent exposure. This alternative has been selected because it effectively eliminates the exposure pathway for human and ecological receptors. The soil cover would be contoured to control stormwater drainage and would be seeded with grasses to control erosion. This alternative is a containment option that effectively establishes a barrier between the ash and human and ecological receptors.

The purpose of institutional controls for the A-Area Ash Pile is to prevent potential exposure by controlling worker access and to maintain the integrity of the soil cover. Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to contaminated soil.

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

- Restrict worker access and prevent unauthorized contact, removal or excavation of contaminated media (i.e., vadose zone soils)

- Prohibit the development and use of property for residential housing, elementary schools, childcare facilities and playgrounds

- Maintain the integrity of any current or future remedial or monitoring systems such as SVE systems, soil cover, or groundwater monitoring wells

- Prevent access to or use of groundwater until cleanup levels are met (under the RCRA program)

- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion

USDOE expects the selected remedy to satisfy the statutory requirements in CERCLA Section 121(h) to (1) be protective of human health and the environment, (2) comply with applicable or relevant and appropriate requirements (ARARs), (3) be cost effective, and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

CERCLA ROD remedial action reviews will be conducted every five years to ensure that the selected remedy is still protective of human health and the environment. The RCRA permit will be revised to reflect selection of the final remedy using the procedures under 40 Code of Federal Regulations (CFR) Part 270, and South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.264.101; 270.

***Statutory Determinations***

Based on the unit RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment (RFI/RI/BRA) reports, the ABRP/MCB/MBP OU poses a threat to human health and the environment. Therefore, Alternative AT-3 - Operation of SVE and Institutional Controls, and Alternative AP-3, Soil Cover and Institutional Controls, have been selected as the final remedies for the ABRP/MCB/MBP OU. A final action for the MCB vadose zone is

ongoing and will continue. The final action is the continued passive operation of the SVE BaroBall™ wells. The future land use of the ABRP/MCB/MBP OU is assumed to be industrial.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Five-year remedy reviews are required under CERCLA Section 121(c).

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

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

The deed shall also include deed restrictions precluding residential use of the property. 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 selected remedy for the ABRP/MCB/MBP OU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure. As agreed on March 30, 2000, between the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Controls and Assurance Plan (LUCAP) to ensure that the land use controls (LUCs) required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Controls Implementation Plan (LUCIP), which is incorporated by reference into this ROD, will provide the details and specific measures required to implement and maintain the LUCs selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the CMI/RAIP, as required in the FFA, for review and approval by 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 and the *SRS Federal Facility Agreement.* The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved by USEPA and SCDHEC as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

***Data Certification Checklist***

This ROD provides the following information:

- Constituents of concern (COCs) and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for the COCs and the basis for the levels
- Current and reasonably anticipated future land and groundwater use assumptions used in the BRA and ROD
- Potential land and groundwater use that will be available at the site as a result of the selected remedy
- 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
- Key decision factor(s) that led to selecting the remedy (i.e., a description of the manner in which the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)
- The manner in which source materials constituting principal threats are addressed

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6/13/07
Date

Jeffrey M. Allison
Manager
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Date

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

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# DECISION SUMMARY
# REMEDIAL ALTERNATIVE SELECTION (U)

## A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit (U)

**CERCLIS Numbers: 19, 28**

**WSRC-RP-2005-4095**
**Rev. 1.1**

**February 2007**

**Savannah River Site**
**Aiken, South Carolina**

**Prepared By:**

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**for the**
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**Savannah River Operations Office**
**Aiken, South Carolina**

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ABRP | A-Area Burning/Rubble Pits, A-Area Rubble Pit |
| ac | acre |
| ARAR | applicable or relevant and appropriate requirement |
| AOC | area of contamination |
| bgs | below ground surface |
| BRA | Baseline Risk Assessment |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CERCLIS | Comprehensive Environmental Response, Compensation, and Liability Information System |
| CFR | Code of Federal Regulation |
| CM | contaminant migration |
| CMI | Corrective Measures Implementation |
| CMS/FS | Corrective Measures Study/Feasibility Study |
| CM COC | contaminant migration constituent of concern |
| COC | constituent of concern |
| CSM | conceptual site model |
| ECO | ecological |
| ESD | Explanation of Significant Difference |
| ft | feet |
| $ft^2$ | square foot |
| FFA | Federal Facility Agreement |
| GCCZ | Green Clay confining zone |
| ha | hectare |
| HBL | health-based limit |
| HEAST | Health Effects Assessment Summary Table |
| HH | human health |
| HH COC | human health constituent of concern |
| HQ | hazard quotient |
| HSWA | Hazardous and Solid Waste Amendments |
| ICMI | Interim Corrective Measures Implementation |
| IOU | integrator operable unit |
| IRA | Interim Remedial Action |
| IRIS | Integrated Risk Information System |
| IROD | Interim Record of Decision |

## LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| JCW | job control waste |
| km | kilometer |
| LLAZ | Lost Lake aquifer zone |
| LOAEL | lowest observable adverse effect level |
| LLC | Limited Liability Company |
| LUC | land use control |
| LUCAP | Land Use Controls Assurance Plan |
| LUCIP | Land Use Controls Implementation Plan |
| µg/L | microgram per liter |
| m | meter |
| MAAZ | M-Area aquifer zone |
| MAX | maximum concentration |
| MBP | Metals Burning Pit |
| MCB | Miscellaneous Chemical Basin |
| MCL | maximum contaminant level |
| mg/kg | milligram per kilogram |
| NC | not calculated |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NEPA | National Environmental Protection Act |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NPL | National Priorities List |
| OCDD | octachlorodibenzo-p-dioxin |
| O&M | operations and maintenance |
| OU | operable unit |
| ppb | parts per billion |
| PCB | polychlorinated biphenyl |
| PCE | tetrachloroethylene |
| pCi/g | picocuries per gram |
| PER | Performance Evaluation Report |
| PPE | personal protective equipment |
| ppmv | parts per million per volume |
| PRG | preliminary remediation goals |
| PTSM | principal threat source material |

## LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| RAIP | Remedial Action Implementation Plan |
| RAO | remedial action objective |
| RCOC | refined constituent of concern |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| RG | remedial goal |
| RGO | remedial goal option |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SARA | Superfund Amendments Reauthorization Act |
| SB/PP | Statement of Basis/Proposed Plan |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| scfm | standard cubic feet per minute |
| SCHWMR | South Carolina Hazardous Waste Management Regulations |
| SESOIL™ | Seasonal Soil Compartment Computer Model |
| SRS | Savannah River Site |
| SVE | soil vapor extraction |
| TCE | trichloroethylene |
| TRV | toxicity reference value |
| UCL | upper confidence limit |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| USDOE | United States Department of Energy |
| USEPA | United States Environmental Protection Agency |
| VOC | volatile organic compounds |
| VZCOMML™ | Vadose Zone Contaminant Migration Multi-layer Model |
| $yd^3$ | cubic yard |
| WSRC | Washington Savannah River Company, LLC |

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

## Unit Name, Location, and Brief Description

A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Numbers: OU- 19, 28

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy (USDOE)

Savannah River Site (SRS) occupies approximately 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 40.2 km (25 mi) southeast of Augusta, Georgia, and 32.2 km (20 mi) south of Aiken, South Carolina.

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 Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) (ABRP) and Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) (MCB/MBP) Operable Units (OUs) as individual Resource Conservation and Recovery Act (RCRA) Solid Waste Management Units/CERCLA units requiring further evaluation. To achieve final closure, the individual units have been consolidated to form the ABRP/MCB/MBP OU. The ABRP/MCB/MBP OU was evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to

determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

## II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

### SRS Operational and Compliance History

The primary mission of SRS has been to produce tritium, plutonium, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are 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 SCDHEC, which was most recently renewed on September 30, 2003. Module VIII 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 RCRA Facility Investigation (RFI) program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 United States Code Section 9620, USDOE has negotiated an FFA (FFA 1993) with United States Environmental Protection Agency (USEPA) and SCDHEC to coordinate remedial activities at SRS as one comprehensive strategy that fulfills these dual regulatory requirements. USDOE

functions as the lead agency for remedial activities at SRS, with concurrence by USEPA - Region 4 and SCDHEC.

**Operable Unit Operational and Compliance History**

The ABRP and MCB/MBP units were individual RCRA/CERCLA units listed in the FFA and further investigation for these units has been mandated. These two units have been consolidated to form the ABRP/MCB/MBP OU. The consolidation offered the potential for achieving final closure of the individual units in a shorter time frame because both have similar contaminants and overlapping groundwater plumes. Both characterization and interim remedial efforts were completed separately at each unit prior to consolidation. The large contaminant groundwater plume that originated in the M Area continues to migrate slowly towards the ABRP/MCB/MBP OU. The most recent groundwater modeling results indicate that contaminant levels emanating from the ABRP/MCB/MBP OU are declining and are expected to fall below the concentrations of the M Area plume within ten years. The M Area plume is currently being addressed by a RCRA corrective action plan. Consequently, the Core Team agreed to transfer responsibility for the ABRP/MCB/MBP groundwater from the FFA to the RCRA program.

The ABRP/MCB/MBP OU is located approximately 4.8 km (3 mi) east of the SRS boundary and 2.4 km (1.5 mi) south of M Area. (Figures 1 and 2). The OU is situated on the eastern edge of a north-south trending topographic ridge within the Upper Three Runs Creek Watershed. This ridge drains east to Tims Branch and west to the Savannah River floodplain. Its relief is characterized by flat areas and a few low rolling hills. Pine/hardwood forests are dominant with some grassy areas.

***ABRP Operational History***

The ABRP is divided into eight subunits (Burning/Rubble Pit 731-A, Burning/Rubble Pit 731-1A, Rubble Pit 731-2A, Potential Pit, Depressional Area, Ash Scatter Area/Ditch, A-Area Ash Pile 788-2A, and Trench) (Figure 2).

The two Burning/Rubble Pits (731-A, 731-1A) were constructed in 1951 and are approximately 6.7 m (22 ft) wide, 2.7 to 3 m (9 to 10 ft) deep, and 76.2 m (250 ft) long. They were used on a monthly schedule to burn paper, plastics, wood, rubber, rags, cardboard, oil degreasers, and solvents. After burning was discontinued in October 1973, the burned remains were covered with a layer of soil. The pits were subsequently filled with rubble consisting of paper, wood, concrete, empty galvanized steel barrels, and cans. The pits reached capacity in 1978 and were taken out of service in 1983. The pits were then covered with native soils to grade level, and vegetation was allowed to re-establish.

Rubble Pit 731-2A was used from about 1951 until 1983 and is approximately 12.2 m (40 ft) wide and 198.1 m (650 ft) long, with an unknown depth that could extend to 6.1 m (20 ft). No specific disposal records are known to exist for this pit. However, SRS rubble pits were generally used to dispose of construction debris, waste wood products, and non-returnable empty drums. After the last use of Rubble Pit 731-2A in 1983, the area was backfilled and seeded.

Aerial photographs from the 1950s through 1980s revealed the presence of several features in the ABRP area for which there are no records or historical information.

The Potential Pit has estimated dimensions of 61 x 79.2 m (200 x 260 ft). This subunit was designated based on the existence of an area of depression/subsidence located approximately 15.2 m (50 feet) east of the A-Area Ash Pile and discussions with SRS personnel. Ground penetrating radar results suggested the presence of a trench boundary; however, interpretation was difficult because soil had been disturbed over the entire area.

The Depressional Area has estimated dimensions of 48.8 x 112.8 m (160 x 370 ft). It was identified by field observations as a potential receptor of surface runoff from the overflow of the pits/trenches or from spills in the immediate area. Although this area is a topographical "low spot," it does not contain permanent standing water or boggy areas, nor does it exhibit characteristic wetland soils and vegetation.

As shown in Figure 2, the Ash Scatter Area/Ditch is located between the A-Area Ash Pile and the Depressional Area and is approximately 0.4 ha (1.0 ac) in size. A historic east-northeast trending ditch (currently filled) is located within this subunit and measures approximately 91 x 6 m (300 x 20 ft).

The A-Area Ash Pile 788-2A subunit is located in the central portion of the ABRP. It covers approximately 1 ha (2.5 ac) and rises approximately 4.6 to 8 m (14 to 24 ft) above the surrounding topography. The A-Area Ash Pile was used to dispose of ash from the A-Area Powerhouse prior to 1994. The A-Area Ash Pile is permitted under Industrial Wastewater Permit No. 7289, which was issued on June 29, 1981.

The Trench subunit extends north-south and is mostly buried beneath 6.1 m (20 ft) of compacted ash along the eastern portion of the A-Area Ash Pile. The Trench was filled with debris and covered with soil prior to construction of the A-Area Ash Pile. The Trench measures approximately 4.6 x 91.4 m (15 x 300 ft). The Trench is between 2.4 and 4.6 m (8 and 15 ft) deep with approximately 5 to 10% of its length exposed to the south of the A-Area Ash Pile.

***MCB/MBP Operational History***

The MCB is an old borrow pit that received liquid chemical waste from about 1956 to 1974. No records of the types or amounts of material disposed of are available. It is believed that drums were emptied at the MCB and then discarded at the MBP. In 1974, the MCB, which was approximately 6 x 6 m (20 x 20 ft) and approximately 0.3 m (1 ft) deep, was graded and allowed to revegetate naturally.

The MBP is a cleared area that was used to burn lithium-aluminum alloys, scrap, and cuttings from A/M-Area operations. The MBP is irregular in shape, approximately 122 x 122 m (400 x 400 ft); it is not an excavated pit. Materials deposited there were placed in piles from 0.9 to 1.8 m (3 to 6 ft) high upon the ground. Wastes were accumulated in two areas, one large pile and a series of small piles oriented in a semicircular arc. The MBP

reportedly was in service from about 1960 to 1974. In 1974, the area was graded and allowed to revegetate with weeds, grasses and small pine trees.

***Groundwater***

Groundwater contamination in the vicinity of the ABRP/MCB/MBP OU will be addressed by RCRA under the 2000 Part B Permit Renewal Application for M Area and Metallurgical Laboratory Hazardous Waste Management Facilities Postclosure (WSRC-IM-98-30, Volume III).

***ABRP/MCB/MBP OU Compliance History***

The operational and document history of the ABRP/MCB/MBP OU is provided in Table 1. The ABRP/MCB/MBP OU remedial summary is provided in Table 2. This table identifies the media, land use, remedy and regulatory mechanism for each of the subunits. The Core Team agreed to transfer responsibility for the ABRP/MCB/MBP OU groundwater to the RCRA program in 2006. Descriptions of interim actions for groundwater provided below are for informational purposes only since the groundwater is no longer within the scope of this operable unit.

Initial characterization of the ABRP began in 1992 with an RFI/Remedial Investigation (RI) for the Burning/Rubble Pits, Potential Pit, and Depressional Area and included soil and groundwater investigations. Following these investigations, a baseline risk assessment (BRA) was conducted to evaluate potential risks to human health and the environment posed by the subunits (WSRC 1997). A summary of site risks is provided in Section VII of this document.

Based on the evaluation provided in the RFI/RI with BRA (WSRC 1997), an Interim Record of Decision (IROD) was prepared to address benzo(a)pyrene in soil at Rubble Pit 731-2A and to reduce the concentrations of volatile organic compounds (VOCs) in the M-Area aquifer zone (MAAZ). The IROD was approved in November 2000 (WSRC 2000a). The approved final remedial action for soil was the installation of a 1-ft thick

earthen cap coupled with the implementation of institutional controls. The approved interim action for groundwater involved the implementation of an air sparging/passive soil vapor extraction (SVE) system to address the portion of the contaminant plume with trichloroethylene (TCE) concentrations > 500 ppb. The air sparging/passive SVE system was placed in service in September 2001 and was shut down in March 2003. The effectiveness of the air sparging/passive SVE system was limited due to the presence of a low-permeability upper clay zone within the Green Clay confining zone (GCCZ), which corresponded to the top of the MAAZ water-level surface. Extensive testing and numerical simulations conducted in support of the Performance Evaluation Report (PER) showed that this low-permeability zone isolated the sparge screens from the vadose zone and prevented collection of the sparge air by the SVE wells. The Core Team reached agreement on March 26, 2003, to discontinue operation of the air sparging/passive SVE component of the ABRP interim action remedial system and to cancel implementation of Stage 2, the expansion of the air sparging / SVE system to address the larger portion of the contaminant plume with TCE concentrations > 100 ppb.

Subsequent investigation activities were conducted for the Ash Scatter Area/Ditch and Trench subunits. The results of these investigations were presented in the RFI/RI Addendum with BRA (WSRC 2003a). A summary of the site risk is provided in Section VII of this document.

Based on this subsequent investigation, an Explanation of Significant Difference (ESD) for the ABRP (WSRC 2002a) was issued. This ESD outlined the expansion of the SVE portion of the remedy presented in the ABRP IROD (WSRC 2000a). This additional interim action involved installation and operation of four new, MicroBlower™-equipped SVE wells at the Trench subunit to remediate VOCs in the vadose zone. The ESD allowed for evaluation of the MicroBlower™ units and the change to passive SVE units at any of the wells, if warranted.

