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United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the P-Area Burning/Rubble Pit (131-P) (U)

WSRC-RP-2000-4197

Rev. 1

June 2002

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

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

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

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

P-Area Burning/Rubble Pit (131-P) Operable Unit

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June 2002

Savannah River Site
Aiken, South Carolina

Prepared by:

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

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

P-Area Burning/Rubble Pit (131-P) Operable Unit

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Identification Number: OU-59

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

Savannah River Site

Aiken, South Carolina

United States Department of Energy

The P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/CERCLA unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). The media associated with this OU are soil and groundwater. The PBRP OU consists of five subunits: (1) PBRP, a single burning/rubble pit; (2) a small drainage ditch near PBRP; (3) a seepline located along an embankment of Steel Creek; (4) a segment of Steel Creek adjacent to the OU; and (5) groundwater in the water table aquifer.

Statement of Basis and Purpose

This decision document presents the selected remedy for the PBRP 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.

The State of South Carolina Department of Health and Environmental Control (SCDHEC) and the United States Environmental Protection Agency (USEPA) concur with the selected remedy.

Assessment of the Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants into the environment.

Description of the Selected Remedy

The PBRP OU future land use will be industrial usage. Levels of contamination remaining buried within the PBRP OU, together with its proximity to the heavy industrial (nuclear) zone of P-Area, would make unrestricted use of the area unsafe. Land use controls are included in the remedy selected for purposes of 1) prohibiting residential uses of the entire operable unit and 2) limiting activities of future industrial users to prevent exposures to buried contamination. Based on contamination identified in the RCRA Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment (RFI/RI/BRA), two of the five subunits within the overall PBRP OU – 1) the PBRP subunit and 2) the groundwater subunit – were determined to require remedial actions under this ROD in addition to land use controls. The selected remedy for PBRP is Alternative PBRP 2: Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls. The selected remedy for groundwater is Alternative GW 2: Continued Monitoring and Reporting to verify that a discernable plume above maximum contaminant levels (MCLs) does not develop. There is no principal threat source material at this OU.

The selected remedy entails the following:

- Cover the burning/rubble pit with an engineered cover system (e.g., native soil cover with a hydraulic conductivity of approximately 10^{-5} cm/sec) to (1) prevent exposure to contaminants in surface soil, (2) reduce rainwater infiltration and resulting leaching, and (3) slow the rate of contaminant migration through the soil to groundwater so that there is more time for natural processes such as biodegradation to reduce the leachability risk.

- Install passive soil venting wells (BaroBalls™) to allow volatile organic compounds (VOCs) in the soil to vent to the atmosphere instead of leaching to groundwater.

- Monitor the groundwater quality to confirm that a discernable groundwater plume above MCLs does not develop.

- Implement and maintain land use/institutional controls (site access controls, SRS Site Use and Site Clearance programs, deed notices and restrictions) and perform ongoing site maintenance (maintaining drainage features and cover integrity, repair of erosion damage) to prevent exposures to buried contamination.

The estimated time to complete construction is 1 year after the remedial action start date.

The RFI/RI/BRA determined that there is no problem (there are no refined constituents of concern [RCOCs]) warranting additional or separate action for the small drainage ditch near PBRP, the seepline located along an embankment of Steel Creek, or the segment of Steel Creek located adjacent to the PBRP OU; therefore, no subunit-specific action is being selected under this ROD for these three areas. The ditch and seepline subunits do not appear to have been contaminated. Although Steel Creek as a whole is contaminated, no subunit-specific action is being selected under this ROD for the portion of this surface water within the PBRP OU because this contamination did not originate from PBRP, and contamination in Steel Creek is being addressed separately under the integrator operable unit program.

The PBRP OU is within the Steel Creek watershed. In addition to this OU, there are many other OUs within this watershed. Under the overall site management strategy, all source control and groundwater OUs within this watershed will be evaluated to determine their impacts, if any, on the associated streams and wetlands. SRS will manage all OUs to mitigate impact to the watershed. Upon disposition of all OUs, a final comprehensive ROD for the watershed will be pursued. The response action for this OU will not adversely impact the response actions of other OUs at SRS.

SCDHEC has modified the SRS RCRA permit to incorporate the Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls remedy for PBRP, and the Continued Monitoring and Reporting remedy for groundwater.

Statutory Determinations

Based on the unit RFI/RI/BRA report, PBRP soil and groundwater pose a threat to human health. Therefore, Alternative PBRP 2 (Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls) for the PBRP and Alternative GW 2 (Continued Monitoring and Reporting) for the groundwater have been selected as the remedies for the PBRP OU.

Section 300.430(f)(2) of the NCP requires that a five-year remedy review be performed if hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure remain in the OU. The three parties, SCDHEC, USEPA, and United States Department of Energy (USDOE), have determined that a five-year review of the remedy for the PBRP OU will be performed to ensure that the remedy continues to provide adequate protection of human health and the environment.

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 (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. By employing passive soil vapor extraction, this remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants through treatment).

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

In the long-term, if the property is ever transferred to nonfederal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The contract for sale and the deed will contain the notification required by CERCLA Section 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility 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 leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As negotiated with USEPA, and in accordance with USEPA Region IV policy (Johnston 1998), SRS has developed a LUCAP (WSRC 1999) to ensure that land use restrictions are maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide detail and specific measures required for the land use controls selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the land use control selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP), as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect until modified as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

Data Certification Checklist

This ROD provides the following information:

- RCOCs and their respective concentrations
- Baseline risk represented by the RCOCs
- Cleanup levels established for the RCOCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the BRA and ROD
- 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
- Decision factor(s) that led to selecting the remedy (i.e., describes how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)
- How source materials are addressed (there is no principal threat source material at this unit)

8/8/02 Date

Jeffrey M. Allison
Acting Manager
U. S. Department of Energy, Owner and Co-operator,
Savannah River Operations Office

6/16/03 Date

~~Richard D. Green~~ Winston A. Smith
Division Director
Waste Management Division
U. S. Environmental Protection Agency – Region IV

7/21/03 Date

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

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

P-Area Burning/Rubble Pit (131-P) Operable Unit

WSRC-RP-2000-4197
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Savannah River Site
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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
bls	below land 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 Regulations
CM RCOC	contaminant migration refined constituent of concern
CMI/RAIP	corrective measures implementation/ remedial action implementation plan
CMS/FS	corrective measures study/feasibility study
COC	constituent of concern
CPT	cone penetrometer technology
CSM	conceptual site model
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
GPR	ground penetrating radar
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
IDW	investigation-derived waste
IOU	integrator operable unit
LLC	Limited Liability Company
LUC	Land Use Controls
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PBRP	P-Area Burning/Rubble Pit (131-P)
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PTSM	principal threat source material
RAO	remedial action objective
RBC	risk-based concentration
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

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
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
SVOC	semivolatile organic compound
TAL	target analyte list
TBC	to-be-considered
TCL	target compound list
µg/L	micrograms per liter
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC	Westinghouse Savannah River Company

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

Unit Name, Location, and Brief Description

P-Area Burning/Rubble Pit (131-P) Operable Unit

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Identification Number: OU-59

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

Savannah River Site

Aiken, South Carolina

United States Department of Energy (USDOE)

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

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

The Federal Facility Agreement (FFA) is a legally binding agreement between regulatory agencies (USEPA and SCDHEC) and regulated entities (USDOE) that establishes the responsibilities and schedules for the comprehensive remediation of the SRS. The FFA for SRS (FFA 1993) lists the P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Unit (OU) as a Resource Conservation and Recovery Act (RCRA) Solid Waste Management Unit/CERCLA unit requiring further evaluation. The PBRP OU required further evaluation through an investigation process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA remedial investigation (RI) process to determine the actual or potential impact to human health and the environment of releases of hazardous substances, pollutants or contaminants to the environment.

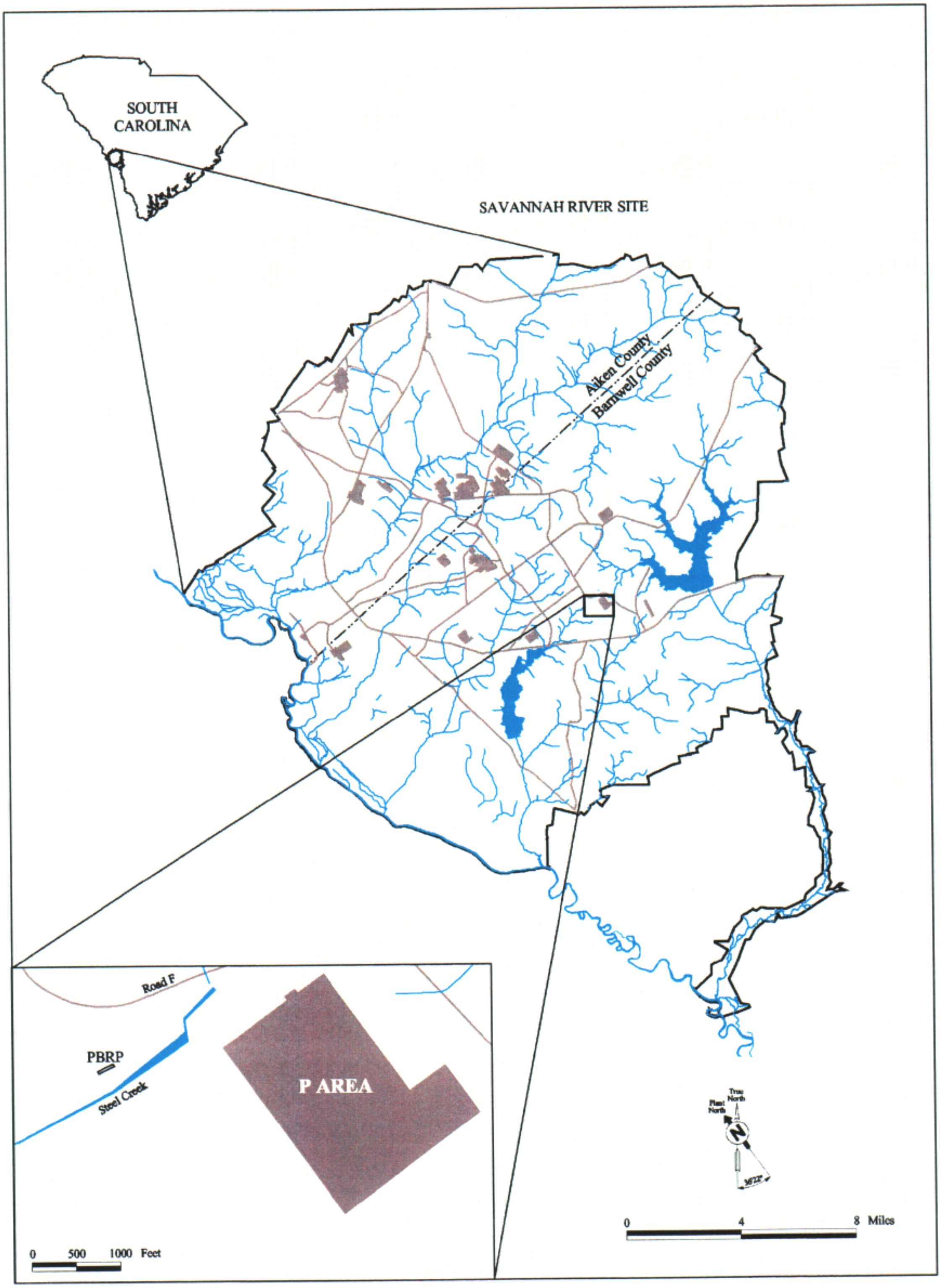


Figure 1. Location of the PBRP OU at SRS

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 at SRS. Past disposal practices have resulted in soil and groundwater contamination.

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

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

Operable Unit Operational and Compliance History

The PBRP OU consists of five subunits: (1) PBRP, a single burning/rubble pit; (2) a small drainage ditch near PBRP; (3) a seepline located along an embankment of Steel Creek; (4) a segment of Steel Creek adjacent to the OU; and (5) groundwater in the water table aquifer.

The land surface at PBRP slopes gently to the south. Approximately 45.7 m (150 ft) to the south of the unit is a steep embankment of Steel Creek. The embankment drops 7.6 m (25 ft) in elevation over a lateral distance of 30.5 m (100 ft). The embankment is punctuated by a terrace located 3.0 m (10 ft) above the elevation of Steel Creek. The terrace is 7.6 m (25 ft) ft wide and contains a seepline. Steel Creek is at the base of the embankment.

An aerial photograph with overlay of the OU is provided as Figure 2. A ground-level photograph is provided as Figure 3.

The OU has been assessed through characterization (Table 1) and a series of documents written by USDOE and approved by the regulatory agencies (SCDHEC and USEPA). These documents include a Work Plan (WSRC 1998), RFI/RI report with Baseline Risk Assessment (BRA) (WSRC 2001a), and a Statement of Basis/Proposed Plan (SB/PP) (WSRC 2001b). A corrective measures study/feasibility study (CMS/FS) was not prepared because USDOE, SCDHEC, and USEPA agreed that the problem warranting action and the scope of the problem was well-defined and that the list of likely response actions was short enough to proceed directly from the RFI/RI/BRA to the SB/PP. The types of assessments typically done in a CMS/FS were included in Appendix A of the SB/PP.