Subsequent to the ABRP IROD and ESD, the A-Area Ash Pile was added as a subunit of the ABRP/MCB/MBP OU due to its proximity to the ABRP OU at the request of the

Core Team. The A-Area Ash Pile investigation was provided as Appendix D of the *Corrective Measures Study/Feasibility Study (CMS/FS) for the ABRP/MCB/MBP OU* (WSRC 2005). A summary of the A-Area Ash Pile risk is provided in Section VII of this document.

An RFI/RI for the MCB/MBP area was completed during 1994/1995 and included an investigation of soil and groundwater. This initial assessment is documented in the RFI/RI with BRA for MCB/MBP (WSRC 1998). A summary of site risks is provided in Section VII of this document.

Based on the evaluation provided in the RFI/RI with BRA (WSRC 1998), an IROD was prepared to address elevated levels of aluminum in MBP surface and subsurface soil, elevated levels of polychlorinated biphenyls (PCBs) (i.e., Aroclor-1254 and Aroclor-1260) in MCB surface and subsurface soil, elevated levels of VOCs in the MCB vadose zone, and elevated levels of VOCs in the MAAZ and Lost Lake aquifer zone (LLAZ). The IROD was approved in December 2000 (WSRC 1999). The approved final remedial action for soil consisted of excavation and disposal in an approved off-site facility and was completed in February 2002.

The approved final remedial action for the MCB vadose zone was a combination of active and passive SVE. Initially, a network of vadose zone wells, installed during early characterization, were operated passively using BaroBall™ technology to optimize VOC removal. An active SVE unit was installed and connected to the five SVE wells having the highest soil-gas contaminant concentrations. Active SVE began in October 2001 and quickly met the established shutdown criteria (WSRC 2003c). The active SVE unit was removed from service in November 2002, and the five wells were returned to passive operation. Although residual contamination remains in fine-grained soils near the surface, soil-gas monitoring indicates the passive SVE system is effectively controlling downward contaminant migration and eliminating VOC impact to the underlying MAAZ.

## 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 alternatives. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulations (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 alternatives for addressing the ABRP/MCB/MBP OU soils. 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 Protection Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit* (WSRC 2006a), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred actions for addressing the ABRP/MCB/MBP OU.

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
8911 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

The South Carolina Department of Health and Environmental Control – Region 5
Aiken 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 Statement of Basis/Proposed Plan (SB/PP) 45-day public comment period began on June 15, 2006, and ended on July 29, 2006. During the public comment period, a presentation of the selected remedial actions was made at the July 18, 2006 SRS Citizens Advisory Board Facilities Disposition and Site Remediation Committee meeting. A Responsiveness Summary, prepared to address any comments received during the public comment period, is provided in Appendix A of this document. A Responsiveness Summary will also be available in the final RCRA permit.

## IV. SCOPE AND ROLE OF THE OPERABLE UNIT

Due to the complexity of multiple contaminant areas, SRS is divided into integrator operable units (IOUs) for the purpose of managing a comprehensive cleanup strategy. Waste units within an IOU are evaluated and remediated individually. The ABRP/MCB/MBP OU is located within the Upper Three Runs Creek IOU (Upper Three Runs Watershed) (Figure 3). Upon disposition of all OUs within the watershed, a final comprehensive Record of Decision (ROD) for the Upper Three Runs IOU will be issued.

The overall strategy for addressing the ABRP/MCB/MBP OU was to (1) characterize the waste unit, delineating the nature and extent of contamination, and identifying the media of concern (perform the RFI/RI); (2) evaluate the media of concern to identify exposure pathways, characterize potential risk, and identify constituents of concern (COCs) (perform the BRA); and (3) evaluate and perform a final action to remediate, as needed, and to address identified media of concern.

Based on the Interim Corrective Measures Investigation / Remedial Action Implementation Plan (ICMI/RAIP) for the ABRP and MCB/MBP OUs (WSRC 2002b and WSRC 2000b, respectively), institutional controls to prevent residential land use are currently in place. Therefore, industrial land use is the most likely future land use scenario, although some subunits do not require any surficial land use controls (Table 2). Remedial action objectives (RAOs) and likely response actions were developed with this expectation.

Several interim actions have been performed to address sources of contamination at the ABRP and MCB/MBP OUs. These interim actions are identified below:

- Installation of soil cap at Rubble Pit 731-2A and operation of an air sparging/SVE system for the groundwater (discontinued) (WSRC 2000a, WSRC 2003a)

- Installation and operation of MicroBlower™-equipped SVE wells in the Trench subunit (WSRC 2003b)

- Excavation and disposal of contaminated soil at the MCB and MBP subunits (WSRC 1999)

- Installation and operation of SVE wells at the MCB subunit vadose zone (currently operating as passive with BaroBalls™) (WSRC 1999)

Remedial actions have been completed at Rubble Pit 731-2A and at the MCB/MBP surface/subsurface soils. These actions have met their RAOs and will not require

additional evaluation. The remedial action at the MCB vadose zone is on-going and is expected to meet final remedial goals (RGs). System performance is periodically evaluated to verify that progress. Off-gas samples are collected for analysis and the results are reviewed in the PERs for the OU. The frequency of sampling and reporting is matched to the extent that the results change with time. Early in the process, more frequent samples are collected because the results can be expected to change significantly in a short time frame. Later on, when the results approach an asymptotic limit, less frequent sampling is necessary to reliably monitor the process.

The remaining principal sources of contamination for the ABRP/MCB/MBP OU that require remedial action include the following:

- VOCs that present a threat of contaminant migration to groundwater above MCLs at the Trench subunit and the MCB/MBP vadose zone;

- elevated metals and coal-related radionuclides associated with ash (A-Area Ash Pile) that present a risk/hazard to future human/ecological receptors.

The response action for the Trench subunit and the on-going action for the MCB/MBP vadose zone will prevent impact to groundwater by removing VOC contamination from the vadose zone by treatment. The response action for the A-Area Ash Pile will eliminate exposure pathways for future human/ecological receptors.

Groundwater contamination in the vicinity of the ABRP/MCB/MBP OU will be addressed by RCRA under the 2000 Part B Permit Renewal Application for M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Postclosure (WSRC-IM-98-30, Volume III).

## V. OPERABLE UNIT CHARACTERISTICS

This section presents the conceptual site model (CSM), provides an overview of the characterization activities, and presents the characterization results and COCs.

**Conceptual Site Model**

The CSM for the portions of the OU that remain sources of contamination requiring remedial action (i.e., A-Area Ash Pile and Trench subunits) is presented in Figure 4. A CSM identifies known and suspected sources of contamination, types of contaminants and potentially affected media, known and potential routes of migration, and known and potential human and ecological receptors.

The primary source of contamination at the A-Area Ash Pile is coal ash from the A-Area Powerhouse. The ash material was evaluated as a secondary source and is referred to as "soil" in this document. If the primary source were to contact other media, secondary sources of contamination could be created through several release mechanisms. Typically, the potential secondary release mechanisms include release of volatile constituents from the soil (volatilization), generation of contaminated fugitive dust by wind or other surface soil disturbance, biotic uptake, radiation emissions, bioturbation between surface and subsurface soils and infiltration/percolation/leaching to groundwater. Contact with contaminated environmental media creates pathways for both human and ecological receptors. Potential human receptors include current on-unit workers, future industrial workers, and future residents. Potential ecological receptors include terrestrial receptors such as soil invertebrates, herbivorous mammals, insectivorous mammals, omnivorous mammals, insectivorous birds, and carnivorous birds. The exposure media at this subunit include ambient air (vapor and particulates), soil, and biota.

The primary source of contamination at the Trench subunit is the debris and fill material within the trench. It should be noted that the majority of the Trench subunit lies beneath the A-Area Ash Pile. Due to the presence of the A-Area Ash Pile, there is no significant exposure pathway for human or ecological receptors at the Trench subunit; however, there is a very small area (approximately 1/100 acre) which extends beyond the footprint of the Ash Pile that represents a very limited exposure pathway for these receptors. If a future remedy associated with the ash pile consisted of removing the ash, an exposure

pathway at the Trench subunit would be created. Migration of contaminants to the groundwater is the primary concern.

**Media Assessment**

The documents listed below give detailed information and analytical data for all investigations conducted and samples taken for the ABRP/MCB/MBP OU. They are available in the Administrative Record File (see Section III of this document). A summary of the historical activities for the ABRP/MCB/MBP OU is provided in Table 1.

- WSRC-RP-96-168, *RCRA Facility Investigation / Remedial Investigation Report with Baseline Risk Assessment for the A-Area Burning/Rubble Pits and Rubble Pit*, Revision 1.2 (WSRC 1997)
  - Burning /Rubble Pit 731-A
  - Burning/Rubble Pit 731-1A
  - Rubble Pit 731-2A
  - Potential Pit
  - Depressional Area

- WSRC-RP-2002-4209, *Addendum to the Revision 1.2 RFI/RI with BRA for the A-Area Burning/Rubble Pits and Rubble Pit* (WSRC-96-168, Revision 1) (WSRC 2003a)
  - Ash Scatter Area/Ditch
  - Trench

- WSRC-RP-2003-4116. *Corrective Measures Study / Feasibility Study Report for A-Area Burning/Rubble Pits (731-A,-1A) and Rubble Pit (731-2A) and Miscellaneous Chemical Basin / Metals Burning Pit (731-4A/5A) Operable Unit (U)*, Revision 1 (WSRC 2005)

- A-Area Ash Pile

- WSRC-RP-96-853. *RCRA Facility Investigation / Remedial Investigation Report with Baseline Risk Assessment for the Miscellaneous Chemical Basin/Metals Burning Pit*, Revision 1.2, (WSRC 1998)
  - MCB
  - MBP

***Media Assessment Results***

**Soil (including vadose zone)**

The ABRP/MCB/MBP OU remedial summary is provided in Table 2. The table identifies the media, land use, remedy and regulatory mechanism for each of the subunits.

No human health, ecological or contaminant migration refined constituents of concern (RCOCs) have been identified at the Burning/Rubble Pits (731-A, -1A), Potential Pit, Depressional Area, and Ash Scatter Area/Ditch subunits. Thus, there is no problem warranting action for these subunits.

Benzo(a) pyrene in surface soil at Rubble Pit 731-2A was identified as an RCOC for the future industrial worker at concentrations exceeding the RG of 0.2 mg/kg. The final action selected for the surface soil in the ABRP IROD consisted of a minimum 1-ft thick soil cover combined with institutional controls. Construction of the soil cover, which also covered the Burning/Rubble Pits (731-A, 731-1A), was completed in 2001. This action remains protective of human health. No further problems warranting action exist at the Rubble Pit 731-2A surface soil subunit.

Arsenic and coal-related radionuclides are present at the A-Area Ash Pile subunit (788-2A) at concentrations that exceed the $1x10^{-6}$ risk for the future industrial worker. Arsenic and selenium are present in concentrations that may be predictive of a potential

ecological hazard (lowest observable adverse effects level [LOAEL] hazard quotients [HQs] > 1). The A-Area Ash Pile covers approximately 2.5 ac (275 x 400 ft). Based on an average thickness of 20 ft, the total volume of the ash is approximately 79,000 $yd^3$.

The Trench subunit is approximately 4.6 m (15 ft) wide by 91.4 m (300 ft) long, most of which is overlain by about 6.1 m (20 ft) of compacted ash. The Trench is between 2.4 and 4.6 m (8 and 15 ft) deep, and approximately 5 to 10% of the Trench is exposed south of the Ash Pile. The vadose zone in the vicinity of the ABRP is about 40 m (130 ft) thick. The upper 24 m (80 ft) is made up of sands and silt. This is underlain by a predominantly clay, 1.8 to 2.4 m (6 to 8 ft) layer that sits atop another sand/silt layer approximately 12.2 m (40 ft) thick. A perched water zone is present at times just above the clay-rich zone at a depth of 22.9 to 25.9 m (75 to 85 ft) below the surface. The ABRP IROD was supplemented by an ESD that added an interim action of low-energy SVE to address TCE contamination in the vadose zone beneath the Trench. Three SVE wells are currently in operation as MicroBlowers™ and one as a passive well as part of this ongoing interim action. The maximum detection of TCE was 487 mg/kg. TCE concentrations are also present at levels in the vadose zone that would migrate to groundwater above the maximum contaminant level (MCL) of 5.0 $\mu$g/L in less than 10 years.

At the MCB subunit, PCBs exceeding both the human health RG (1 mg/kg) and the ecological RG (0.215 mg/kg) were present in soils. Octachlorodibenzo-p-dioxin (OCDD) was also present as a human health RCOC. The final action selected for MCB surface soils in the MCB IROD was institutional controls combined with excavation of PCB-contaminated soils to a maximum depth of 1 .2 m (4 ft). The excavation, which included an area of about 95,000 $ft^2$ (over 2 acres), was completed in February 2002. Confirmatory sampling was performed to verify that RGs were met. The excavation was backfilled with clean soil. This action remains protective of human health. No further problems warranting action exist at the MCB surface soil subunit.

The MCB vadose zone is approximately 36.6 m (120 ft) thick. The vadose zone contains a fine-grained sediment zone up to 4.6 m (15 ft) below ground surface (bgs), underlain by 18.3 to 21.3 m (60 to 70 ft) of sands/silts, a 3.0 m (10 ft) thick clay lens at a depth of 22.9 to 25.9 m (75 to 85 ft), and sands and silts to the water table. Tetrachloroethylene (PCE) and TCE contamination was found in the vadose zone at levels that would migrate to groundwater at a concentration above the MCL of 5.0 $\mu$g/L in less than 10 years. The final action selected for the MCB vadose zone in the MCB IROD was active/passive SVE, with a contaminant migration remedial goal option (RGO) of 0.344 mg/kg for both PCE and TCE. Twenty-seven SVE wells were installed covering an area of about 93,200 $ft^2$ (over 2 ac). Active SVE operation has been completed and passive SVE is ongoing. Effectiveness monitoring indicates declining contaminant concentrations consistent with effective removal of contaminated soil gas. Residual TCE and PCE contamination remains above the RG of 0.344 mg/kg at depths of 0 to 15 ft bgs. Passive SVE is ongoing per the MCB/MBP IROD, with 14 wells currently venting. The passive SVE system that began operating under the MCB/MBP OU IROD will continue to operate under this ROD until RGs are met. No further response action is required.

Aluminum concentrations at the MBP subunit exceeded the ecological RG of 11,000 mg/kg at two areas totaling approximately 1,765 $m^2$ (19,000 $ft^2$). The final action selected for MBP surface soils in the MCB/MBP IROD was excavation of contaminated soils to a maximum depth of 1.2 m (4 ft). Confirmatory sampling was performed to verify that RGs were met. The excavation was backfilled with clean soil. No further problems warranting action exist at the MBP surface soil subunit.

**Site-Specific Factors**

No site-specific factors requiring special consideration that might affect the remedial action for the ABRP/MCB/MBP OU are present at the site.

### Contaminant Transport Analysis

Contaminant fate and transport analyses were performed to select contaminant migration (CM) COCs on the basis of leaching by infiltrating water and subsequent transport to groundwater. These analyses were also used to predict the rate of contaminant migration and to project contaminant concentrations at receptor locations via various transport media. The overall objective of these analyses is to evaluate potential future impact to human health and the environment. The leachability modeling identified TCE as a CM COC at the Trench subunit.

## VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

### Land Uses

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited. The *Savannah River Site Long Range Comprehensive Plan* (USDOE 2000) designates the ABRP/MCB/MBP OU as being within the site industrial support area (Figure 5).

The respective ICMI/RAIPs for ABRP and MCB/MBP includes institutional controls with the specific exclusion of residential land use due to the presence of soil covers. Therefore, industrial land use is the most likely future land use scenario.

### Groundwater Uses/Surface Water Uses

SRS does not use the water table 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 ABRP/MCB/MBP OU will not be used as a potential water source or for irrigation. Groundwater monitoring is ongoing and is being addressed under the SRS RCRA Part B Permit.

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

## VII. SUMMARY OF OPERABLE UNIT RISKS

### Baseline Risk Assessments

As a component of the RFI/RI process, BRAs were performed at various stages of the project to evaluate risks associated with the ABRP/MCB/MBP OU. A BRA estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The BRA includes human health and ecological risk assessments.

An RFI/RI with BRA was performed to assess the risks to human health and the environment posed by the Burning/Rubble Pits, Rubble Pit, Potential Pit, and Depressional Area subunits of ABRP (WSRC 1997). An RFI/RI Addendum with BRA was performed to assess the risks posed by the Ash Scatter Area/Ditch and Trench subunits of ABRP (WSRC 2003a). The risk assessment for the A-Area Ash Pile subunit of ABRP is provided in the Corrective Measures Study/Feasibility Study (CMS/FS) for the ABRP/MCB/MBP OU (WSRC 2005). An RFI/RI with BRA was also performed to assess the risks posed by the MCB/MBP OU (WSRC 1998). The assessments included quantitative calculations of human health risks, ecological risks, and the threat posed by future leaching to groundwater. This section summarizes the results of the risk assessments for the ABRP/MCB/MBP subunits. The ABRP/MCB/MBP OU remedial summary is provided in Table 2. The table identifies the media, land use, remedy and regulatory mechanism for each of the subunits.