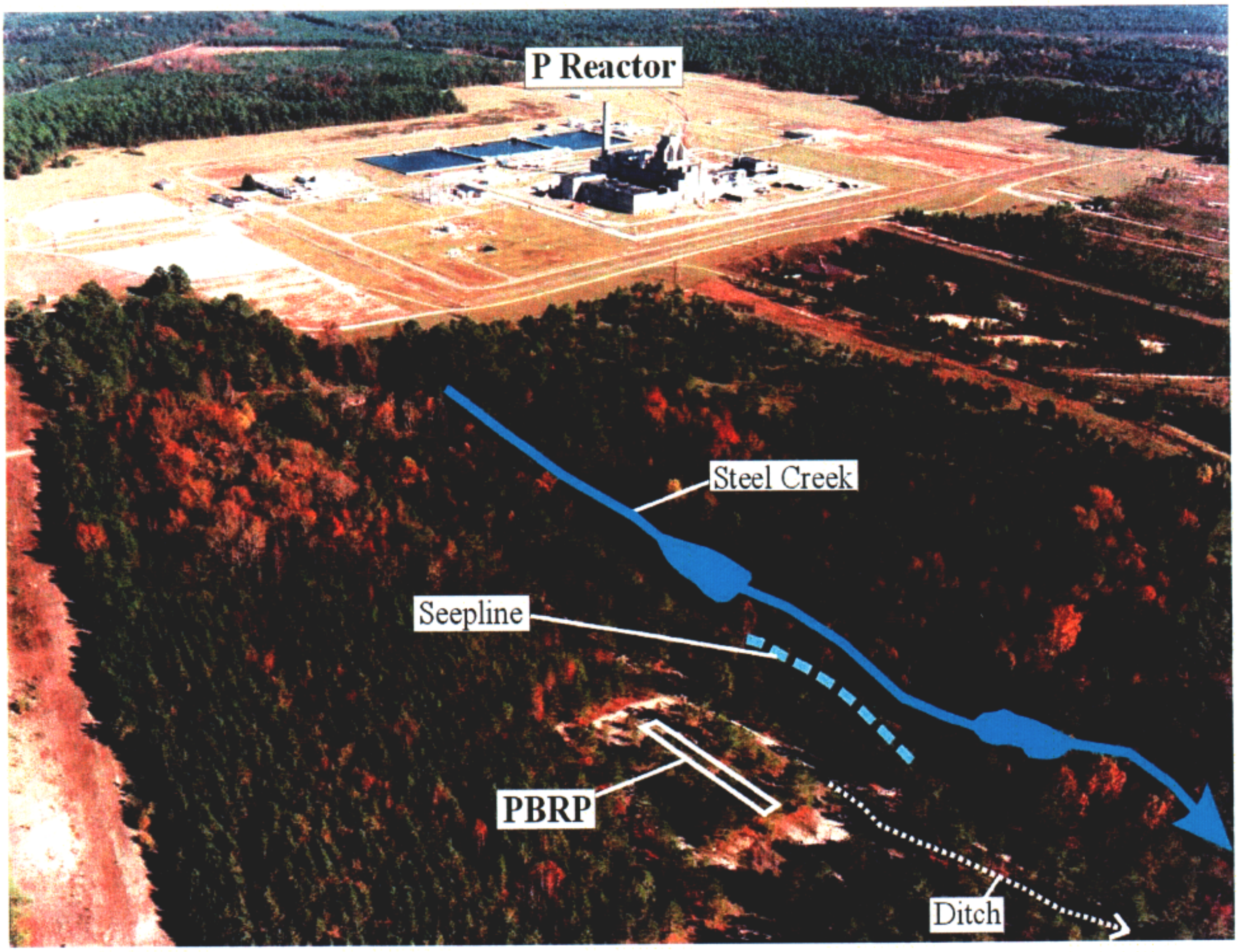


Figure 2. Oblique Aerial Photograph of the PBRP OU

(looking southeast with P Area in background)

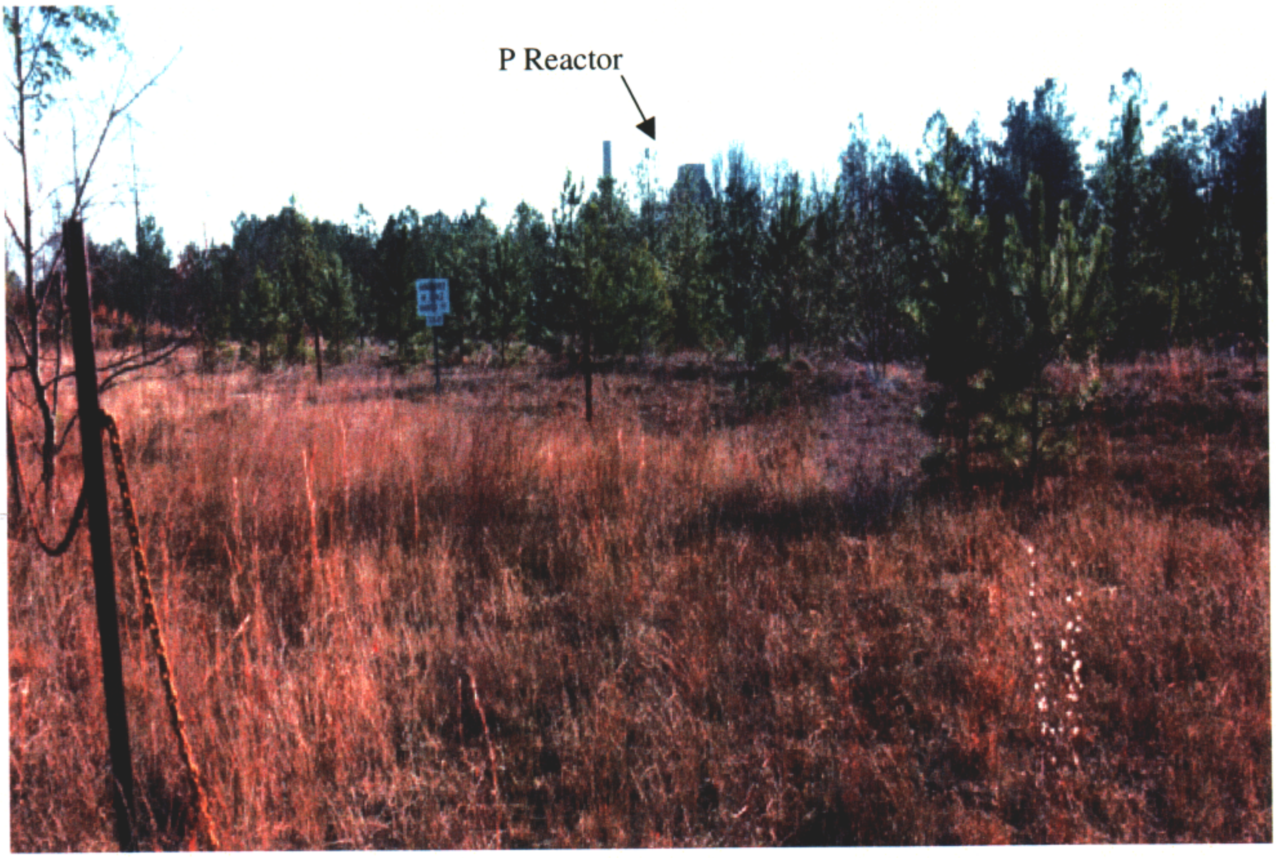


Figure 3. Ground-Level Photograph of PBRP

(looking southeast)

Table 1. History of Characterization Activities at the PBRP OU

Investigation Dates	Description
1983 - 1984	Installation of four groundwater monitoring wells (PBP-1A,-2, -3, and –4)
1984 - 1998	Groundwater monitoring
1986	Soil gas survey (16 sites in pit, 8 around perimeter, 1 auger boring)
1988	Initial soil sampling (two borings in pit, two around perimeter)
1991	Soil gas survey (10 sites in pit)
1994	Ecological field survey of northern and northeastern P Area
1997	Ground penetrating radar (GPR) survey of pit
1997: Phase I (PBRP1)	Three background soil boring locations (PBRP-06, PBRP-07, and PBRP-08)
	Five soil boring locations through pit (PBRP-01 through PBRP-05)
	Surface water and soil sampling at two locations in ditch (PBRP-09 and PBRP-10)
1998: Phase II (PBRP2)	Exploratory trenching across pit (soil and water samples from 2 trenches)
	Six perimeter soil borings (PBRP-11 through PBRP-16)
	Installation of temporary piezometers
	Installation and sampling of monitoring well PRP-5 in May 1998 Refurbishing of wells PRP-1A, -2, -3, and -4 in June 1998
	Permeability tests (slug tests)
	Shelby tube samples
	Surface water (TS01) and sediment (SC04) sampling at the seepline
	Surface water and sediment sampling along Steel Creek (SC02 and SC03)
	Background surface water and sediment sampling along Steel Creek (SC01)
	CPT: lithologic data and groundwater sampling (CPT-1 to –16)
1998: Phase II (PBRP3)	Surface water and sediment sampling at the seepline (TS02 to TS07)
	Surface water and sediment sampling along Steel Creek (SC06 to SC11, and SC13 to SC15)
	Background surface water (SC05) and sediment (SC12) sampling along Steel Creek
	Groundwater sampling of wells PRP-1A, -2, -3, and -4
	CPT: lithologic data and groundwater sampling (CPT-17 and –18)
1998: Phase II (PBRP4)	Background surface water sampling along Steel Creek (SC16 to SC19)
	Groundwater sampling of wells PRP-1A, -2, -3, -4, and –5
	CPT: lithologic data and groundwater sampling (CPT-19 through 28, excluding CPT-23)

Phase I (PBRP1) was a pre-Work Plan investigation in 1997.
Phase II sampling was performed and analyzed in stages (PBRP2, PBRP3, and PBRP4).
All work was performed per the FFA under USDOE lead agency authority.
There have been no previous removal or remedial actions conducted under CERCLA or other authorities.