### Summary of Human Health Risk Assessment

Human health risks were assessed for current and future land use scenarios. The potentially exposed receptor under the current land use scenario is the known on-unit

worker. The potentially exposed receptors under the future land use scenario are the hypothetical industrial worker and the hypothetical resident (adult and child). Existing land use controls (LUCs) will ensure protection against unrestricted (i.e., residential) use.

The probable exposure routes for the future industrial worker at the ABRP/MCB/MBP OU are ingestion of contaminated media or biota, inhalation of particles and vapors, radiological emissions, and dermal exposure to contaminated media. The media investigated as a potential concern is surface soil.

***Current Land Use***

No human health COCs (HH COCs) were identified for the current land use scenario (known on-unit worker).

***Future Land Use***

At the Burning/Rubble Pits, Potential Pit, Depressional Area, and Ash Scatter Area/Ditch subunits of the ABRP, no HH COCs were identified for the surface soil exposure group. There is no exposure pathway for the majority of the Trench subunit; no HH COCs were identified for the exposed portion of the Trench that offers a potential exposure pathway of very limited extent.

At the Rubble Pit subunit of the ABRP, benzo(a)pyrene was identified as an HH COC for the surface soil exposure group. The approved final remedial action for soil was the installation of a 1-ft thick earthen cap coupled with the implementation of institutional controls (WSRC 2000a). No additional evaluation of this subunit is required.

The A-Area Ash Pile is the only subunit for which a final action is currently required based on the human health risk assessment. Table 3 lists the COCs and their exposure point concentrations. Table 4 provides toxicity data, and Table 5 provides the calculated risk levels for the RCOCs based on future land use (i.e., industrial). Arsenic, potassium-40, radium-226, radium-228, thorium-228, and uranium-238 were identified as HH COCs

for the surface soil exposure group. These HH COCs (both individual and cumulative) exceed a risk of 1 x $10^{-6}$ for the future industrial worker (total media risk = 2.6 x $10^{-4}$). For the future resident scenario, uranium-235 was also identified as a COC in addition to those listed above (total media risk = 6.0 x $10^{-4}$).

At the MCB subunit of the MCB/MBP, PCBs and OCDD were identified as HH COCs for the surface soil exposure group. The approved final remedial action for soil consisted of excavation and disposal in an approved off-site facility (WSRC 1999). No additional evaluation of this subunit is required.

At the MBP subunit of the MCB/MBP, no HH COCs were identified for the surface soil exposure group.

**Summary of Ecological Risk Assessment**

Ecological risks due to soil exposure were assessed for various receptors. The toxic mechanisms of the COCs at the ABRP/MCB/MBP OU may result in reproductive, growth, and/or physiological effects.

At the Burning/Rubble Pits, Rubble Pit, Potential Pit, Depressional Area, and Ash Scatter Area/Ditch subunits of the ABRP, no ecological COCs were identified for the surface or subsurface soil exposure groups. There is no exposure pathway for the majority of the Trench subunit; no ecological COCs were identified for the exposed portion of the Trench that offers a potential exposure pathway of very limited extent.

At the A-Area Ash Pile subunit, arsenic and selenium were identified as ecological COCs for the surface and subsurface soil exposure groups. These constituents are consistent with the presence of coal ash. Based on food chain modeling, each constituent has an HQ greater than one for the insect-eating mammal and/or bird communities. These communities are expected to be exposed to the ecological COCs through ingestion of soil-dwelling invertebrates and incidental ingestion of soil material. The ecological exposure pathways and the associated assessment and measurement endpoints are

presented in Table 6. Protective concentrations for the ecological COCs at this subunit are presented in Table 7.

At the MCB subunit, PCBs were identified as ecological COCs for the surface and subsurface soil exposure groups. At the MBP subunit, aluminum was identified as an ecological COC for the surface and subsurface soil exposure groups. The approved final remedial action for soil consisted of excavation and disposal in an approved off-site facility (WSRC 1999). Since this action met final RGs, no additional evaluation of this subunit is required.

**Summary of the Fate and Transport Analysis**

A contaminant migration analysis was performed to identify CM COCs. The constituent is identified as a CM COC if leachability modeling predicts the constituent will leach to groundwater and exceed MCLs or preliminary remediation goals (PRGs) within 1,000 years.

The leachability modeling identified TCE as a CM COC at the Trench subunit. No CM COCs were identified for the Burning/Rubble Pits, Rubble Pit, Potential Pit, Depressional Area, Ash Scatter Area/Ditch, or A-Area Ash Pile subunits.

The leachability modeling also identified TCE and PCE as CM COCs for the MCB vadose zone. The final action selected for the MCB vadose zone in the MCB IROD was active/passive SVE for both PCE and TCE. Passive SVE is on-going, with fourteen wells currently venting. This action is meeting RAOs and will continue until final RGs are met. Therefore, no further response action is required.

**Discussion of Principal Threat Source Material**

No PTSM based on toxicity has been identified at the ABRP/MCB/MBP OU.

**Conclusions**

Actual or threatened releases of hazardous substances from this waste unit, if not addressed by the Selected Remedy or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

A remedial action has been completed at the Rubble Pit subunit of the ABRP to address human health risk. The remedial action included installing a soil cover over the Rubble Pit subunit and extending it over the Burning/Rubble Pits subunits to achieve adequate drainage. No further actions were necessary for the Potential Pit or Depressional Area (WSRC 2000a).

A remedial action has been completed for the MCB/MBP surface/subsurface soils. The remedial actions included the removal and disposal of soils that presented a human health risk and an ecological hazard. These areas will not require additional evaluation (WSRC 1999).

At the MCB vadose zone, TCE and PCE were identified as CM COCs. The final remedial action in place for the MCB vadose zone is passive SVE (WSRC 1999). No further response action is required.

No COCs were identified for the Ash Scatter Area/Ditch subunit of the ABRP; therefore, no further action is required.

At the Trench subunit, TCE was identified as a CM COC. The remedial actions selected for the Trench subunit have been designed to remove TCE from the soil and to prevent additional impacts to the groundwater.

At the A-Area Ash Pile subunit, inorganics and radionuclides related to coal ash currently present a risk to the future industrial worker ($2.6 \times 10^{-4}$), as well as an unacceptable hazard to ecological receptors. The remedial actions selected for the A-Area Ash Pile will prevent human and ecological exposure to the contaminants.

A CSM for the subunits that require remedial action is provided as Figure 4.

## VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

The goals of remedial actions are to protect human health and the environment and to mitigate the effects of contamination. USEPA has established a structured process to identify and evaluate technologies for remedial applications. This process involves developing and screening a range of appropriate remedial options and selecting the most suitable approach(es) for corrective measures and remedial actions.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) specifies six criteria for developing this range of remedial technologies [40 CFR Part 300.430 (a) (1) (iii) (A) - (F)]:

- Whenever practical, use treatment to address principal threats posed by the unit.
- Use engineering controls for waste that poses a relatively low long-term risk or when treatment is impractical.
- Combine methods (for example, treatment plus engineering controls) to protect human health and the environment.
- Supplement engineering controls with institutional controls to prevent or limit exposure.
- Whenever practical, use innovative technologies.

- Return usable groundwater to beneficial uses or prevent further degradation.

The CSM is developed from data gathered during site characterization and includes a description of contaminants that are present and the potential receptors that may be impacted. RAOs are medium or OU specific objectives for protecting human health and the environment. RAOs usually specify protection of potential receptors, exposure pathways, and are identified during the scoping process once the CSM is understood. Remedial goal options (RGOs) are typically identified along with the RAOs, and represent the preliminary media-specific goals that provide a measure that the RAO will be achieved for a selected remedial action. RAOs are based on the nature and extent of contamination and the potential for human and environmental exposure for each contaminated environmental medium. RAOs for soil were developed for the Trench and A-Area Ash Pile subunits of the ABRP OU and the MCB vadose zone.

RGOs can be qualitative statements or numerical values often expressed as concentrations in soils or groundwater, or actions (installation of engineered barriers, placement of caps and covers, etc.) that achieve the RAO. RGOs become finalized as RGs after public comment and approval of the SB/PP and are documented in this ROD. Final RGs will be monitored to determine when the remedial action is complete. The development of final RGs for cleanup actions is intended to protect human health and the environment and to prevent further contaminant migration. Final RGs as well as the rationale or basis for selection are summarized in Table 8.

The CMI/RAIP outlines the design strategy for the remedial action (using the selected remedy) documented in this ROD. The CMI/RAIP also discusses typical activities to be conducted during construction and implementation of the remedial action and the mechanism for demonstrating completion.

***Trench Subunit***

The RAO for the Trench subunit is defined as follows:

- Prevent migration of TCE contamination in soil to groundwater at a concentration above its MCL (5 μg/L).

TCE within the vadose zone at the Trench subunit poses a threat to groundwater quality because of leaching. A final RG based on the protection of groundwater from leaching of contaminants was calculated using the analytical models Vadose Zone Contaminant Migration Multi-layer Model (VZCOMML$^{TM}$) and Seasonal Soil Compartment Model (SESOIL$^{TM}$) to simulate contaminant leaching from the vadose zone at the Trench subunit to groundwater.

***A-Area Ash Pile Subunit***

RAOs for the A-Area Ash Pile subunit are defined as follows:

- Prevent human exposure to COCs that present a risk to future industrial workers

- Prevent ecological exposure to COCs that present a hazard to ecological receptors.

Arsenic has been detected at concentrations that pose a potential human cancer risk of greater than $1 \times 10^{-6}$ and a potential hazard to ecological receptors. Both HH and ecological (ECO) RGOs are within naturally occurring background levels; therefore, the RG is based on site-specific background levels.

Selenium has been detected at concentrations that pose a potential hazard to ecological receptors. The ecological RGO is within naturally occurring background levels; therefore, the RG is based on site-specific background levels.

Radium-226 and uranium-238 were detected at concentrations that pose a potential human cancer risk of greater than $1 \times 10^{-6}$. Because future land use will most likely be industrial, the RG is based upon the HH industrial RGO.

Potassium-40, radium-228, and thorium-228 were detected at concentrations that pose a potential human cancer risk of greater than $1 \times 10^{-6}$. The HH RGO is within naturally occurring background levels; therefore, the RG is based on site-specific background levels.

***MCB Vadose Zone Subunit***

The RAO for the MCB vadose zone subunit is defined as follows:

- Prevent migration of TCE and PCE contamination in soil to groundwater at a concentration above their MCLs (5 μg/L for each).

TCE and PCE within the vadose zone at the MCB vadose zone subunit pose a threat to groundwater quality because of leaching. A final RG based on the protection of groundwater from leaching of contaminants was established in the IROD (WSRC 1999).

## IX. DESCRIPTION OF ALTERNATIVES

A detailed analysis of alternatives was conducted in the CMS/FS (WSRC 2005) to determine the best set of alternatives for the ABRP/MCB/MBP OU.

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

For each of the alternatives below, a discount rate of 3.9% and an inflation rate of 0% were used to estimate the present-worth. The present-worth costs include the five-year remedy reviews if included as part of the alternative. Present-worth costs for these items are based on an estimated operation time frame of up to 150 years. Applicable or relevant

and appropriate requirements (ARARs) for the ABRP/MCB/MBP OU are provided in Appendix B.

***Alternatives for the Trench Subunit***

Three alternatives were developed and screened for this subunit based on effectiveness, implementability, and cost. The screening process resulted in the retention of the following two alternatives for detailed evaluation.

**Alternative AT-1 - No Action:** The No Action alternative for the Trench subunit makes no remedial effort to control risks, treat or remove wastes, or reduce the toxicity, mobility, or volume of contaminated media. Institutional controls and remedial actions do not continue. Under this hypothetical scenario, the ongoing interim remedial action (IRA)-SVE system, consisting of MicroBlower™-equipped wells, would be discontinued. The No Action alternative does not mitigate VOC-contaminant migration to groundwater.

The No Action alternative requires no construction or system operation and maintenance (O&M) and can be implemented immediately.

Summary of Costs

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

**Alternative AT-3 - Operation of SVE and Institutional Controls:** This alternative involves operating an SVE system and implementation of institutional controls until the vadose zone RAOs have been achieved. In the final SVE system, the existing IRA well network would be expanded to address soils contaminated above the RG. The SVE system will be operated on a "phased" approach between active SVE, enhanced passive

SVE (MicroBlowers™), and passive SVE (BaroBalls™), as appropriate, based on the level of contamination and performance of the well. The existing system consists of three MicroBlower™ and one BaroBall™ vapor extraction wells that target contamination in the vadose zone beneath the Trench. System air emissions do not require treatment and are vented to the atmosphere. The ABRP and MCB SVE systems received an Air Quality Control (AQC) permit exemption because of the expected (and demonstrated) low exhaust emissions. SRS plans to pursue a similar strategy for future SVE systems in the area.

This alternative effectively removes VOCs from the permeable portions of the vadose zone. Additional monitoring and confirmation sampling will be required.

Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to contaminated soil.

This alternative is easily implemented.

Summary of Costs

| | |
|---|---|
| Capital: | $693,600 |
| O&M: | $1,905,200 |
| Present-worth: | $2,598,800 |

***Alternatives for the A-Area Ash Pile Subunit***

A total of five alternatives were developed and screened for this subunit based upon effectiveness, implementability, and cost. The screening process resulted in the retention of the following two alternatives for detailed evaluation.

**Alternative AP-1 - No Action:** The No Action alternative for the A-Area Ash Pile makes no remedial effort to control risks, treat or remove wastes, or reduce the toxicity, mobility, or volume of contaminated media. Institutional controls and remedial actions do not continue.

The No Action alternative can be implemented immediately.

Summary of Costs

| | |
|---|---|
| Capital: | $0 |
| O&M: | $0 |
| Present-worth: | $0 |

**Alternative AP-3 - Soil Cover and Institutional Controls:** This alternative entails the installation of a soil cover over the A-Area Ash Pile and implementation of institutional controls to prevent exposure. The soil cover would be contoured to control stormwater drainage and would be seeded with grasses to control erosion.

This alternative effectively establishes a barrier between the ash and human and ecological receptors.

The purpose of institutional controls for the A-Area Ash Pile is to prevent potential exposure by controlling worker access and to maintain the integrity of the soil cover. Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to contaminated soil.

This alternative is easily implemented.

Summary of Costs

| | |
|---|---|
| Capital: | $1,251,000 |
| O&M: | $277,000 |
| Present-worth: | $1,528,000 |

## X. COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remedial alternatives was assessed against evaluation criteria to provide the basis for selecting a remedy. The criteria are identified in 40 Code of Federal Regulations (CFR) 300.430(e)(9)(A-I) and are derived from the statutory requirements of CERCLA § 121. The nine criteria are divided into three categories: threshold, primary balancing, and modifying criteria.

### *Threshold Criteria*

Threshold criteria are requirements that each alternative must achieve to be eligible for selection as a permanent remedy under CERCLA. The threshold criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs. There are no chemical-specific or location-specific ARARs. Action-specific ARARs are provided in Appendix B.

### *Primary Balancing Criteria*

Primary balancing criteria are factors that identify key trade-offs among alternatives. The primary balancing criteria are:

- Long-term effectiveness and permanence

- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

***Modifying Criteria***

Modifying criteria are also considered during remedy selection. These criteria were assessed formally after the public review and comment period on the SB/PP. The modifying criteria are:

- State acceptance
- Community acceptance

**Comparative Analysis for the Trench Subunit**

The following sections present a comparative analysis of the two remedial action alternatives (AT-1 and AT-3) considered for the Trench subunit. The alternatives are compared based on their relative achievement of NCP-threshold and primary-balancing criteria. This analysis identifies the trade-offs between alternatives. The comparative analysis of alternatives is summarized in Table 9.

***Overall Protection of Human Health and the Environment***

Both alternatives are protective of human health and the environment. The No Action (AT-1) alternative does not reduce the time necessary to remediate the vadose zone. Alternative AT-3, SVE and Institutional Controls, could reduce the impact of remedial contamination on underlying groundwater units.

***Compliance with ARARs***

*Chemical-Specific ARARs*: There are no chemical-specific ARARs for VOCs in soils at the Trench subunit.

*Location-Specific ARARs*: There are no location-specific ARARs for the Trench subunit.

*Action-Specific ARARs*: There are no action-specific ARARs for the No Action alternative.

Fugitive dust generation is controlled during construction activities for Alternative AT-3 and AP-3 to meet South Carolina regulations (SC R.61-62.6), Control of Fugitive or Particulate Matter. The very limited scale of construction activities also limits potential problems with particulate emissions. The substantive requirements of South Carolina Air Pollution Control Standards (SC R.61-62.5) and National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 63) apply to emissions of VOCs. However, historic operations have shown that offgas treatment is not necessary. Groundwater monitoring well and relevant details of SVE well installation will comply with South Carolina requirements (SC R.61-71).

***Long-Term Effectiveness and Permanence***

The No Action alternative provides no long-term protection of the environment. Alternative AT-3 permanently removes contaminants from the vadose zone and is long term in nature.