PBRP

PBRP is a single, inactive burial pit approximately 200 ft long by 30 ft wide. The depth of the pit ranges from 8 ft below land surface (bls) in the western end to 11 ft bls in the eastern end.

From 1951 to 1973, PBRP was used for periodic burning of combustible materials. Disposal records of individual burials were not kept for this unit; however, information obtained from historical records and from characterization of similar burning/rubble pits at SRS indicate that materials such as wood, cardboard, paper, plastics, rubber, rags, oils and organic liquids of unknown origins were disposed of in the pit and burned on a monthly basis. In 1973, burning in open pits was discontinued at SRS, and a soil layer was placed over the pit contents. The pit continued to receive inert debris such as construction materials. When the pit reached capacity in 1978, the debris was covered with approximately 4 ft of clean soil to grade. No removal actions have been performed at the unit. Currently, PBRP is covered by grassy vegetation and several pine trees. The area around the pit is wooded.

Ditch

No waste was placed in the ditch. The ditch was assessed as part of this OU to determine if runoff and erosion from PBRP had impacted it.

The ditch is approximately 22.9 m (75 ft) to the southwest of PBRP. It is 0.3 to 0.6 m (1 to 2 ft) deep and may, at times, receive surface water runoff from the vicinity of the western end of PBRP. Surface water occasionally collects in the ditch, but the ditch is generally dry. Any water in the ditch either quickly infiltrates, becomes lost to evapotranspiration, or flows south into a tributary of Steel Creek.

Seepline

No waste was placed along the seepline. The seepline was assessed as part of this OU to determine if leaching and seepage from PBRP had impacted it.

The seepline is present on a terrace approximately 3.0 m (10 ft) above Steel Creek. The area identified as the seepline is approximately 3.0 m (10 ft) wide and 61.0 m (200 ft) long. Surface water is locally present at the seepline for much of the year. However, the seepline is not a significant source of surface water, as most of the seepline area has surface water only after heavy rainfall events, and the seepline occasionally dries up completely in the summer. When surface water is present, it is usually in a small part of the seepline area and is never more than a few inches deep. Surface water at the seepline either infiltrates or is lost to evapotranspiration. There is no visible evidence, such as channeling and erosion, to indicate that the surface water at the seepline flows regularly into Steel Creek.

Field data indicate the seepline is attributable to an ephemeral water layer above a localized clay lens. It is not an outcrop of the water table aquifer.

Steel Creek

No waste associated with PBRP was placed in Steel Creek. A segment of Steel Creek adjacent to PBRP was assessed to determine if runoff or seepage from PBRP had impacted it.

Steel Creek is approximately 68.6 m (225 ft) south of PBRP. Prior to 1997, cooling water, process sewer water, and stormwater runoff from P Area were discharged to Steel Creek at a location upgradient of PBRP. In addition, groundwater in the water table aquifer under P Area discharges to Steel Creek. Consequently, Steel Creek has been contaminated by upgradient sources in P Area unrelated to the PBRP OU. All process/cooling water discharges were discontinued February 1997. Steel Creek still flows from stormwater runoff and groundwater seepage at a reduced rate. There is a narrow (<25 ft wide) floodplain along Steel Creek. Water is present in Steel Creek throughout the year. During most of the year, the elevation of the water table is approximately the same as the elevation of the Steel Creek streambed. Consequently, Steel Creek is a discharge point for the water table aquifer.

Groundwater

The water table aquifer represents the "upper" aquifer zone of the Upper Three Runs aquifer and is composed of silt and clay. The top of the water table is approximately 23 ft bls. The upper aquifer zone is approximately 57 ft thick; it extends from the water table to a locally continuous clay layer (the "tan clay") at a depth of approximately 80 ft bls. The general groundwater flow direction is to the west. The water table aquifer discharges to Steel Creek, 250 ft south of PBRP.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA, 42 U.S.C.A. §§ 9613 and 9617. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternative for addressing the PBRP OU. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan* *for the P-Area Burning/Rubble Pit (131-P)* (WSRC 2001b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the PBRP OU.

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

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

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

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

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

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

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

The SB/PP 45-day public comment period began on February 28, 2002, and ended on April 13, 2002. As detailed in the Responsiveness Summary (Appendix A) there were no public comments. This information is also be included in the final RCRA permit modification.

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

RCRA/CERCLA Programs at SRS

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

- investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste site and surrounding areas

- evaluation of risk to human health and the local ecological community

- screening of possible remedial actions to identify the selected technology which will protect human health and the environment

- implementation of the selected alternative

- documentation that the remediation has been performed competently

- evaluation of the effectiveness of the technology

The steps of this process are iterative in nature, and include decision points which require concurrence between USDOE as owner/manager, USEPA and SCDHEC as regulatory oversight agencies, and the public (see Figure 4).

Operable Unit Remedial Strategy

The overall strategy for addressing the OU was to (1) characterize the OU, delineating the nature and extent of contamination and identifying the media of concern (perform the

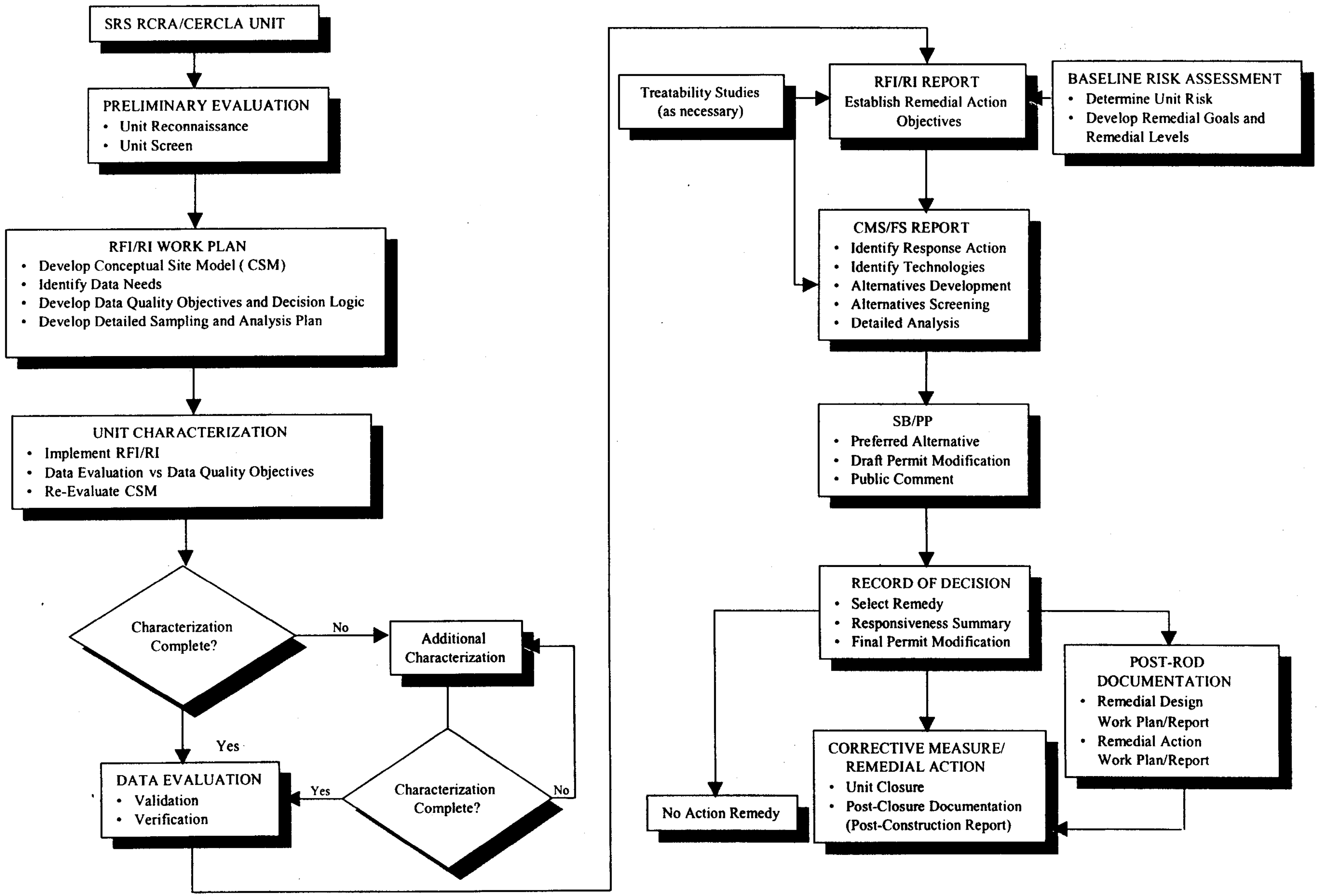


Figure 4. RCRA/CERCLA Logic and Documentation

RFI/RI); (2) perform a BRA to evaluate media of concern and exposure pathways and to characterize potential risks and identify refined constituents of concern (RCOCs); and (3) identify and perform a final action to remediate, as needed, the identified media of concern.

The scope of the problem to be addressed by this final action is contamination in soil and groundwater at PBRP. There is no problem warranting sub-unit specific action at the ditch or seepline (no RCOCs for industrial or residential land uses were identified in the RFI/RI/BRA), and Steel Creek is being addressed separately under SRS's integrator operable unit (IOU) program.

The PBRP OU is within the Steel Creek watershed in the Steel Creek IOU. In addition to this OU, there are many other OUs within this watershed. Under the overall site management strategy, all source control and groundwater OUs within this watershed will be evaluated to determine their impacts, if any, on the associated streams and wetlands. SRS will manage all OUs to mitigate impact to the watershed. Upon disposition of all OUs, a final comprehensive ROD for the watershed comprising the Steel Creek IOU will be pursued with additional public involvement. Surface water and sediment data from Steel Creek generated during the PBRP OU RFI/RI is being provided to the IOU program for use in evaluation of the Steel Creek IOU.

The response action for this OU will not impact the response actions of other OUs at SRS.

V. OPERABLE UNIT CHARACTERISTICS

Conceptual Site Model for the PBRP OU

To better understand the risks posed against current and future receptors, a conceptual site model (CSM) of the unit was developed. The CSM illustrates the sources of contamination, potential exposure pathways, and exposure media relevant to the unit.

The CSM is provided as Figure 5. A detailed explanation of the CSM is provided in Chapter 2 of the RFI/RI/BRA (WSRC 2001a).

Media Assessment

The RFI/RI/BRA (WSRC 2001a) contains detailed information and analytical data for the media assessment. This document is available in the Administrative Record File (see Section III). The investigations are summarized below and in Table 1.

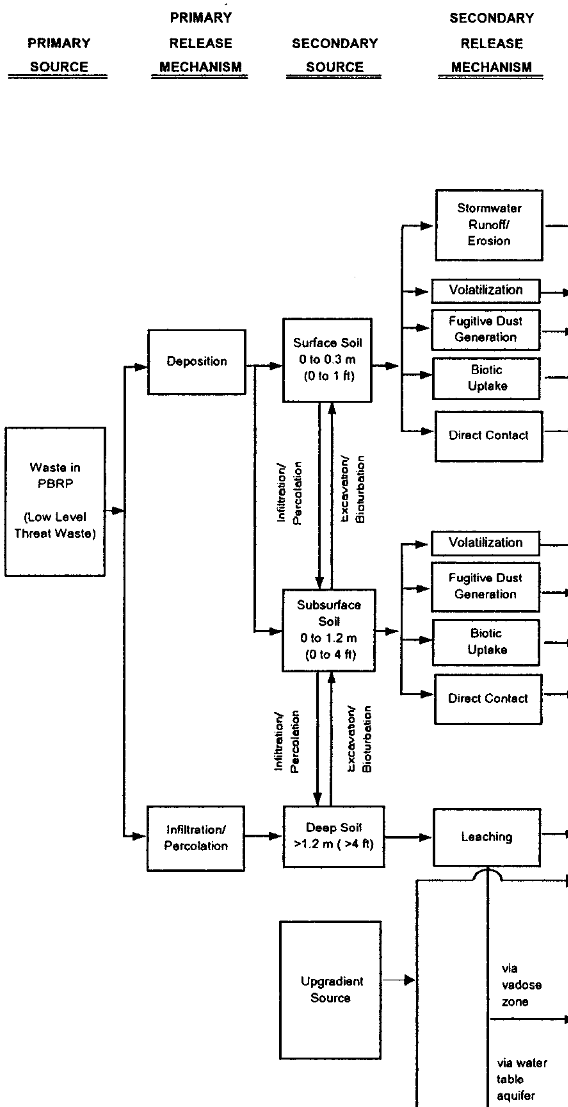
Soil Investigation

PBRP

Characterization of PBRP was performed through a series of sampling events. Generally, the sampling locations of each successive event were selected based on review of data previously collected with the intent of targeting the areas exhibiting the highest levels of contamination.

Investigation of PBRP began in 1986 with a soil-gas survey that consisted of 24 soil-gas samples collected from locations in and around the pit. In 1988, soil sampling was performed to investigate the pit construction and contents. In 1991, a second soil-gas survey was performed at 10 locations within the backfill of the pit. In 1997, a GPR survey was performed to produce a graphic profile of the subsurface. The survey was used to define the boundaries of the pit before further soil sampling was performed.

Phase I pre-Work Plan soil activities also began in 1997. Five soil borings were advanced through the entire depth of the pit (PBRP-01 through PBRP-05) (Figure 6). In each boring, samples were collected of the backfill, the soil among the debris within the pit, the soil at the base of the pit, and the soil below the base of the pit (Figure 7). In addition, four other borings were performed to determine the pit geometry, but no soil