***Reduction of Toxicity, Mobility, or Volume through Treatment***

The No Action alternative does not reduce the toxicity, mobility, or volume of VOCs. Alternative AT-3 reduces mobility and volume by removing VOCs from the vadose zone, while toxicity and volume are reduced through photodegradation of the contaminants by sunlight.

*Short-Term Effectiveness*

There are no short-term risks to the community, remedial workers, or the environment under the No Action alternative. The No Action alternative will not effectively remediate VOCs in the short term because it takes approximately 200 years to reach RAOs.

Alternative AT-3 requires handling relatively small volumes of contaminated soil. Engineering controls and health/safety procedures are implemented to protect remedial workers, on-unit workers, the community, and the environment. Based on the declining TCE concentrations observed at the adjacent MCB over the past seven years, Alternative AT-3 achieves substantial contaminant removal in 27 years.

*Implementability*

The No Action alternative requires no effort to implement. For Alternative AT-3, the existing IRA SVE system requires no major construction efforts. However, equipment, materials, and suppliers are readily available for installation of the new SVE wells.

*Cost*

The total present-worth costs of the alternatives addressing the Trench subunit are $0 for the No Action alternative and $2,598,800 for Alternative AT-3.

**Comparative Analysis for the A-Area Ash Pile Subunit**

The following sections present a comparative analysis of the two remedial action alternatives (AP-1 and AP-3) considered for the A-Area Ash Pile subunit. The alternatives are compared based on their relative achievement of NCP-threshold and primary-balancing criteria. This analysis identifies the trade-offs between alternatives. The comparative analysis of alternatives is summarized in Table 10.

***Overall Protection of Human Health and the Environment***

The No Action alternative (AP-1) is not protective of human health or the environment because no controls are established to prevent contact with ash-related contaminants. Alternative AP-3 effectively protects human and ecological receptors and achieves RAOs.

***Compliance with ARARs***

*Chemical-Specific ARARs*: There are no chemical-specific ARARs associated with the A-Area Ash Pile subunit.

*Location-Specific ARARs*: There are no location-specific ARARs for the No Action alternative.

*Action-Specific ARARs*: There are no action-specific ARARs for the No Action alternative.

Implementation of the AP-3 alternative requires erosion and runoff controls to prevent sediment and contaminant runoff to surface water and wetlands downgradient of the remedial area to meet South Carolina regulations (SC R.72-300).

Fugitive dust generation is controlled during construction activities for Alternative AP-3 to meet South Carolina regulations (SC R.61-62.6), Control of Fugitive or Particulate Matter.

Closure of the Ash Pile will comply with applicable portions of SC R.61-82, Close Out of Wastewater Treatment Facilities.

***Long-Term Effectiveness and Permanence***

The No Action alternative provides no long-term protection of the environment. Alternative AP-3 isolates contaminants from exposure to human and ecological receptors and is long term in nature.

***Reduction of Toxicity, Mobility, or Volume through Treatment***

Neither alternative reduces the toxicity, mobility, or volume of contaminants.

***Short-Term Effectiveness***

There are no short-term risks to the community under the No Action alternative. Existing institutional controls minimize risks to remedial workers. The No Action alternative is not protective of ecological receptors.

Alternative AP-3 requires the temporary disturbance of contaminated media during construction activities. Engineering controls and health/safety procedures are implemented to protect remedial workers, on-unit workers, the community, and the environment.

The No Action alternative does not achieve RAOs while Alternative AP-3 does achieve RAOs upon completion of construction.

***Implementability***

The No Action alternative requires no effort to implement. Alternative AP-3 involves modest construction activities. Equipment, materials, and suppliers are readily available for the installation of a soil cover.

*Cost*

The total present-worth costs of the alternatives addressing the A-Area Ash Pile Subunit are $0 for the No Action alternative and $1,528,000 for Alternative AP-3.

## XI. THE SELECTED REMEDY

### Detailed Description of the Selected Remedy

The ABRP/MCB/MBP OU remedial summary is provided in Table 2. The table identifies the media, land use, remedy and regulatory mechanism for each of the subunits.

For the ABRP/MCB/MBP OU, no action is required for the following subunits:

- Burning/Rubble Pits 731-A and 731-1A
- Depressional Area
- Potential Pit
- Ash Scatter Area/Ditch

As per the respective IRODs, final actions have been completed for the following subunits and no further action is required:

- Rubble Pit 731-2A (WSRC 2000a)
- MCB/MBP surface soils (WSRC 1999)

A final action for the MCB vadose zone is on-going and will continue. The final action is the continued passive operation of SVE BaroBall™ wells.

Based on the detailed evaluation of alternatives performed in the CMS/FS (WSRC 2005), the selected remedy for final remedial action for the remaining subunits of the ABRP/MCB/MBP OU include the following:

***Trench Subunit***

**Alternative AT-3 - Operation of SVE and Institutional Controls:** This alternative involves operating an SVE system and implementing institutional controls until the vadose zone RAOs are achieved. This alternative has been selected because it effectively removes VOCs from the vadose zone and protects groundwater by depleting the source. The final SVE system would be an expansion of the existing IRA well network. The existing system consists of three MicroBlower™ and one BaroBall™ vapor-extraction wells targeting contamination in the vadose zone beneath the trench. The expanded system would include an additional 11 SVE wells (Figure 6). System air emissions do not require treatment and are vented to the atmosphere. The ABRP and MCB SVE systems received an AQC permit exemption because of the expected (and demonstrated) low exhaust emissions. SRS plans to pursue a similar strategy for future SVE systems in the area.

SVE is used to remove VOCs from the vadose zone. Vadose zone remediation using SVE reduces/removes the VOC source and is typically performed to manage the release of VOCs to groundwater. For example, the groundwater may be contaminated with VOCs above the MCL or the concentrations within the vadose zone may be elevated enough to threaten groundwater, and SVE is expected to improve groundwater conditions by reducing the further migration of VOCs to the groundwater. In these circumstances, the USDOE concurs with the concept of developing a vadose zone soil RG for the improvement or protection of groundwater. Every attempt will be made to meet the established RGs as finalized following public comment.

The effect of VOC soil contamination on the groundwater depends on multiple factors, including both concentration and mobility. Thus recognized, RGs may not be the sole

indicator used to determine when the degradation to groundwater has been halted and/or the threat to groundwater has been eliminated. Additional data and information may be used by the Core Team to establish these conditions.

SRS believes that it is important to review all of the monitoring data, including VOC concentrations in soil, soil gas extracted by the SVE system, and groundwater concentrations when determining the effectiveness of a particular SVE technology in achieving RAOs. USDOE, USEPA, and SCDHEC have agreed to jointly decide on significant changes in the operation of the SVE system (typically transitioning from active to passive extraction) taken to maintain the efficiency of the remedial system. This process for transitioning from active to passive SVE technology will be discussed in detail in the CMI/RAIP.

The SVE process will be optimized by matching the specific technology applied to each well to the amount of mobile contaminant present. Initially each well will be tested using a portable SVE unit capable of producing air flows of up to 100 scfm and vacuum levels of up to 15 inches of mercury. By monitoring the applied vacuum, air flow and contaminant concentration in the exhausted soil gas, estimates can be made about the permeability of the formation and the extent and mobility of the soil contamination. This information will guide the selection of the specific equipment to be installed at each well.

The mass removal efficiency from the vadose zone depends on a variety of site-specific soil conditions and the type and amount of contaminant mass present. SVE performance is commonly monitored by the exhaust gas contaminant concentration over time (Appendix D).

The purpose of institutional controls for the vadose zone is to prevent potential exposure by limiting excavation of soil at depth. Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to

contaminated soil. Actual soil samples from the vadose zone will be taken to demonstrate when the RGs have been met. Confirmatory sample locations will be based upon process knowledge developed over the duration of the remedial action and will be chosen to be representative of the residual contamination that might remain.

***A-Area Ash Pile Subunit***

**Alternative AP-3 - Soil Cover and Institutional Controls:** This alternative involves the installation of a soil cover over A-Area Ash Pile 788-2A and implementation of institutional controls to prevent exposure. This alternative is selected because it effectively eliminates the exposure pathway for human and ecological receptors. The soil cover would be contoured to control stormwater drainage and would be seeded with grasses to control erosion. This alternative effectively establishes a barrier between the ash and human and ecological receptors.

The purpose of institutional controls for the A-Area Ash Pile is to prevent potential exposure by controlling worker access and to maintain the integrity of the soil cover. Institutional controls include the installation of signs and fences, or the construction of other barriers to restrict access. Land-use restrictions such as excavation permit restrictions and deed restrictions will be used to restrict the activities that can be performed. These measures will prevent exposure to contaminated soil.

**Institutional Controls**

Institutional controls would be maintained to prevent unrestricted land use. Institutional controls will be implemented by:

- Providing access controls for onsite 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 USEPA and SCDHEC in advance of any changes in land use or excavation of waste.

- Providing access controls against trespassers as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Table 11 summarizes the LUCs for the ABRP/MCB/MBP OU. 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 Section 120(h). The deed notification shall notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. The deed shall expressly prohibit activities inconsistent with the remedial goals and LUC objectives in this ROD upon any and all transfers. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any re-evaluation 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 selected remedy for the ABRP/MCB/MBP OU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions until the concentration of hazardous substances in the soil and groundwater are at such levels to

allow for unrestricted use and exposure. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Controls and Assurance Plan (LUCAP) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Controls Implementation Plan (LUCIP) referenced in this ROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the CMI/RAIP, as required in the FFA, for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the *SRS Federal Facility Agreement*. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved by USEPA and SCDHEC as needed to be protective of human health and the environment. The deed shall expressly prohibit activities inconsistent with the remedial goals and LUC objectives in this ROD upon any and all transfers. The LUCs shall be maintained until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. Approval by USEPA and SCDHEC is required for any modification or termination of institutional controls

USDOE has recommended that residential use of SRS land be controlled; therefore, future residential use and potential residential water usage will be restricted to ensure long-term protectiveness. LUCs, including institutional controls, will restrict the ABRP/MCB/MBP OU to future industrial use and will prohibit residential use of the area. Unauthorized excavation will also be prohibited, and the waste unit will remain undisturbed. LUCs selected as part of this action will be maintained for as long as they are necessary and termination of any LUCs will be subject to CERCLA requirements for documenting changes in remedial actions.

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

- Restrict worker access and prevent unauthorized contact, removal or excavation of contaminated media (i.e., vadose zone soils)
- Prohibit the development and use of property for residential housing, elementary schools, childcare facilities and playgrounds
- Maintain the integrity of any current or future remedial or monitoring system, such as SVE systems, soil covers, or groundwater monitoring wells
- Prevent access to or use of groundwater until cleanup levels are met (under the RCRA program)
- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion

**Cost Estimate for the Selected Remedy**

Estimated costs associated with the selected remedy on the 3.9% discount rate over a 150-year period are summarized below.

***Trench Subunit***

**Alternative AT-3 - Operation of SVE and Institutional Controls:**

Summary of Costs

| | |
|---|---|
| Capital: | $693,600 |
| O&M: | $1,905,200 |
| Present-worth: | $2,598,800 |

*A-Area Ash Pile Subunit*

**Alternative AP-3 - Soil Cover and Institutional Controls:**

Summary of Costs

| | |
|---|---|
| Capital: | $1,251,000 |
| O&M: | $277,000 |
| Present-worth: | $1,528,000 |

Detailed cost estimates for each of these subunits are presented in Appendix C of this document. The information in these cost estimate summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering and design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record File, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30% of the actual project cost.

**Estimated Outcomes of Selected Remedy**

The expected condition after the preferred alternative is implemented is that institutional controls will prevent access to human receptors, the SVE will prevent future leaching of CM COCs to groundwater above MCLs, and the soil cover would eliminate exposure for human and ecological receptors. Groundwater will be remediated as specified in the SRS RCRA Part B Permit and addressed by the requirements of the M-Area and Metallurgical Laboratory Hazardous Waste management Facilities Groundwater Monitoring and Corrective Action agreement. The ABRP/MCB/MBP OU would be available for SRS use as an industrial area with land use restrictions.

The selected remedy will meet the RAOs through the following means:

- Preventing migration of TCE contamination of soil to groundwater at a concentration above its MCL (5 μg/L) (Trench subunit)

- Preventing human exposure to COCs that present a risk to future industrial workers (A-Area Ash Pile)

- Preventing ecological exposure to COCs that present a hazard to ecological receptors (A-Area Ash Pile)

**Waste Disposal and Transport**

The waste streams generated during remediation action may include: condensate from SVE units, well drilling material (typically described as non-aqueous fluids), personal protective equipment (PPE)/job control waste (JCW), failed equipment (e.g., SVE system components), rinse and wash solutions, and decon liquids. Each of these waste streams has been previously dispositioned during the characterization phase of ABRP/MCB/MBP OU. Rinse and wash solutions will be dispositioned to the ground inside the area of contamination (AOC). PPE/JCW and equipment will be decontaminated in accordance with the alternative treatment standards and disposed of at a sanitary landfill. Soil from shallow borings (15 feet or less) will be returned to the borehole. Environmental media will be evaluated against appropriate Health Based Limits (HBLs) identified in the Savannah River Site Investigation-Derived Waste Management Plan (WSRC 2006b) to determine if it must be managed as waste or may be returned to the unit. Waste that is considered hazardous under RCRA will be managed within the AOC in a Waste Storage Area. Final disposition will be to an appropriately permitted facility; this may include sending aqueous waste to a Clean Water Act permitted facility. Any unforeseen waste will be managed per existing SRS procedures and RCRA/CERCLA regulations. The ABRP/MCB/MBP OU is primarily located in a designated AOC, which would preclude the need for RCRA hazardous waste satellite accumulation areas. Any hazardous waste

generated outside the AOC will be appropriately stored in a satellite or staging area. Specific details regarding waste disposal and transport will be described in the CMI/RAIP document and the project-specific Waste Management Plan.

## XII. STATUTORY DETERMINATIONS

Based on the unit RFI/RI/BRA reports, the ABRP/MCB/MBP OU poses a threat to human health and the environment. Therefore, Alternative AT-3 - Operation of SVE and Institutional Controls, and Alternative AP-3, Soil Cover and Institutional Controls, have been selected as the remedy for the ABRP/MCB/MBP OU. The future land use of the ABRP/MCB/MBP OU is assumed to be industrial.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Five-year remedy reviews are required under CERCLA Section 121(c).

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

## XIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy selected in this ROD does not contain any significant changes from the preferred alternative presented in the SB/PP. No comments were received during the public comment period. However, after the public comment period ended, the USDOE, USEPA, and SCDHEC determined that soil from the 741-A Salvage Yard (a subunit of

the M Area OU) can be used as fill material under the soil cover at the A-Area Ash Pile (a subunit of the ABRP/MCB/MBP OU). The constituents found in the 741-A Salvage Yard soil are similar in nature to the constituents found at the A-Area Ash Pile and do not present a contaminant migration to groundwater concern.

A detailed implementation schedule for the removal action at the 741-A Salvage Yard is shown in Figure 7. This schedule allows for SRS submittal, USEPA and SCDHEC review and comment, and SRS revision of the 741-A Salvage Yard Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA). The schedule also allows for a 30-day public comment period. The administrative process for the 741-A Salvage Yard RSER/EE/CA must be completed before the ABRP/MCB/MBP OU ROD can be signed.

## XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary is included as 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 8.

The forecast schedule for the post-ROD documentation is provided below:

- SRS submittal of Revision 0 CMI/RAIP and Revision 0 LUCIP is scheduled for March 7, 2007.

- USEPA and SCDHEC will receive 60 calendar days for review of the Revision 0 CMI/RAIP and Revision 0 LUCIP.

- The SRS revision of the CMI/RAIP and LUCIP will be completed 45 calendar days after receipt of all regulatory comments on each of the documents.

- USEPA and SCDHEC will receive 30 days for final review and approval of the CMI/RAIP and LUCIP.

- The projected Remedial Action start date is May 6, 2008.

- The Revision 0 Post-Construction Report will be submitted to USEPA and SCDHEC after completion of the remedial action in accordance with the implementation schedule in the approved ABRP/MCB/MBP OU CMI/RAIP.