PATHWAYS (media)	EXPOSURE ROUTE	POTENTIAL RECEPTORS: KNOWN: On-unit Worker	HYPOTHETICAL: Industrial Worker	HYPOTHETICAL: Adult Resident	HYPOTHETICAL: Child Resident	ECOLOGICAL: Terrestrial	ECOLOGICAL: Aquatic	Refined COCs
Surface Soil in Drainage Ditch	Ingestion	—	—	—	—	—	—	None
	Dermal Contact	—	—	—	—	—	—	None
	External Radiation	—	—	—	—	—	—	None
Surface Water in Drainage Ditch	Ingestion	—	—	—	—	—	—	None
	Dermal Contact	—	—	—	—	—	—	None
	External Radiation	—	—	—	—	—	—	None
Air (Vapor)	Inhalation	●	●	●	●	○	—	None
Air (Particulates)	Inhalation	●	●	●	●	○	—	None
Biota	Ingestion	—	—	●	●	●	—	None
Surface Soil	Ingestion	●	2×10^{-4}	2×10^{-3}	●	●	—	B(a)A, B(a)P, B(b)F, B(k)F, Chry, Dba, Ip
	Dermal Contact	1×10^{-6}	4×10^{-4}	1×10^{-3}	●	○	—	B(a)A, B(a)P, B(b)F, B(k)F, Dba, Ip
	External Radiation	—	—	—	—	—	—	None
Air (Vapor)	Inhalation	●	●	●	●	○	—	None
Air (Particulates)	Inhalation	●	●	●	●	○	—	None
Biota	Ingestion	—	—	●	●	●	—	None
Subsurface Soil	Ingestion	●	3×10^{-4}	3×10^{-3}	HI = 0.5	●	—	B(a)A, B(a)P, B(b)F, B(k)F, Chry, Dba, Fl, Ip, Ph, Py
	Dermal Contact	●	6×10^{-4}	2×10^{-3}	●	○	—	B(a)A, B(a)P, B(b)F, B(k)F, Chry, Dba, Ip
	External Radiation	—	—	—	—	—	—	None
Groundwater in Water Table Aquifer	Ingestion	—	8×10^{-5}	4×10^{-4}	HI =0.3	—	—	1,1-DCE, TCE
	Inhalation (1)	—	—	1×10^{-4}	●	—	—	1,1-DCE, TCE
	Dermal Contact (1)	—	—			—	—	
Sediment at Seepline	Ingestion	—	—	—	—	○	●	None
	Dermal Contact	—	—	—	—	○	○	None
	External Radiation	—	—	—	—	—	—	None
Surface Water at Seepline	Ingestion	—	—	—	—	○	●	None
	Dermal Contact	—	—	—	—	○	○	None
	External Radiation	—	—	—	—	○	●	None
Surface Water in Steel Creek	Ingestion	—	—	● (2)		○	●	None
	Dermal Contact	—	—	● (2)		○	○	None
	External Radiation	—	—	—	—	○	●	None
Sediment in Steel Creek	Ingestion	—	—	● (2)		○	●	None
	Dermal Contact	—	—	● (2)		○	○	None
	External Radiation	—	—	● (2)		—	—	None

LEGEND

→ = Pathways, current, historical and future
● = Pathway quantitatively evaluated - no RCOCs identified
○ = Pathways for qualitative evaluation
— = Incomplete pathways

Posted risk/hazard is the sum of risks/hazards for RCOCs
(1) Showering scenario includes both inhalation and dermal contact pathways
(2) Hypothetical resident receptor for surface water and sediment in Steel Creek is an adolescent