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## XVII. APPENDICES

Appendix A Responsiveness Summary

Appendix B Applicable or Relevant and Appropriate Requirements

Appendix C Cost Estimate for the Selected Remedy

Appendix D Operational Trend of SVE Unit

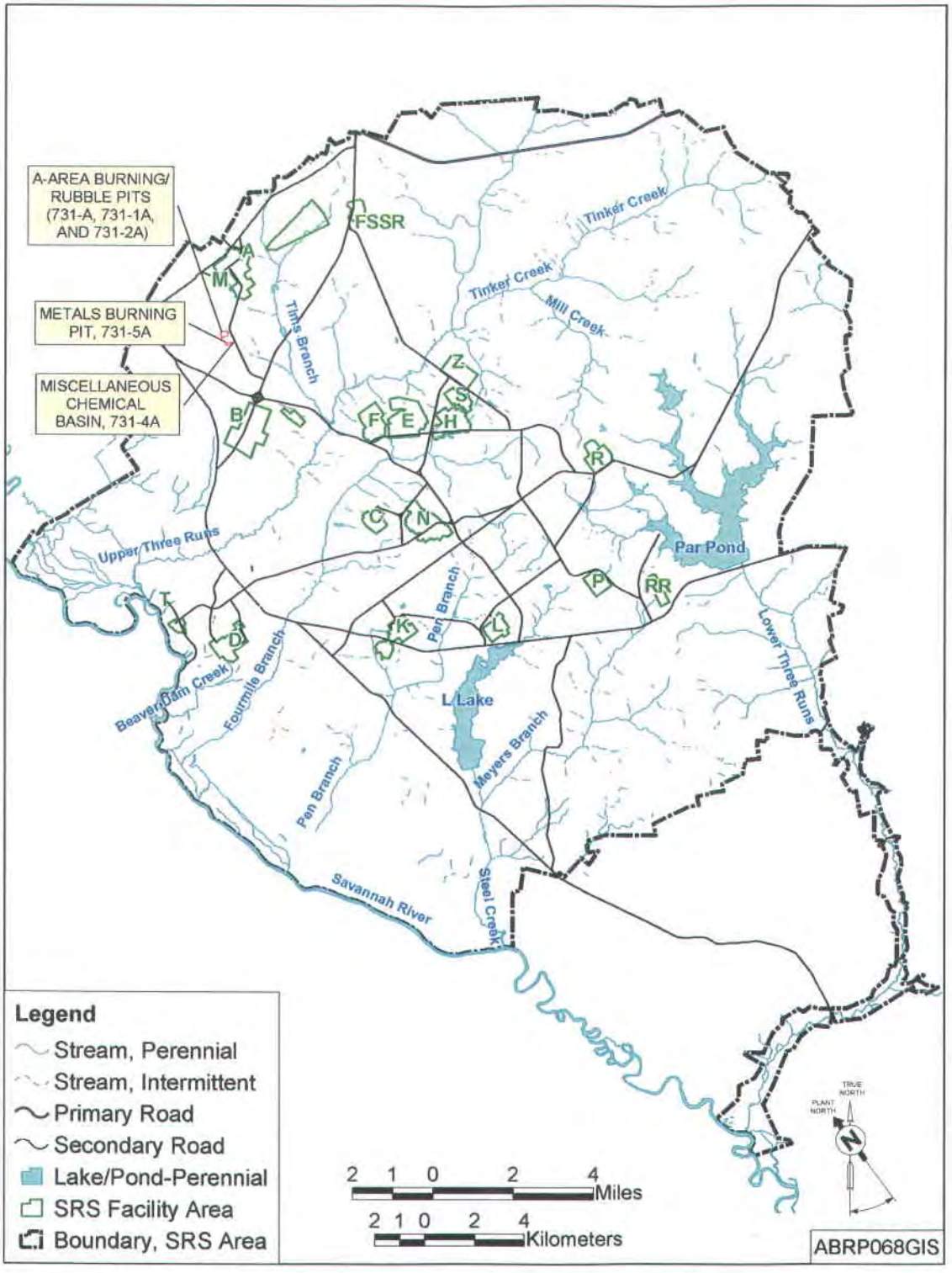


**Figure 1. Location of the ABRP/MCB/MBP OU at SRS**

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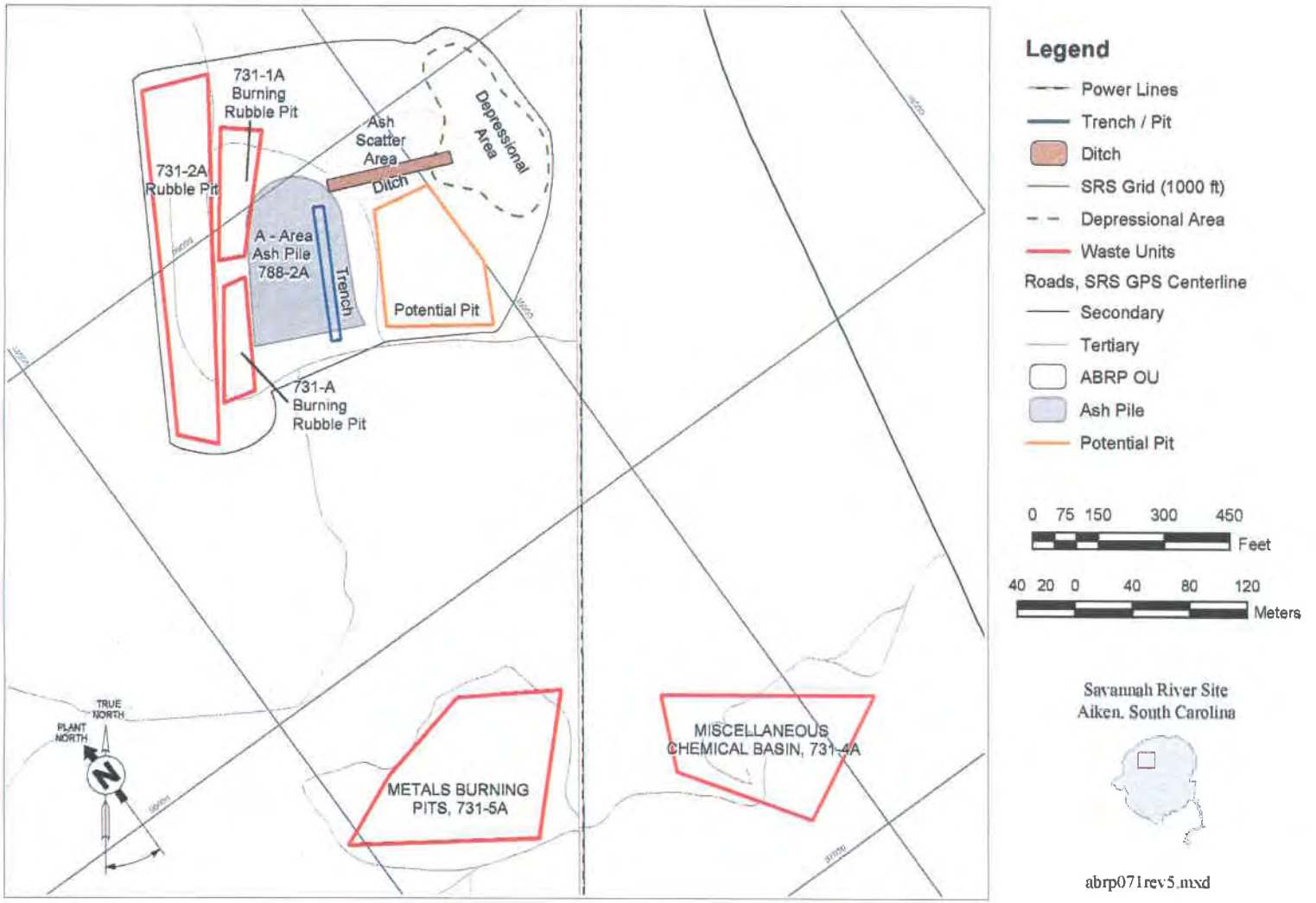


**Figure 2. ABRP/MCB/MBP OU Layout**

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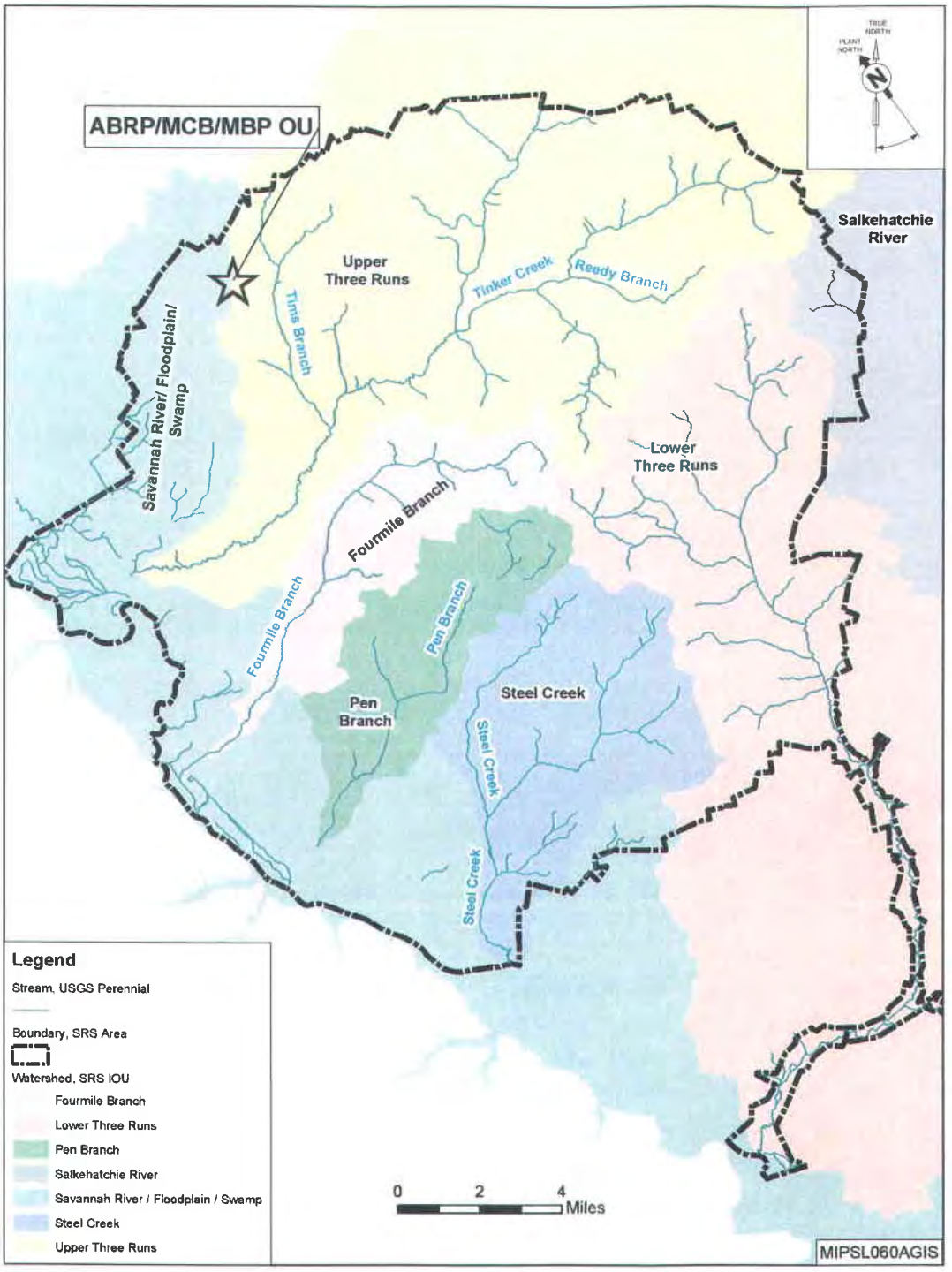


**Figure 3. Location of the ABRP/MCB/MBP OU within Upper Three Runs Watershed**

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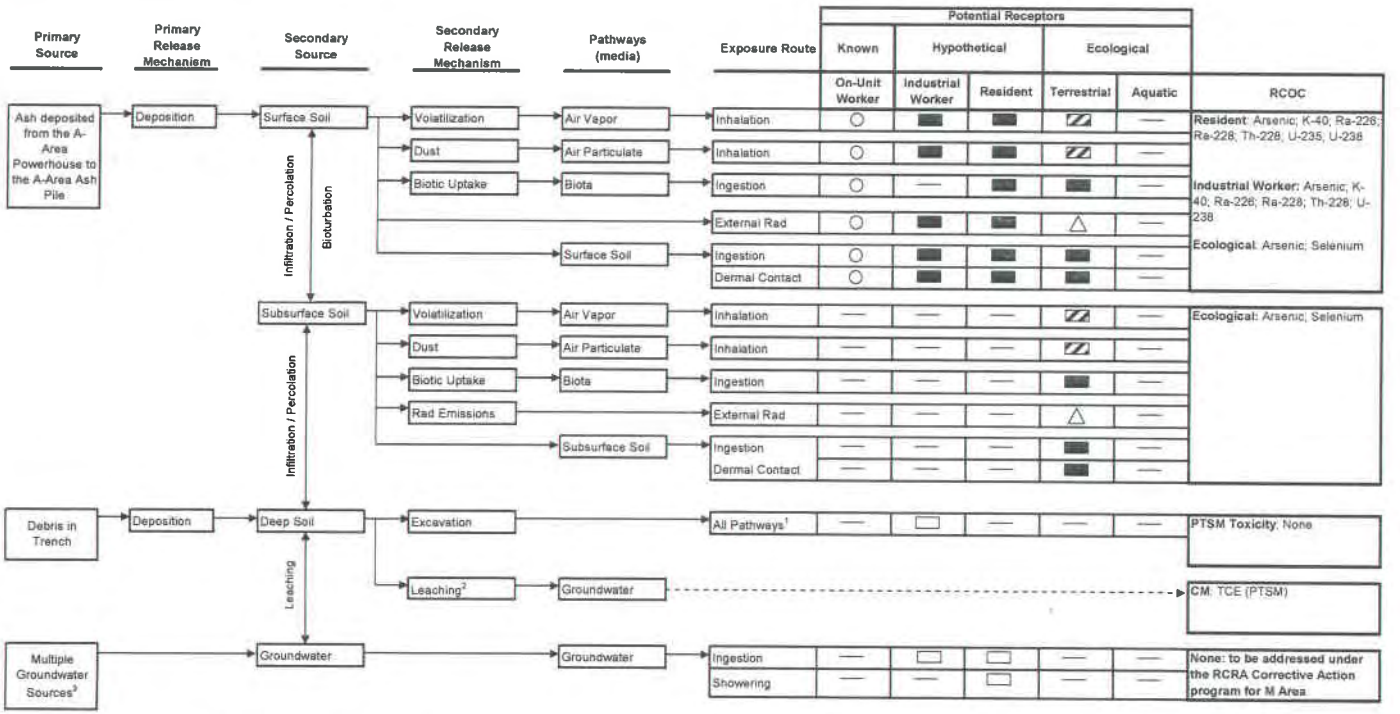


**Figure 4. Conceptual Site Model for the A-Area Ash Pile and Trench Subunits**

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Note: Land use refers to the soil portion of the unit. Due to groundwater contamination, institutional controls to prevent access or use of groundwater until cleanup levels are met under the RCRA program are required for all of the subunits in this operable unit.

**Figure 5. Land Use Map for ABRP/MCB/MBP OU**

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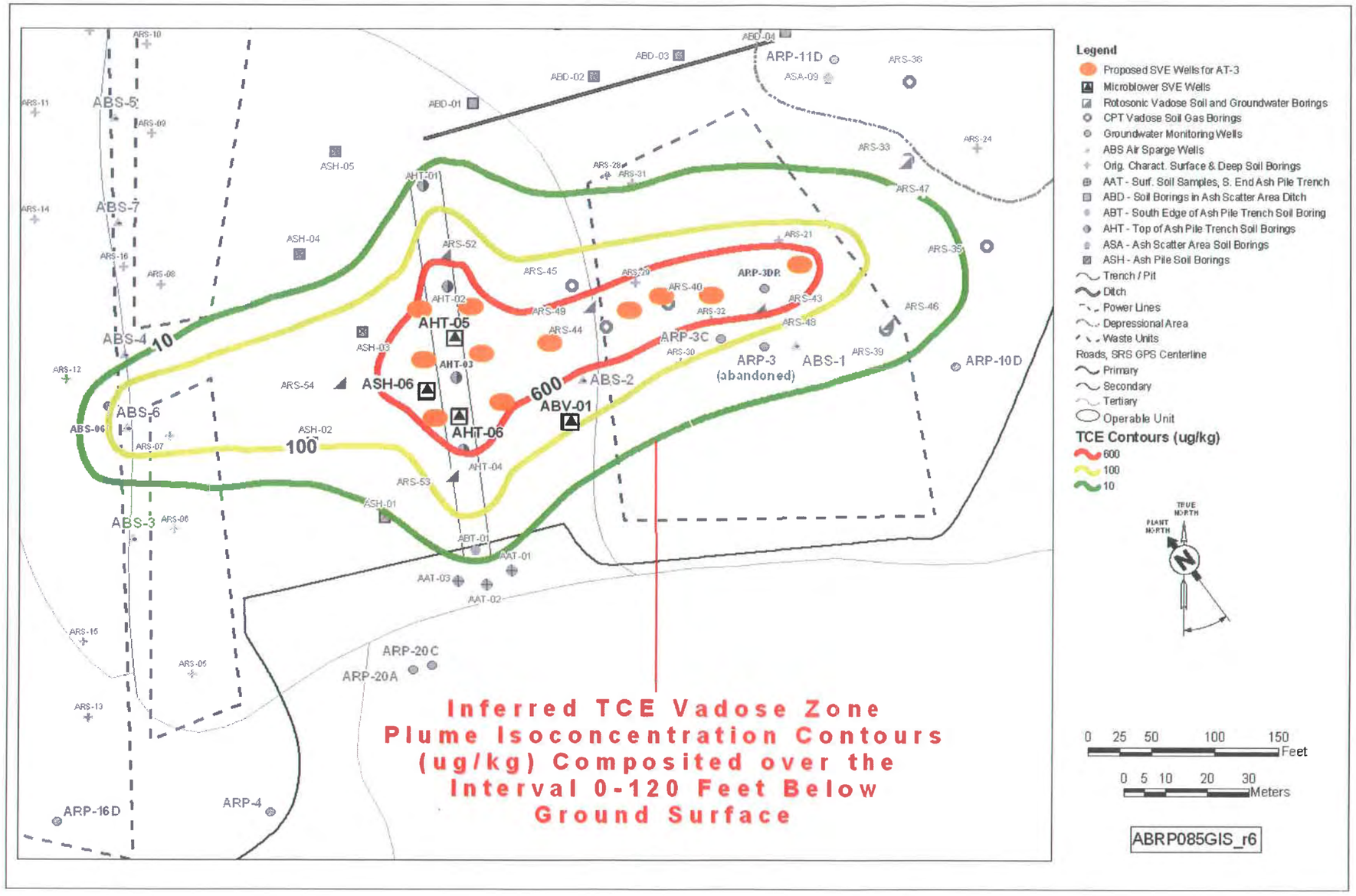


**Figure 6. Proposed Soil Vapor Extraction Wells for the Trench Subunit – Alternative AT-3**

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| Activity ID | Activity Description | Orig Dur | Early Start | Early Finish |
|---|---|---|---|---|
| LCS 13 - PRELIMINARY ENGINEERING | | | | |
| RMP0613060 | SRS - Develop Rev.0 EE/CA for Salvage Yard | 36 | 08SEP06A | 08NOV06A |
| RMP0613065 | SRS - Submit Rev 0 EE/CA to Regulators | 0 | | 08NOV06A |
| RMP0613066 | Regulators Review Rev.0 EE/CA & Return Comments | 78 | 08NOV06A | 25JAN07A |
| RMP0613067 | SRS - Receive Comments | 0 | | 25JAN07A |
| RMP0613068 | SRS - Develop Rev. 1 EE/CA | 32 | 26JAN07A | 26FEB07 |
| RMP0613071 | SRS - Submit Rev. 1 EE/CA to Regulators | 0 | | 26FEB07 |
| RMP0613072 | Regulators Review & Concur | 30 | 27FEB07 | 28MAR07 |
| RMP0613073 | Public Notice | 14 | 29MAR07 | 11APR07 |
| RMP0613074 | Public Comment Period | 30 | 12APR07 | 11MAY07 |
| LCS 15 - CONSTRUCTION | | | | |
| RMP0616095 | Salvage Yard Removal Action | 42 | 09JUL07* | 05SEP07 |

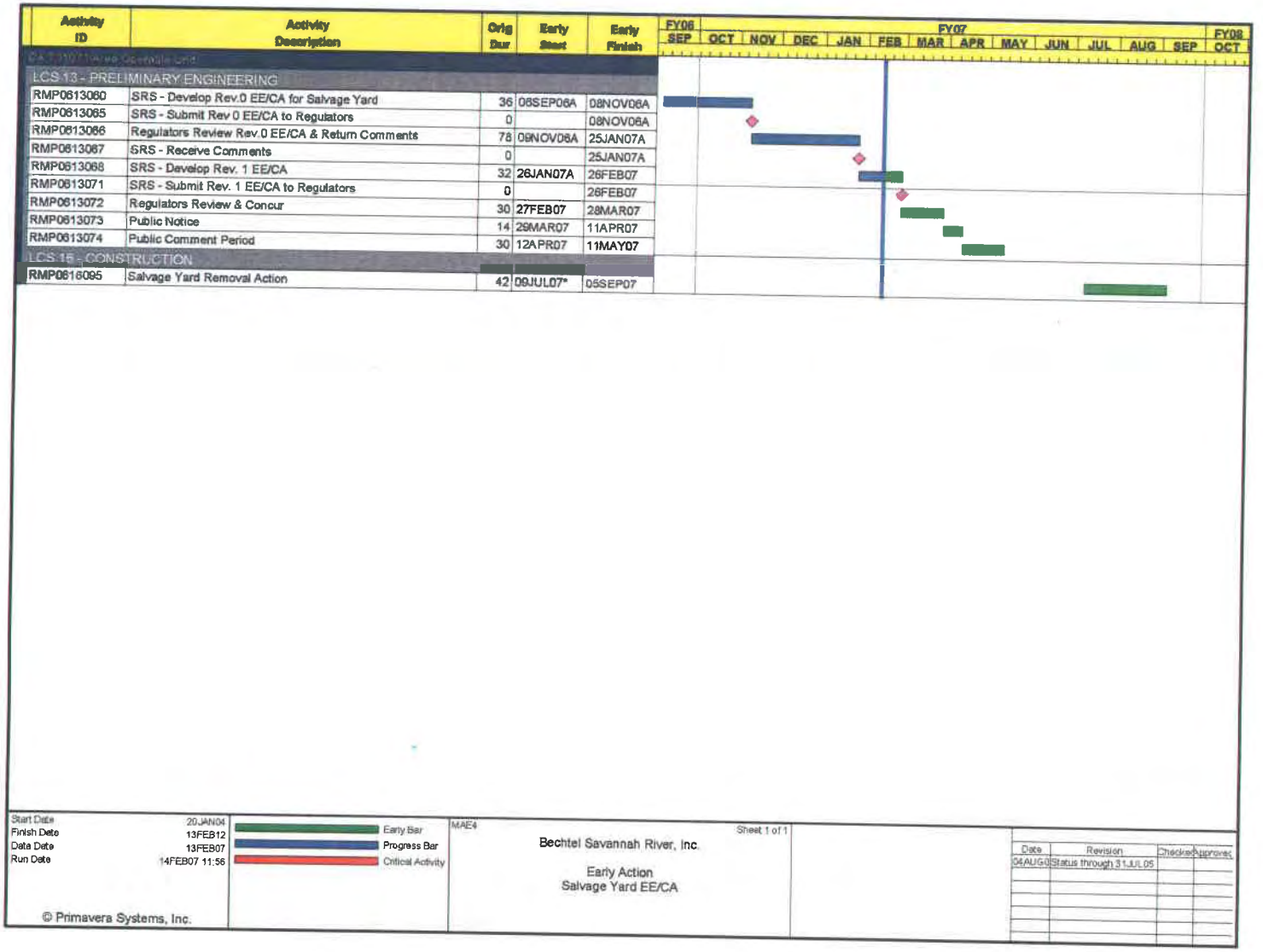


**Figure 7. 741-A Salvage Yard Early Action Schedule**

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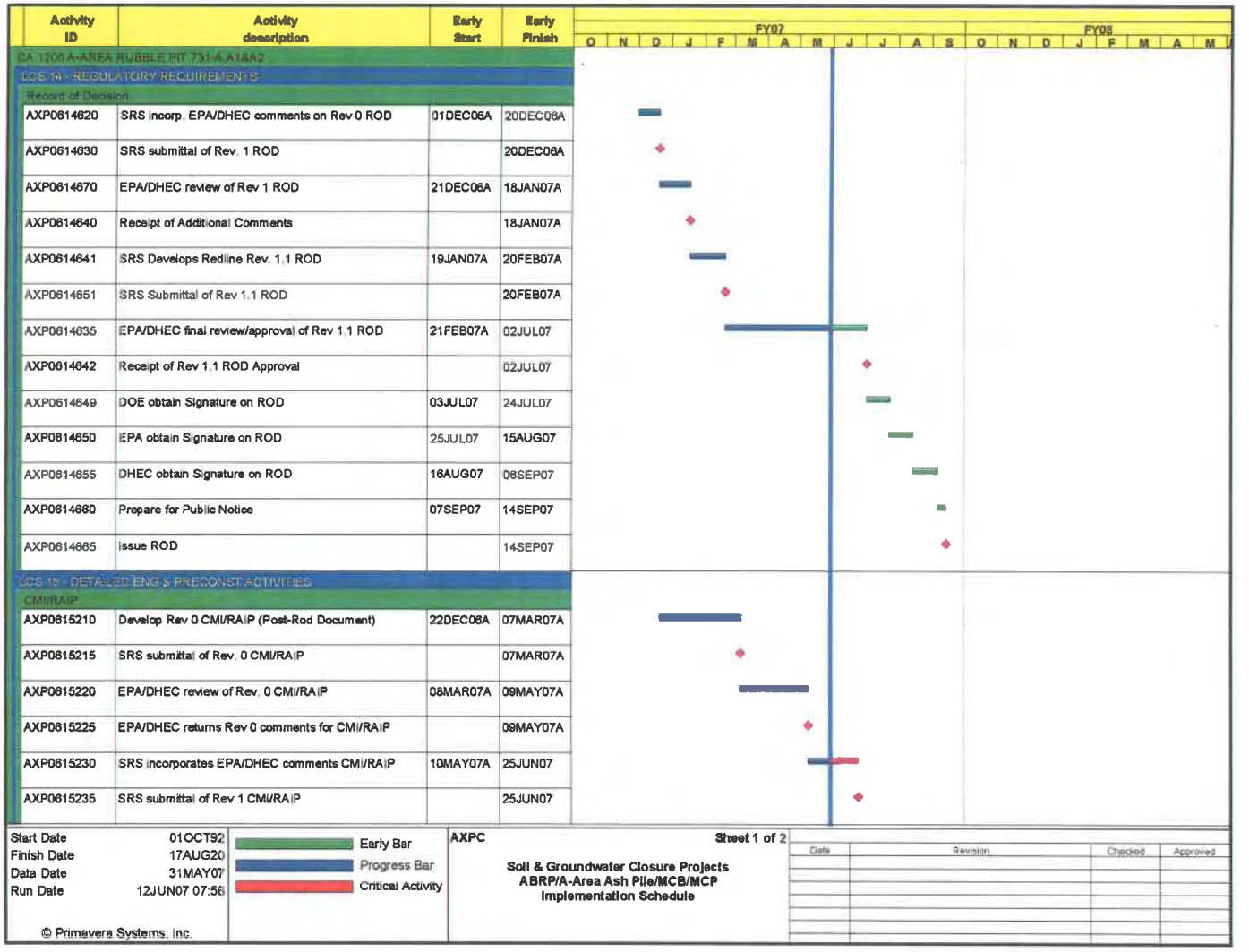


**Figure 8. Post-ROD Schedule**

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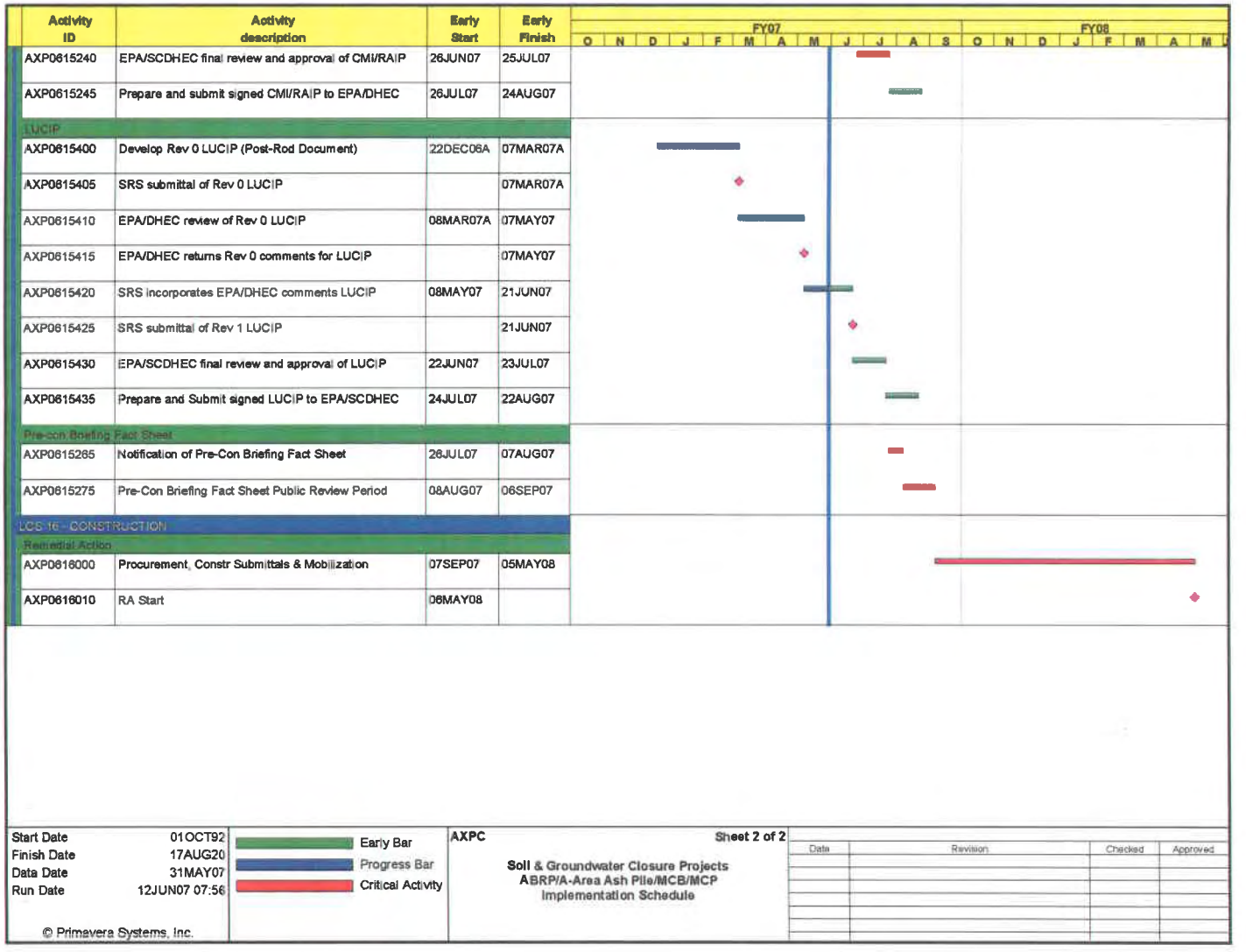


**Figure 8. Post-ROD Schedule (Continued)**

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**Table 1. Historical Activities for the ABRP/MCB/MBP OU**

| Dates | Event | Location (Unit) |
|---|---|---|
| 1951 to 1983 | ABRP Operation | ABRP |
| 1956 to 1974 | MCB Operation | MCB |
| 1960 to 1974 | MBP Operation | MBP |
| Approx. 1978 | Closure of ABRP Subunits | ABRP |
| 1994 to 1995 | RFI/RI for ABRP and MCB/MBP completed | ABRP and MCB/MBP |
| 9/1996 | Start passive SVE Treatability Study | MCB |
| 6/1997 | RFI/RI/BRA Report for ABRP Area | ABRP |
| 7/1997 | Corrective Measures Study/Focused Feasibility Study for ABRP Area | ABRP |
| 4/1998 | Corrective Measures Study/Focused Feasibility Study for MCB/MBP Area | MCB/MBP |
| 10/1996 (Revised 8/1998) | RFI/RI with BRA Report for MCB/MBP Area | MCB/MBP |
| 1/1999 | Interim Action Proposed Plan for MCB/MBP | MCB/MBP |
| 11/1999 | Interim Action Proposed Plan for ABRP | ABRP |
| 12/1999 | Interim Record of Decision for MCB/MBP | MCB/MBP |
| 4/2000 | Interim Record of Decision for ABRP | ABRP |
| 2000/2001 | Additional Soil Sampling | ABRP |
| 9/2001 | Soil Cover Complete, Air Sparging System Completed and Started | ABRP |
| 10/2001 | Start active SVE | MCB |
| 2/2002 | Soil Excavation and Recirculation Wells Installed | MCB/MBP |
| 11/2002 | Shut down active SVE | MCB |
| 3/2003 | RFI/RI Addendum with BRA for ABRP | ABRP |
| 3/2003 | Combine ABRP and MCB/MBP units into one OU | ABRP/MCB/MBP |
| 3/2003 | Shutdown Air Sparging | ABRP |
| 12/2003 | Start MicroBlower™ SVE | ABRP |
| 12/2004 | Added A-Area Ash Pile subunit to the OU | ABRP/MCB/MBP |
| 7/2005 | Corrective Measures Study/ Feasibility Study | ABRP/MCB/MBP |
| 4/2006 | Statement of Basis/Proposed Plan | ABRP/MCB/MBP |

## Table 2. Remedial Summary for ABRP/MCB/MBP OU

| Unit | Media | Land Use* | Remedy | Regulatory Mechanism |
|---|---|---|---|---|
| *ABRP OU* | | | | |
| Burning/Rubble Pit 731-A<br>Burning/Rubble Pit 731-1A<br>Potential Pit<br>Depressional Area | Surface Soil<br>Vadose Zone | Residential | No Action (soil)<br>No Action (vadose zone) | WSRC 2000a<br>IROD for ABRP |
| Rubble Pit 731-2A | Surface Soil | Industrial | Earthen Cap, IC<br><br>No Further Action<br>(final action complete) | WSRC 2000a<br>IROD for ABRP<br><br>WSRC 2006<br>ROD for ABRP/MCB/MBP OU |
| Ash Scatter Area/ Ditch | Surface Soil<br>Vadose Zone | Residential | No Action (soil)<br>No Action (vadose zone) | WSRC 2006<br>ROD for the ABRP/MCB/MBP OU |
| Trench | Surface Soil<br>Vadose Zone | Industrial | No Action (soil)<br>SVE, IC (vadose zone) | WSRC 2002a<br>ESD for ABRP IROD<br><br>WSRC 2006<br>ROD for ABRP/MCB/MBP OU |
| 788-2A A-Area Ash Pile | Surface Soil<br>Vadose Zone | Industrial | Earthen Cap, IC (soil)<br>No Action (vadose zone) | WSRC 2006<br>ROD for ABRP/MCB/MBP OU |
| *MCB/MBP OU* | | | | |
| MCB | Surface Soil | Industrial | Excavation, Off-site Disposal<br><br>No Further Action<br>(final action complete) | WSRC 1999<br>IROD for MCB/MBP<br><br>WSRC 2006<br>ROD for the ABRP/MCB/MBP OU |
| MCB Vadose Zone | Vadose Zone | Industrial | SVE, IC<br>(final action ongoing) | WSRC 1999<br>IROD for MCB/MBP<br><br>WSRC 2006<br>ROD for the ABRP/MCB/MBP OU |
| MBP | Surface Soil | Residential | Excavation, Off-site Disposal<br>(ecological risk driver)<br><br>No Further Action<br>(final action complete) | WSRC 1999<br>IROD for MCB/MBP<br><br>WSRC 2006<br>ROD for ABRP/MCB/MBP OU |

* Land use refers to the soil portion of the unit. Due to the groundwater contamination, institutional controls to prevent access or use of groundwater until cleanup levels are met under the RCRA program are required for all of the subunits in this operable unit. Although the interim actions for groundwater were described in the respective IRODs, groundwater is not within the scope of this operable unit and is not presented in this table.