Figure 5. CSM for the PBRP OU

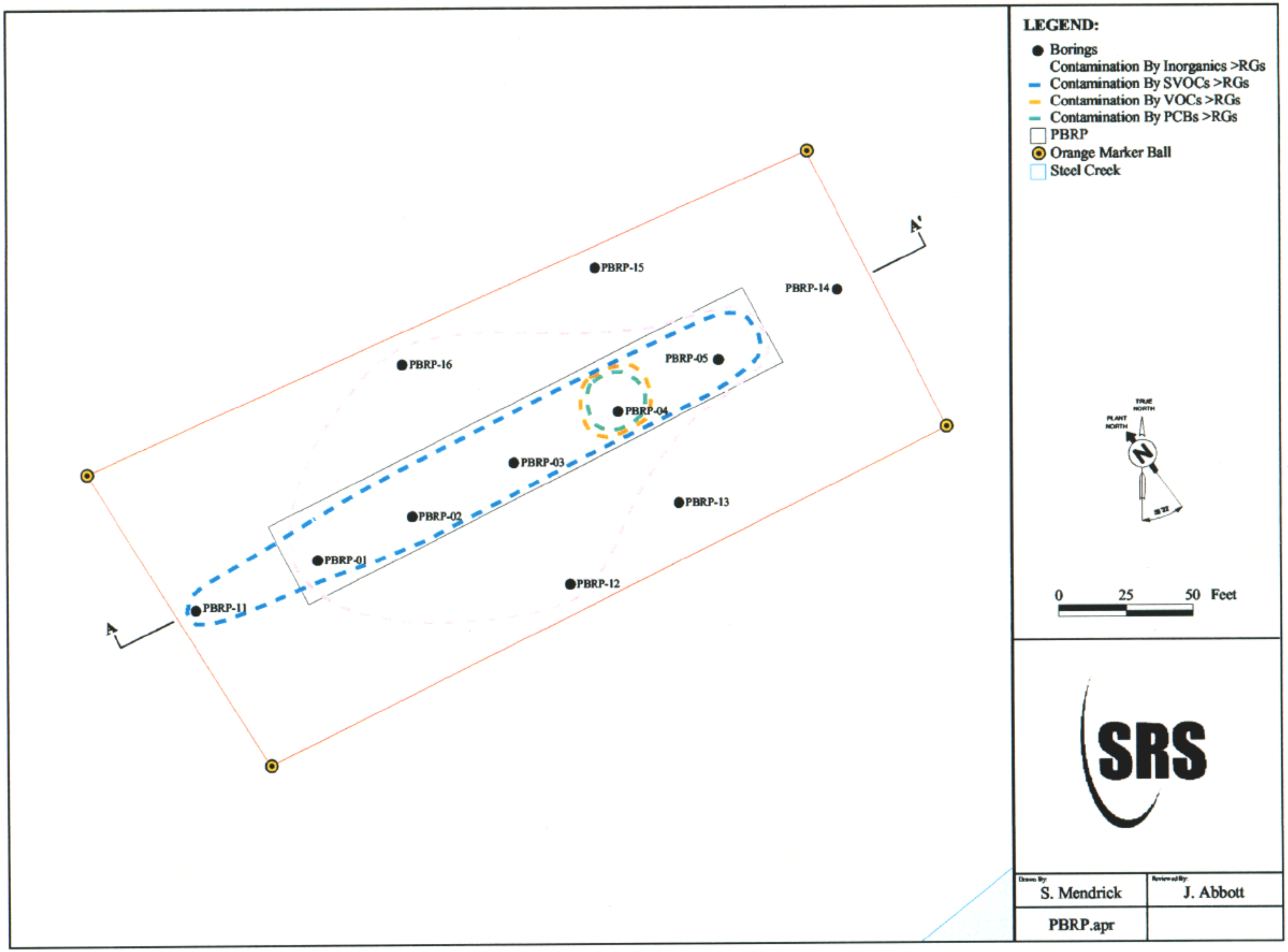


Figure 6. Soil Contamination at PBRP - Plan View

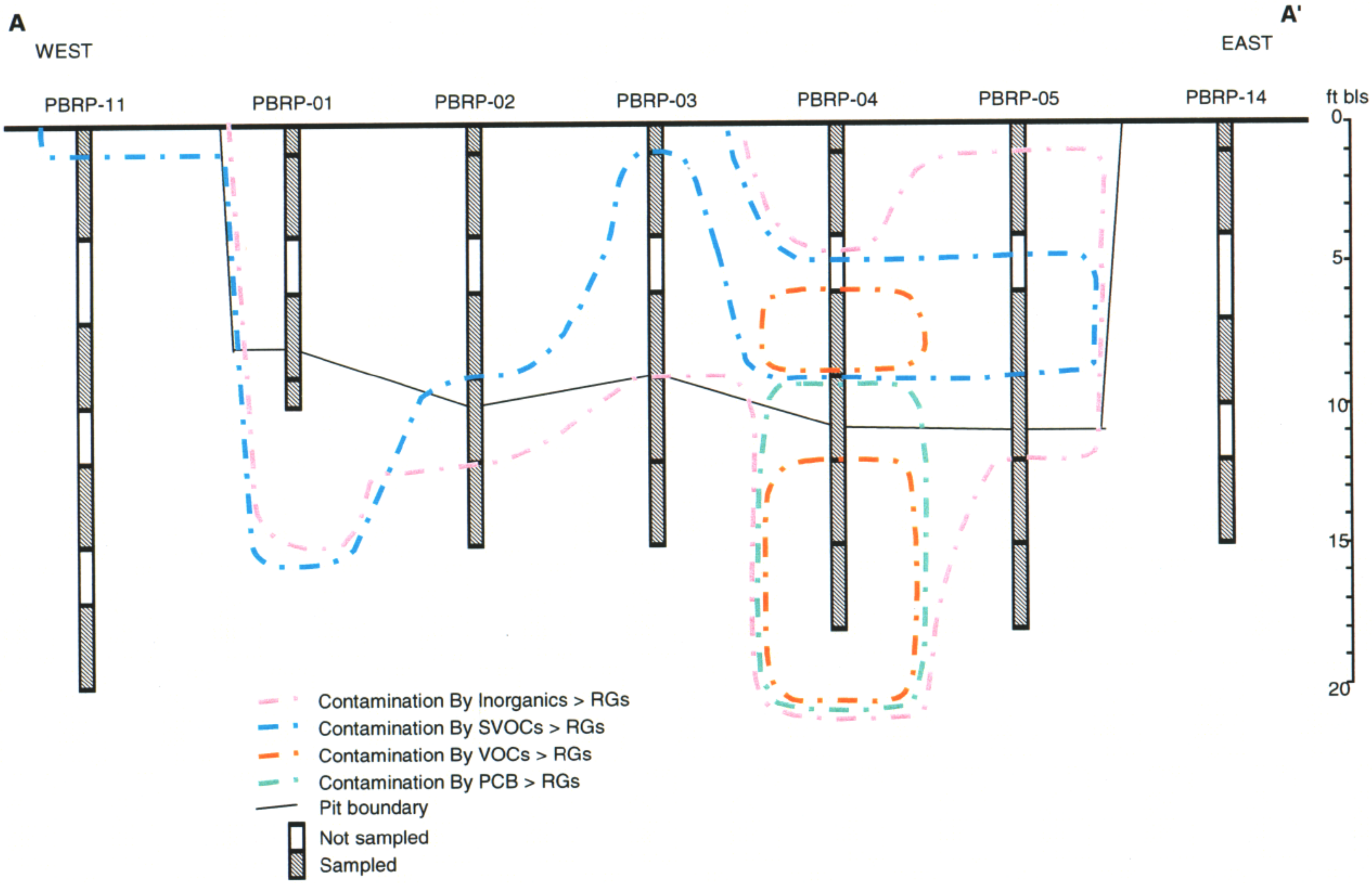


Figure 7. Soil Contamination at PBRP – Cross-Section

samples were taken at these four locations. The soil samples were analyzed for target analyte list (TAL) inorganics, target compound list (TCL) semivolatile organic compounds (SVOCs), TCL volatile organic compound (VOCs), TCL pesticides/polychlorinated biphenyls (PCBs), dioxins/furans, and radionuclides.

The Phase II investigation began in 1998 with exploratory trenching at PBRP as part of standard characterization activities for burning/rubble pits at SRS. Soil and trapped water samples from the two trenches received definitive-level analysis for TAL inorganics, TCL SVOCs, TCL VOCs, TCL pesticides/PCBs, dioxins/furans, and radionuclides.

Phase II borings at the PBRP were advanced around the perimeter of the pit (Figure 6). Six perimeter borings (PBRP-11 through PBRP-16) were advanced to augment the data for the RFI/RI/BRA and to determine if past operations at the unit and/or surface runoff from the PBRP had impacted the adjacent areas. The perimeter soil samples were analyzed for TAL inorganics, TCL SVOCs, TCL VOCs, TCL pesticides/PCBs, dioxins/furans, and radionuclides.

Ditch

The ditch was investigated in 1997. Two locations were sampled in the ditch. One sample of surface soil and one sample of surface water were collected at each location. The samples were analyzed for TAL inorganics, TCL SVOCs, TCL VOCs, TCL pesticides/PCBs, and radionuclides.

Seepline

The seepline was characterized during Phase II activities in 1998 to determine if leaching of PBRP impacted the seepline. Sediment and surface water samples were obtained from four locations along the seepline. The samples were analyzed for TAL inorganics, TCL SVOCs, TCL VOCs, TCL pesticides/PCBs, and radionuclides.

Groundwater Investigation

Characterization of groundwater was performed through a series of sampling events. Generally, the sampling locations of each successive event were selected based on review of data previously collected with the intent of targeting the areas exhibiting the highest levels of contamination.

The groundwater investigation began in 1983 with installation and monitoring of four wells around the pit (PRP-1A, PRP-2, PRP-3, and PRP-4). In 1998, the pumps were replaced and the wells were refurbished. A fifth well was installed under Phase II activities in May 1998 (PRP-5).

In 1998, three temporary piezometers were installed around the OU to establish groundwater flow direction, and twenty-seven cone penetrometer technology (CPT) pushes were advanced around the OU to aid in interpretation of the nature and extent of contamination.

In October and November 1999, SRS installed two new wells: one well (PRP-6) was installed approximately 15 ft upgradient (east) of well PRP-3, and the other well (PRP-7) was installed approximately 80 ft downgradient (west) of well PRP-3. These data demonstrated that the results from PRP-3 had not been representative of actual groundwater conditions. Well PRP-3 was abandoned in Fall 2000.

Media Assessment Results

The sampling data were evaluated in the RFI/RI/BRA to identify RCOCs (constituents warranting remedial action). Constituents of concern (COCs) were identified using the SRS protocols for data processing, human health and ecological risk assessment, and contaminant migration modeling. Human health COCs, which were calculated based on residential and industrial land use exposure scenarios, have a cancer risk of at least 1×10^{-6} (one additional incident of cancer per one million people) or a noncancer hazard quotient of at least 0.1 (the ratio of the estimated chronic daily intake of a constituent to the reference dose, which is the toxicity value used most often in evaluating noncarcinogenic effects on human health). Ecological COCs have a HQ greater than 1 (the ratio of constituent daily intake to the No Observed Adverse Effect Level or Lowest Observed Adverse Effect Level which are conservative values taken from wildlife toxicological studies in the scientific literature). Contaminant migration COCs (CMCOCs) are predicted to leach to groundwater above MCLs within 1,000 years. Applicable or relevant and appropriate requirement (ARAR) COCs are constituents that exceed a chemical-specific threshold value established in environmental regulations. COCs were subsequently evaluated in the RFI/RI/BRA in a weight-of-evidence analysis of all the available information where technical judgement was used to determine whether the COC poses an actual threat warranting remediation. COCs that were retained through this analysis are termed refined constituents of concern (RCOCs). Tables 2 and 3 lists the RCOCs and risks at the unit. The key findings of the RFI/RI/BRA are discussed below.

Soil

PBRP

The unit investigation confirmed that miscellaneous inert debris remains buried in the pit. Soil contaminants within the pit include inorganics, SVOCs, VOCs, and PCBs. Soils around the perimeter of the pit are generally uncontaminated. However, there are a few places around the perimeter of the pit where low levels of unit-related contamination are present. Figures 6 and 7 illustrate the extent of contamination at PBRP. There are no RCRA listed or characteristic wastes at the unit. The volume of contaminated soil is 3,500 cubic yards.

There is no principal threat source material (PTSM) (highly-mobile or highly-toxic source materials that require a bias toward treatment alternatives) at PBRP. The contamination is largely isolated by backfill with its exposure limited by land use restrictions; the waste is categorized as a low-level threat.