**Table 3. Summary of Constituents of Concern and Medium-Specific Exposure Point Concentrations**

**A-Area Ash Pile Surface Soil**

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

| Exposure Route | Constituent of Concern | Concentration Detected | | Units | Frequency of Detection | Exposure Point Concentration | Exposure Point Concentration Units | Statistical Measure |
|---|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | | |
| Soil Onsite – Direct Contact | Arsenic | 4.91 | 95.9 | mg/kg | 9/9 | 69.0 | mg/kg | 95% UCL |
| | Potassium-40 | 8.04 | 15.3 | pCi/g | 5/5 | 15.3 | pCi/g | MAX |
| | Radium-226 | 2.46 | 3.51 | pCi/g | 8/8 | 3.12 | pCi/g | 95% UCL |
| | Radium-228 | 2.48 | 4.02 | pCi/g | 8/8 | 3.64 | pCi/g | 95% UCL |
| | Thorium-228 | 2.70 | 3.77 | pCi/g | 8/8 | 3.62 | pCi/g | 95% UCL |
| | Uranium-238 | 2.15 | 3.15 | pCi/g | 8/8 | 2.98 | pCi/g | 95% UCL |

**Key**
mg/kg: milligrams per kilogram
pCi/g: picoCuries per gram
95% UCL: 95% Upper Confidence Limit
MAX: maximum concentration

## Table 4. Cancer Toxicity Data Summary

### A-Area Ash Pile Surface Soil

**Pathway:Ingestion, Dermal**

| Constituent of Concern | Oral Cancer Slope Factor | Dermal Cancer Slope Factor | Slope Factor Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (Year) |
|---|---|---|---|---|---|---|
| Arsenic | 1.50E+00 | none[1] | 1/(mg/kg-d) | A | IRIS | 2004 |
| Potassium-40 | 1.51E-11 | NA | Risk/pCi | A | HEAST | 2003 |
| Radium-226 (+D) | 2.95E-10 | NA | Risk/pCi | A | HEAST | 2003 |
| Radium-228 (+D) | 6.70E-10 | NA | Risk/pCi | A | HEAST | 2003 |
| Thorium-228 (+D) | 1.62E-10 | NA | Risk/pCi | A | HEAST | 2003 |
| Uranium-238 (+D) | 5.62E-11 | NA | Risk/pCi | A | HEAST | 2003 |

**Pathway: Inhalation**

| Constituent of Concern | Unit Risk | Units | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (Year) |
|---|---|---|---|---|---|---|---|
| Arsenic | NA | NA | 1.51E+01 | 1/(mg/kg-d) | A | IRIS | 2004 |
| Potassium-40 | NA | NA | 1.03E-11 | Risk/pCi | A | HEAST | 2003 |
| Radium-226 (+D) | NA | NA | 1.16E-08 | Risk/pCi | A | HEAST | 2003 |
| Radium-228 (+D) | NA | NA | 5.23E-09 | Risk/pCi | A | HEAST | 2003 |
| Thorium-228 (+D) | NA | NA | 1.43E-07 | Risk/pCi | A | HEAST | 2003 |
| Uranium-238 (+D) | NA | NA | 9.35E-09 | Risk/pCi | A | HEAST | 2003 |

**Pathway: External (Radiation)**

| Constituent of Concern | Cancer Slope or Conversion Factor | Exposure Route | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (Year) |
|---|---|---|---|---|---|---|
| Potassium-40 | 7.97E-07 | External exposure | Risk/yr per pCi/g | A | HEAST | 2003 |
| Radium-226 (+D) | 8.49E-06 | External exposure | Risk/yr per pCi/g | A | HEAST | 2003 |
| Radium-228 (+D) | 4.53E-06 | External exposure | Risk/yr per pCi/g | A | HEAST | 2003 |
| Thorium-228 (+D) | 7.76E-06 | External exposure | Risk/yr per pCi/g | A | HEAST | 2003 |
| Uranium-238 (+D) | 1.14E-07 | External exposure | Risk/yr per pCi/g | A | HEAST | 2003 |

**Table 4. Cancer Toxicity Data Summary (Continued)**

**A-Area Ash Pile Surface Soil**

**Key**

HEAST: Health Effects Assessment Summary Table USEPA; values used in the USEPA Radcalculator website http://epa-prgs.ornl.gov/radionuclides

IRIS: Integrated Risk Information System USEPA; values used in the USEPA Region 9 website www.epa.gov/region09/waste/sfund/prg/index.htm

A: Human carcinogen

1: Dermal cancer slope factors obtained by using the oral cancer slope factor and applying an oral-to-dermal adjustment factor.

Radiological PRGs are industrial worker soil values from Radionuclide Preliminary Remediation Goals, Engineering Calculation K-CLC-G-00077, Rev. 1, Washington Savannah River Company, (July 2003). PRG for K-40 = 2.71E-01 pCi/g; Ra-226(+D) = 2.55E-02 pCi/g; Ra-228(+D) = 1.49E-01 pCi/g; Th-228(+D) = 2.52E-01 pCi/g; U-238(+D) = 1.79E+00 pCi/g.

Nonradiological PRGs are industrial worker soil values from the USEPA Region 9 Preliminary Remediation Goals Table, United States Environmental Protection Agency, San Francisco, CA (October 2004). PRG for As = 1.59E+00 mg/kg.

**Table 5. Risk Characterization Summary - Carcinogens**

**A-Area Ash Pile Surface Soil**

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

| Medium | Exposure Medium | Exposure Route | Constituent of Concern | Carcinogenic Risk | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation)[1] | Exposure Routes Total |
| Soil | Surface Soil, Dust | Soil Onsite-Direct Contact, Inhalation of Soil as Dust | Arsenic | NC | NC | NC | NA | 4.3E-05 |
| | | | Potassium-40 | NC | NC | NA | NC | 5.6E-05 |
| | | | Radium-226 (+D) | NC | NC | NA | NC | 1.2E-04 |
| | | | Radium-228 (+D) | NC | NC | NA | NC | 2.4E-05 |
| | | | Thorium-228 (+D) | NC | NC | NA | NC | 1.4E-05 |
| | | | Uranium-238 (+D) | NC | NC | NA | NC | 1.7E-06 |
| | | | | | | | Soil Risk Total[1] = | 2.6E-04 |

**Key**

NA: Not applicable

NC: Not calculated. Risk was not calculated separately for each exposure pathway. Instead, the PRG value that was used to calculate risk is a risk-based concentration that is derived from standardized equations and combines all of the exposure pathways and assumptions with USEPA toxicity data. Use of the PRG provides an exposure routes total risk estimate for each constituent.

1 - Soil Risk Total is based on an industrial land use scenario.

## Table 6. Ecological Exposure Pathways of Concern

**A-Area Ash Pile Soil**

| Exposure Medium | Sensitive Environment Flag (Y or N) | Receptor | Endangered/ Threatened Species Flag (Y or N) | Exposure Routes | Assessment Endpoints | Measurement Endpoints |
|---|---|---|---|---|---|---|
| Soil | No | Insectivorous Mammal (shrew)<br><br>Insectivorous Bird (robin) | No | Ingestion, direct contact and indirect contact of chemicals in soil | Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival and reproduction | Measured concentrations in soil used to model food chain uptake and compared to literature-based toxicity reference value (TRV) |

## Table 7. COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors

| Habitat Type/ Name | Exposure Medium | COC | Concentration Range (min - max) | Protective Level | Units | Basis | Assessment/Measurement Endpoint |
|---|---|---|---|---|---|---|---|
| A-Area Ash Pile | Soil | Arsenic | 4.91 - 95.9 | 15.4 | mg/kg | HQ = 1 | Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival and reproduction |
| | | Selenium | 1.15 - 26.0 | 0.7 | mg/kg | HQ = 1 | |

## Table 8. Summary of Remedial Action Objectives and Remedial Goals for Soil

| Area/Media of Concern | Refined COCs | Type of COC | | | | Final Remedial Goal | Final Remedial Goal Basis |
|---|---|---|---|---|---|---|---|
| | | ARAR/PTSM | CM | HH | ECO | | |
| **MCB Vadose Zone**<br>**Remedial Action Objectives**<br>▪ Prevent migration of TCE and PCE contamination in soil to groundwater at a concentration above its MCL | TCE | | X | | | 344 µg/kg | Final RG – WSRC 1999 |
| | PCE | | X | | | 344 µg/kg | Final RG – WSRC 1999 |
| **ABRP Trench Subunit**<br>**Remedial Action Objective**<br>▪ Prevent migration of TCE contamination in soil to groundwater at a concentration above its MCL | TCE | | X | | | 610 µg/kg | Contaminant Migration |
| **A-Area Ash Pile Subunit**<br>**Remedial Action Objectives**<br>▪ Prevent human exposure to refined COCs that present a risk to future industrial workers<br>▪ Prevent ecological exposure to refined COCs that present a hazard to ecological receptors | Arsenic | | | X | X | 9,753 µg/kg | 2x Background[1] |
| | Selenium | | | | X | 15,280 µg/kg | 2x Background[1] |
| | Potassium-40 | | | X | | 1.60 pCi/g | 2x Background[1] |
| | Radium-226 | | | X | | 0.0255 pCi/g | HH-industrial |
| | Radium-228 | | | X | | 1.83 pCi/g | 2x Background[1] |
| | Thorium-228 | | | X | | 1.69 pCi/g | 2x Background[1] |
| | Uranium-238 | | | X | | 1.79 pCi/g | HH – Industrial |

1. The final RG value is two times average site-specific background concentration from Table 4-3 of the RFI/RI with BRA for the A-Area Burning/Rubble Pits and Rubble Pit (WSRC 1997). The activities of the daughter products of some of the radiological COCs identified in the table were used to establish the activity of the parent since these constituents are in secular equilibrium. Specifically, the two times background mean of Ac-22 (from Table 4-3) was used to establish the Ra-228 concentration and the two times background mean of Pb-212 (from Table 4-3) was used to establish the Th-228 background concentration.

**Table 9. Comparative Analysis of Alternatives for the Trench Subunit**

| Alternative | Overall Protection of Human Health and Environment | Compliance with ARARs | Long-Term Effectiveness | Reduction of Toxicity, Mobility, or Volume | Short-Term Effectiveness | | Implementability | Cost |
|---|---|---|---|---|---|---|---|---|
| | | | | | Risk to Implement Alternative | Time to Achieve RAOs | | |
| AT-1 | No | N/A | Poor | None | None | 200 years | Easy | $0 |
| AT-3 | Yes | Yes | Good | Medium | Low | 27 years | Easy | $2.6 million |

**Table 10. Comparative Analysis of Alternatives for the A-Area Ash Pile Subunit**

| Alternative | Overall Protection of Human Health and Environment | Compliance with ARARs | Long Term Effectiveness | Reduction of Toxicity, Mobility, or Volume | Short Term Effectiveness | | Implementability | Cost |
|---|---|---|---|---|---|---|---|---|
| | | | | | Risk to Implement Alternative | Time to Achieve RAOs | | |
| AP-1 | No | N/A | Poor | None | None | Not Achieved | Easy | $0 |
| AP-3 | Yes | Yes | Good | None | Low | 1 years | Easy | $1.5 million |

## Table 11. Land Use Controls for the ABRP/MCB/MBP OU

| Type of Control | Purpose of Control | Duration | Implementation | Affected Areas[a] |
|---|---|---|---|---|
| 1) Property Record Notices[b] | Provide notice to anyone searching records about the existence and location of contaminated areas. | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. | Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership. | All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions. |
| 2) Property record restrictions[c]:<br>A. Land Use<br>B. Groundwater | Restrict use of property by imposing limitations.<br>Prohibit the use of groundwater. | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. | Drafted and implemented by USDOE upon transfer of affected areas. Recorded by USDOE in accordance with state law at County Register of Deeds office. | All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions. |
| 3) Other Notices[d] | Provide notice to city &/or county about the existence and location of waste disposal and residual contamination areas for zoning/planning purposes. | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. | Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership. | All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions. |
| 4) Site Use Program[e] | Provide notice to worker/developer (i.e., permit requestor) on extent of contamination and prohibit or limit excavation/penetration activity. | As long as property remains under DOE control. | Implemented by USDOE and site contractors.<br>Initiated by permit request | Remediation systems, all waste management areas. And areas where levels requiring land use and / or groundwater restrictions. |
| 5) Physical Access Controls[f] (e.g., fences, gates, portals) | Control and restrict access to workers and the public to prevent unauthorized access. | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. | Controls maintained by USDOE. | At select locations throughout SRS. |

## Table 11. Land Use Controls for the ABRP/MCB/MBP OU (Continued)

| Type of Control | Purpose of Control | Duration | Implementation | Affected Areas[a] |
|---|---|---|---|---|
| 6) Warning Signs[g] | Provide notice or warning to prevent unauthorized uses. | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use | Signage maintained by USDOE. | At select locations throughout SRS |
| 7) Security Surveillance Measures | Control and monitor access by workers/public | Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use | Established and maintained by USDOE.<br>Necessity of patrols evaluated upon completion of remedial actions. | Patrol of selected area throughout SRS, as necessary |

[a]Affected areas – Specific locations identified in the SRS LUCIP or subsequent post-ROD documents.

[b]Property Record Notices – Refers to any non-enforceable, purely informational document recorded along with the original property acquisition records of USDOE and its predecessor agencies that alerts anyone searching property records to important information about residual contamination; waste disposal areas in the property.

[c]Property Record Restrictions – Includes conditions and/or covenants that restrict or prohibit certain uses of real property and are recoded along with original property acquisition records of USDOE and its predecessor agencies.

[d]Other Notices – Includes information on the location of waste disposal areas and residual contamination depicted on as survey plat, which is provided to a zoning authority (i.e., city planning commission) for consideration in appropriate zoning decisions for non-USDOE property.

[e]Site Use Program – Refers to the internal USDOE/DOE contractor administrative program(s) that requires the permit requestor to obtain authorization, usually in the form of a permit, before beginning any excavation/penetration activity (e.g., well drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities/structure, or, in the case of contaminated soil or groundwater, will not disturb the affected areas without the appropriate precautions and safeguards.

[f]Physical Access Controls – Physical barriers or restrictions to entry.

[g]Signs – Posted command, warning or direction.

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# APPENDIX A -
# RESPONSIVENESS SUMMARY

## Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit began on June 15, 2006, and ended on July 29, 2006. During the public comment period, a presentation of the selected remedial actions was made at the July 18, 2006 SRS Citizens Advisory Board Facilities Disposition and Site Remediation Committee meeting.

## Public Comments

No public comments were received.

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# APPENDIX B -
# APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Table B-1. Action-Specific ARARs for the ABRP/MCB/MBP OU

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## Table B-1. Action-Specific ARARs for the ABRP/MCB/MBP OU

| Citation(s) | Status | Requirement Summary | Alternative |
|---|---|---|---|
| **Action - Specific** | | | |
| ▪ 40 CFR 261<br>▪ 40 CFR 262<br>▪ SC R.61-79.261<br>▪ SC R.61-79.262 | Applicable | Hazardous Waste<br>Defines criteria for determining whether a waste is RCRA hazardous waste and provides treatment, storage, and disposal requirements. | All Alternatives |
| | | | |
| ▪ 40 CFR 50<br>▪ 40 CFR 61<br>▪ 40 CFR 60<br>▪ 40 CFR 63, Subpart G<br>▪ SC R.61-62.5 | Applicable | Air Quality Standards<br>Identifies allowable air concentrations and permit requirements for air emissions of toxic chemicals from new and existing sources. | AT-3 |
| SC R.61-58.2<br>SC R.61-71 | Relevant and Appropriate | Groundwater Monitoring Wells<br>▪ Prescribes minimum standards for the construction of groundwater sources and treatment facilities. Groundwater wells must be installed/abandoned and drilling wastes disposed of in a manner to prevent cross-contamination of aquifers.<br>▪ Establishes minimum standards for construction, maintenance, and operation of monitoring wells. | AT-3 |
| SC R.61-62.6 | Applicable | Fugitive Dust<br>Identifies statewide controls on fugitive particulate matter. Requirements apply to emissions of particulates (dust) generated during excavation or other remedial construction activities. | AP-3<br>AT-3 |
| SC R.61-82 | Applicable | Proper Close Out of Wastewater Treatment Facilities<br>Applicable due to Industrial Wastewater Construction Permit No. 7289 for the Ash Pile. | AP-3 |
| SC R. 72-300 | Applicable | Stormwater Management<br>Prescribes the stormwater management and sediment control plan requirements for land disturbances. | AP-3 |

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# APPENDIX C -
# COST ESTIMATE FOR THE SELECTED REMEDY

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# Table C-1. Alternative AT-3 ABRP Soils SVE

**Alternative AT-3**
**Construction and operation of SVE system, Maintaining the Existing Cover, and Institutional Controls**
**ABRP/MCB/MBP OU**

**ABRP Soils**
**Savannah River Site**

| Item | Quantity | Units | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Direct Capital Costs** | | | | |
| Active SVE System Equipment & Construction (Install end of Year 2) | | | | |
| SVE System Existing and Operational | | | | |
| Install SVE Wells (depth aproximately 85 ft) | 11 | ea | $7,200 | $79,200 |
| Install Vapor Manifold System (350 ft length, above-ground) | 2 | ea | $13,495 | $26,989 |
| Electric Generator - purchase | 2 | ea | $46,800 | $93,600 |
| Pads for Electric Generator and Diesel Storage | 400 | $ft^2$ | $6 | $2,592 |
| Trailer-Mounted Blowers | 2 | ea | $20,614 | $41,227 |
| Subtotal - Active SVE System Capital Costs | | | | $243,608 |
| Passive SVE Equipment (install end of year 5) | | | | |
| Passive Pressure Check Valve System | 11 | ea | $500 | $5,500 |
| Present Worth Active SVE System Capital Cost | | | | $4,791 |
| Institutional Controls | | | | |
| Posting of Warning Signs | 20 | ea | $50 | $1,000 |
| Land Use Control Implementation Plan | 1 | ea | $5,000 | $5,000 |
| Deed Restrictions | 1 | ea | $5,000 | $5,000 |
| Subtotal - Direct Capital Cost | | | | $259,399 |
| Mobilization/Demobilization | 20% of subtotal direct capital | | | $51,880 |
| Site Preparation/Site Restoration | 20% of subtotal direct capital | | | $51,880 |
| **Total Direct Capital Cost** | (sum of * items) | | | **$363,158** |
| **Indirect Capital Costs** | | | | |
| Engineering & Design | 16% of direct capital | | | $58,105 |
| Project/Construction Management | 25% of direct capital | | | $90,790 |
| Health & Safety | 5% of direct capital | | | $18,158 |
| Overhead | 30% of direct capital | | | $108,948 |
| Contingency | 15% of direct capital | | | $54,474 |
| **Total Indirect Capital Cost** | | | | **$330,474** |
| **Total Estimated Capital Cost** | | | | **$693,633** |
| **Direct O&M Costs** | 3.9% discount rate for costs > 30 years duration[1] | | | |
| Annual Cost (IRA SVE (Passive) Operations) | 2 year O&M period | | | *Years 2004 - 2006* |
| O&M Costs for these Operations are included in the Interim Remedial Action Budget | | | | $0 |
| Subtotal - Annual Costs | | | | $0 |
| Present Worth Annual Costs | | | | $0 |
| Annual Costs (Active SVE Operations) | 3 year O&M period | | | *Years 2006 - 2009* |
| Air Emissions Monitoring | 1 | ea | $16,400 | $16,400 |
| SVE System Operation | | | | |
| O&M Labor - 1.5 full-time persons | 1.5 | ea | $50,000 | $75,000 |
| Diesel for Electric Generators (6gal/hr, 85% operation) | 45,000 | gallon | $2 | $90,000 |
| Spare Parts & Corrective Maintenance | 1 | ea | $12,500 | $12,500 |
| SVE System Performance Reporting | 1 | ea | $25,000 | $25,000 |
| Institutional Controls | 1 | ea | $1,700 | $1,700 |
| Subtotal - Annual Costs | | | | $220,600 |
| Present Worth Annual Costs | | | | $592,741 |

## Table C-1. Alternative AT-3 ABRP Soils SVE (Continued)

**Alternative AT-3**
**Construction and operation of SVE system, Maintaining the Existing Cover, and Institutional Controls**
**ABRP/MCP/MBP OU**
**ABRP Soils**
**Savannah River Site**

| | | | | | |
|---|---|---|---|---|---|
| Annual Costs (Passive SVE Operations) | | 24 | year O&M period | | *Years 2009 - 2033* |
| Air Emissions Monitoring | | 1 | ea | $16,400 | $16,400 |
| SVE System Operation | | 1 | ea | $10,000 | $10,000 |
| SVE System Performance Reporting | | 1 | ea | $25,000 | $25,000 |
| Institutional Controls | | 1 | ea | $1,700 | $1,700 |
| | Subtotal - Annual Costs | | | | $53,100 |
| | Present Worth Annual Costs | | | | $675,551 |
| Five Year Costs | | | | | |
| Remedy Review | | 6 | ea | $13,308 | $13,308 |
| | Subtotal - Five Year O&M Costs | | | | $13,308 |
| | Present Worth Five Year Costs | | | | $45,643 |
| | **Total Present Worth Direct O&M Cost** | | | | **$1,313,935** |
| **Indirect O&M Costs** | | | | | |
| Project/Admin Management | | 10% | of direct O&M | | $131,393 |
| Health & Safety | | 5% | of direct O&M | | $65,697 |
| Overhead | | 30% | of direct O&M | | $394,180 |
| Contingency | | 15% | of direct O&M | | $197,090 |
| | **Total Present Worth Indirect O&M Cost** | | | | **$591,271** |
| | **Total Estimated Present Worth O&M Cost** | | | | **$1,905,205** |
| | **TOTAL ESTIMATED COST** | | | | **$2,598,838** |

1. Interest rate for costs with duration < 30 years (i.e., before 2034) is based on WSRC's 16 April 2002 Technical Memorandum.

## Table C-2. Alternative AP-3 - 788-2A A-Area Ash Pile – 2 ft Soil Cover

| Item | Qty. | Units | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Direct Capital Costs** | | | | |
| Submittals | 1 | LS | $25,000 | $25,000 |
| Temporary Controls | | | | |
| Dust Suppression/Site Maint. | 6 | Mo | $9,500 | $57,000 |
| Construction Facilities (Contract Period) | 6 | Mo | $5,250 | $31,500 |
| Site Permit | 1 | Ea | $25,000 | N.A. |
| Site Work | | | | |
| Survey | 3 | Ac | $7,125 | $21,375 |
| Erosion Control | 3 | Ac | $3,300 | $9,900 |
| Clear & Chip Trees in Place (Assume 30% of 2.5 Acres) | | | | |
| Clear & Chip Trees in Place | 0.8 | Ac | $9,450 | $7,088 |
| Haul Chips to C&D Landfill (512 cy @ 20% Swell) | 615 | CY | $10 | $6,150 |
| Borrow | | | | |
| Borrow Pit Development | 11,832 | CY | $1 | $11,240 |
| Geophysical/Geotechnical Investigation | 11,832 | CY | $1 | $15,382 |
| Borrow Matl. Contaminant Sampling | 2 | Ea | $2,500 | $5,000 |
| Access Rds, Staging Area & Maintenance | 6 | Mo | $1,500 | $9,000 |
| Backfill | | | | |
| Common Backfill - From Borrow | 11,832 | CY | $20 | $236,640 |
| Topsoil | | | | |
| F & I Topsoil | 2,465 | CY | $32 | $78,880 |
| Topsoil Contaminant Sampling | 1 | Ea | $2,500 | $2,500 |
| Geophysical/Geotechnical Testing & Inspection | 3 | Mo | $10,000 | $30,000 |
| Decon | 1 | LS | $0 | N.A. |
| | | | Subtotal - Direct Capital Cost | $546,655 |
| Mobilization / Demobilization | 5% | of subtotal direct capital | | $27,333 |
| Site Preparation / Site Restoration | 5% | of subtotal direct capital | | $27,333 |
| | | | **Total Direct Capital Cost (sum of * items)** | **$601,320** |
| **Indirect Capital Costs** | | | | |
| Engineering & Design | 28% | of direct capital | | $168,370 |
| Project/Construction Management | 28% | of direct capital | | $168,370 |
| Health & Safety | 7% | of direct capital | | $42,092 |
| Overhead | 30% | of direct capital | | $180,396 |
| Contingency | 15% | of direct capital | | $90,198 |
| | | | **Total Indirect Capital Cost** | **$649,426** |
| | | | **Total Estimated Capital Cost** | **$1,250,745** |
| **Direct O&M Costs** | 3.9% | discount rate[1] | | |
| Annual Costs (Cover System Maintenance) | 150 | years O&M | | |
| Cover Inspection / Maintenance | 2 | Ea / yr | $2,000 | $4,000 |
| | | | Subtotal - Annual Costs | $4,000 |
| | | | Present Worth Annual Costs | $102,234 |
| Five Year Costs | 30 | Ea | | |
| Remedy Review | 1 | Ea | $15,000 | $15,000 |
| | | | Subtotal - Five Year O&M Costs | $15,000 |
| | | | Present Worth Five Year Costs | $70,923 |
| | | | **Total Present Worth Direct O&M Cost** | **$173,157** |
| **Indirect O&M Costs** | | | | |
| Project/Admin Management | 10% | of direct O & M Cost | | $17,316 |
| Health & Safety | 5% | of direct O & M Cost | | $8,658 |
| Overhead | 30% | of direct O & M Cost | | $51,947 |
| Contingency | 15% | of direct O & M Cost | | $25,974 |
| | | | **Total Present Worth Indirect O&M Cost** | **$103,894** |
| | | | **Total Estimated Present Worth O&M Cost** | **$277,052** |
| | | | **TOTAL ESTIMATED COST** | **$1,527,797** |

**Notes:**
1 ) The financial discount rate is based upon WSRC's 16 April, 2002 Technical Memorandum (ERTEC-2002-00011)

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# APPENDIX D -
# OPERATIONAL TREND OF SOIL VAPOR EXTRACTION UNIT

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**Operational Trend of SVE Unit**

Initially, an active SVE unit would establish a rapidly declining exponential exhaust gas concentration trend. As the initial pore gas volume is removed from the contamination area, the exponential trend flattens slightly and continues to decline. Typically in the vadose zone soils common to the M Area and ABRP, the exhaust concentration trend has followed a curve similar to the one shown in Figure D-1.

It is important to note the difference between an active and passive system. An active system relies on an exhaust blower driven by a conventional electric motor. A passive system relies on barometric fluctuation or solar-powered blowers to withdraw soil gas from the formation.

An effective method to measure the decline in residual contamination is to perform periodic rebound tests. They measure the amount of residual volatile organic compounds (VOCs) in the formation. Figure D-1 shows the spikes of the rebound tests. Each spike represents an increase in the concentration of exhaust gas that occurs when the SVE system is briefly shut off.

As the concentration trend approaches a limit, less energy intensive SVE technologies such as solar-powered MicroBlowers™ or passive SVE using BaroBalls™ can be employed. These less intensive technologies can effectively complete remedial efforts while still preventing an impact to underlying groundwater.

The monitoring data used in the example in Figure D-1 will be used as a template to determine when this transition from active to passive should take place. An appropriate transition point can be identified based upon the exhaust gas concentration and the slope of the concentration trend. These transition points should be based on definitive data. In this example, the initial transition from active to passive operation may be appropriate when the normalized concentration drops below 25 parts per million by volume (ppmv)

and the slope falls below -0.01 ppmv/day. However, the transition points should be site specific.

SRS believes that it is important to review all of the monitoring data VOC concentrations in soil, soil gas being extracted by the system, and in the groundwater) when determining the effectiveness of a particular SVE technology in achieving remedial action objectives (RAOs). The United States Department of Energy, the United States Environmental Protection Agency, and the South Carolina Department of Health and Environmental Control have agreed to jointly decide on significant changes in the operation of the SVE system (typically transitioning from active to passive extraction) taken to maintain the efficiency of the remedial system. This process for transitioning from active to passive SVE technology will be discussed in detail in the Corrective Measures Implementation (CMI)/Remedial Action Implementation Plan (RAIP).

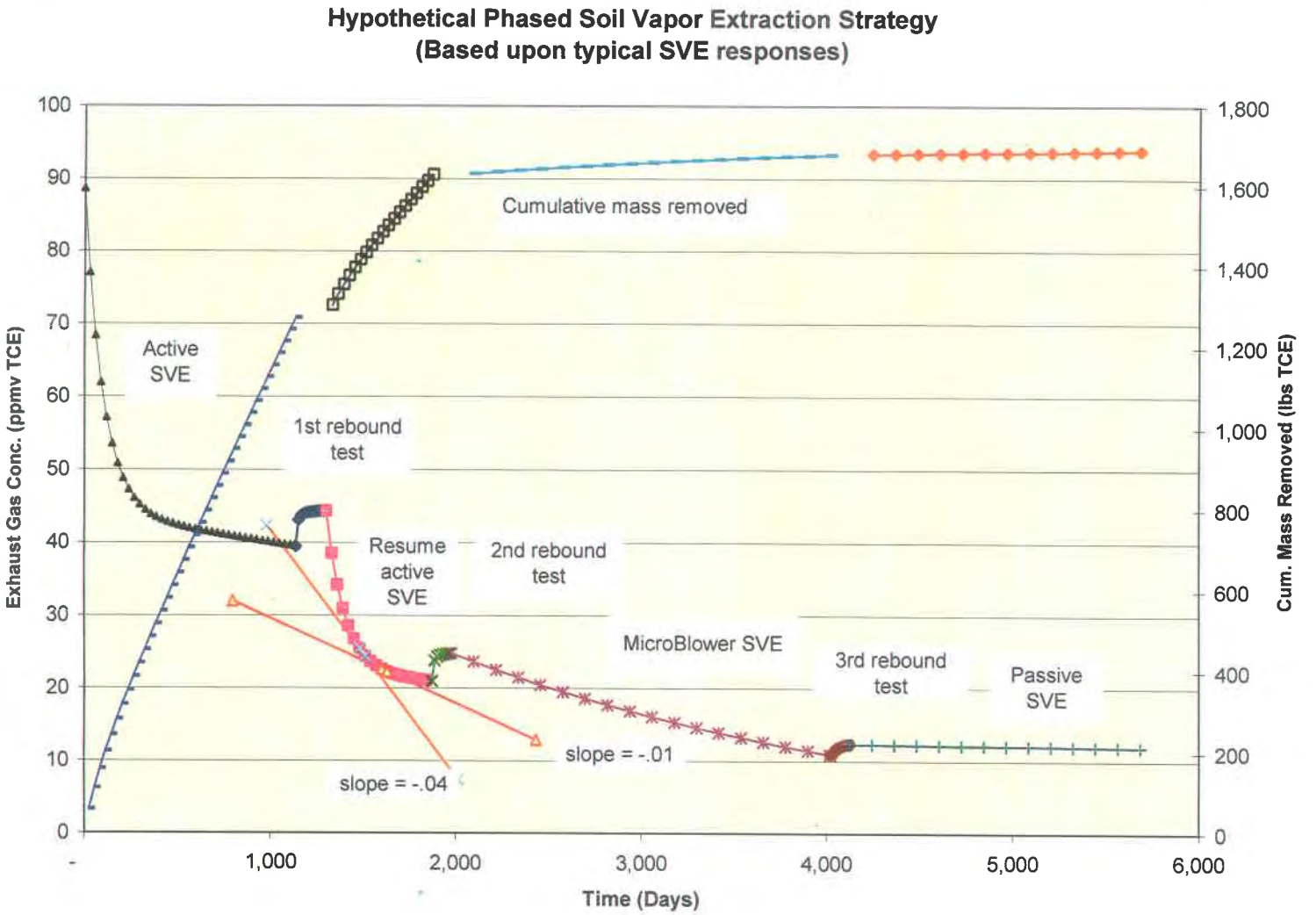


**Figure D-1. Hypothetical Operational Strategy for the ABRP/MCB/MBP Operable Unit**

**NOTE:** SVE strategy is based upon concentration and time responses. Concentrations and time durations can vary depending upon location-specific conditions.

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