Table 2. Summary of Risks and Hazards

RCOC	Type of RCOC	Frequency Detect	Units	Maximum Result	Average Result	Location of Maximum	Depth of Maximum (ft bls)	Summary of Risks
PBRP Soil [a]								
Antimony	CM	14/26	mg/kg	7	1.81	PBRP-04	6-9	Predicted to exceed MCL in 612 years. Max groundwater concentration (10X MCL) in 800 years
Chromium	CM	26/26	mg/kg	547	47.8	PBRP-05	6-9	Predicted to exceed MCL in 422 years. Max groundwater concentration (30X MCL) in 830 years
Copper	CM	26/26	mg/kg	1440	93.3	PRBP 05	9-12	Predicted to exceed RBC in 489 years. Max groundwater concentration (5X MCL) in 860 years
Nickel	CM	19/26	mg/kg	17.6	3.93	PBRP-01	6-9	Predicted to exceed MCL in 232 years. Max groundwater concentration (3X MCL) in 430 years
Zinc	CM	26/26	mg/kg	4620	377	PBRP-01	6-9	Predicted to exceed RBC in 232 years. Max groundwater concentration (4X RBC) in 450 years
Benzo(a)anthracene	$HH_{ind, res}$	16/26	mg/kg	178	15.1	PBRP-01	0-1	Future Industrial Worker Risk = up to 5 x 10^{-5} Hypothetical Resident Risk = up to 2 x 10^{-4}
Benzo(a)pyrene	$HH_{cur, ind, res}$	15/26	mg/kg	175	14.5	PBRP-01	0-1	Current Worker Risk = up to 1 x 10^{-6} Future Industrial Worker Risk = up to 5 x 10^{-4} Hypothetical Resident Risk = up to 2 x 10^{-3}
Benzo(b)fluoranthene	$HH_{ind, res}$	15/26	mg/kg	182	15.2	PBRP-01	0-1	Future Industrial Worker Risk = up to 5 x 10^{-5} Hypothetical Resident Risk = up to 2 x 10^{-4}
Benzo(k)fluoranthene	$HH_{ind, res}$	15/26	mg/kg	152	12.5	PBRP-01	0-1	Future Industrial Worker Risk = up to 4 x 10^{-6} Hypothetical Resident Risk = up to 2 x 10^{-5}
Chrysene	HH_{res}	17/26	mg/kg	197	16.7	PBRP-01	0-1	Hypothetical Resident Risk = up to 2 x 10^{-6}
Dibenzo(a,h)anthracene	$HH_{ind, res}$	9/26	mg/kg	40.4	3.27	PBRP-01	0-1	Future Industrial Worker Risk = up to 7 x 10^{-5} Hypothetical Resident Risk = up to 3 x 10^{-4}
Dibenzofuran	CM	8/26	mg/kg	21.7	1.9	PBRP-01	0-1	Predicted to exceed RBC in 94 years. Max groundwater concentration (19X RBC) in 170 years
Fluoranthene	HH_{res}	20/26	mg/kg	454	35.7	PBRP-01	0-1	Hypothetical Resident Hazard = up to 0.14
Indeno(1,2,3-c,d)pyrene	$HH_{ind, res}$	14/26	mg/kg	91.7	7.39	PBRP-01	0-1	Future Industrial Worker Risk = up to 2 x 10^{-5} Hypothetical Resident Risk = up to 1 x 10^{-4}
Phenanthrene	HH_{res}	18/26	mg/kg	376	31.8	PBRP-01	0-1	Hypothetical Resident Hazard = up to 0.16
Pyrene	HH_{res}	20/26	mg/kg	366	33.1	PBRP-01	0-1	Hypothetical Resident Hazard = up to 0.16
Tetrachloroethene	CM	5/26	mg/kg	0.4810	0.0195	PBRP-04	15-18	Predicted to exceed MCL in 5 years. Max groundwater concentration (15X MCL) in 6 years
Trichloroethene	CM	2/26	mg/kg	0.1330	0.0065	PBRP-04	15-18	Predicted to exceed MCL in 4 years. Max groundwater concentration (10X MCL) in 4 years
PCB-1242	CM	3/26	mg/kg	0.3730	0.0428	PBRP-04	12-15	Predicted to exceed MCL in 428 years. Max groundwater concentration (9X MCL) in 500 years

Table 2. Summary of Risks and Hazards (Continued)

RCOC	Type of RCOC	Frequency Detect	Units	Maximum Result	Average Result	Location of Maximum	Depth of Maximum (ft bls)	Summary of Risks
Groundwater [b]								
1,1-Dichloroethene	ARAR, $HH_{res, ind}$	8/8	µg/L	9.29	4.86	PRP-6	N/A	Exceeds MCL by 1.3X
Trichloroethene	ARAR, HH_{res}	6/8	µg/L	15.9	3.94	PRP-7	N/A	Exceeds MCL by 3X

ARAR = applicable or relevant and appropriate requirement (ARAR) RCOC
CM = Contaminant Migration RCOC
HH_{cur} = Human health RCOC for the current on-unit worker
HH_{ind} = Human health RCOC for the future industrial worker
HH_{res} = Human health RCOC for the future on-unit resident
[a] Soil statistics calculated using soil samples from borings through the pit (0-18 ft)
[b] Groundwater statistics calculated using 4Q99 and 1Q01 results for wells PRP-6 and PRP-7

Table 3. Total Aggregate Risks for RCOCs

Human Health	PBRP Surface Soil	PBRP Subsurface Soil	Groundwater
Total media risk for current worker	1×10^{-6}	N/A	N/A
Total media risk for future industrial worker	6×10^{-4}	9×10^{-4}	8×10^{-5}
Total media risk for future on-unit resident adult	3×10^{-3}	5×10^{-3}	5×10^{-4}
Hazard index for future on-unit resident child	<0.1	0.5	0.3

N/A = not applicable, current worker not exposed to subsurface soil or groundwater.

<u>Ecological</u>:
No RCOCs.

<u>Contaminant Migration</u>:
Predicted MCL/RBC exceedances in 4 to 1,000 years, up to 30 times the MCL/RBC (constituent-specific, see Table 2).

<u>PTSM</u>:
No PTSM.

Ditch, Seepline, and Steel Creek

For the ditch, evaluation of the nature and extent of contamination indicated that neither soil nor surface water in the ditch has been impacted by the PBRP OU. The observed concentrations of constituents in the ditch are consistent with natural ambient background conditions. No RCOCs were identified.

For the seepline, based on the analytical results from the samples, and given the small size of the seepline and the ephemeral nature of the surface water, no RCOCs were identified.

For Steel Creek, the nature and extent of the constituents indicate that they did not originate from the PBRP OU but rather from an unrelated upgradient source. The contribution of contamination to Steel Creek from PBRP, if any, is indistinguishable from the contribution from the upgradient source. No RCOCs were identified for Steel Creek.

Groundwater

There is no discernable contaminant plume in the groundwater, and detections above maximum contaminant levels (MCLs) are sporadic and limited to the water table aquifer (i.e., shallow unconfined aquifer). Excluding results obtained from well PRP-3 before it was abandoned, only 1,1-dichloroethene and trichloroethene exceed MCLs. 1,1-dichloroethene was detected above its MCL of 7 micrograms per liter (μg/L) in well PRP-6 in one of four sampling events (9.29 μg/L in January 2001) and in well PRP-7 in one of four sampling events (7.13 μg/L in November 1999). Trichloroethene was detected above its MCL of 5 μg/L in well PRP-7 in one of four sampling events (15.9 μg/L in November 1999). Figures 8 and 9 show the locations of wells and CPT samples at PBRP, the groundwater flow direction, and the analytical results for 1,1-dichloroethene and trichloroethene. The volume of contaminated groundwater cannot be defined; there is no discernable contaminant plume.

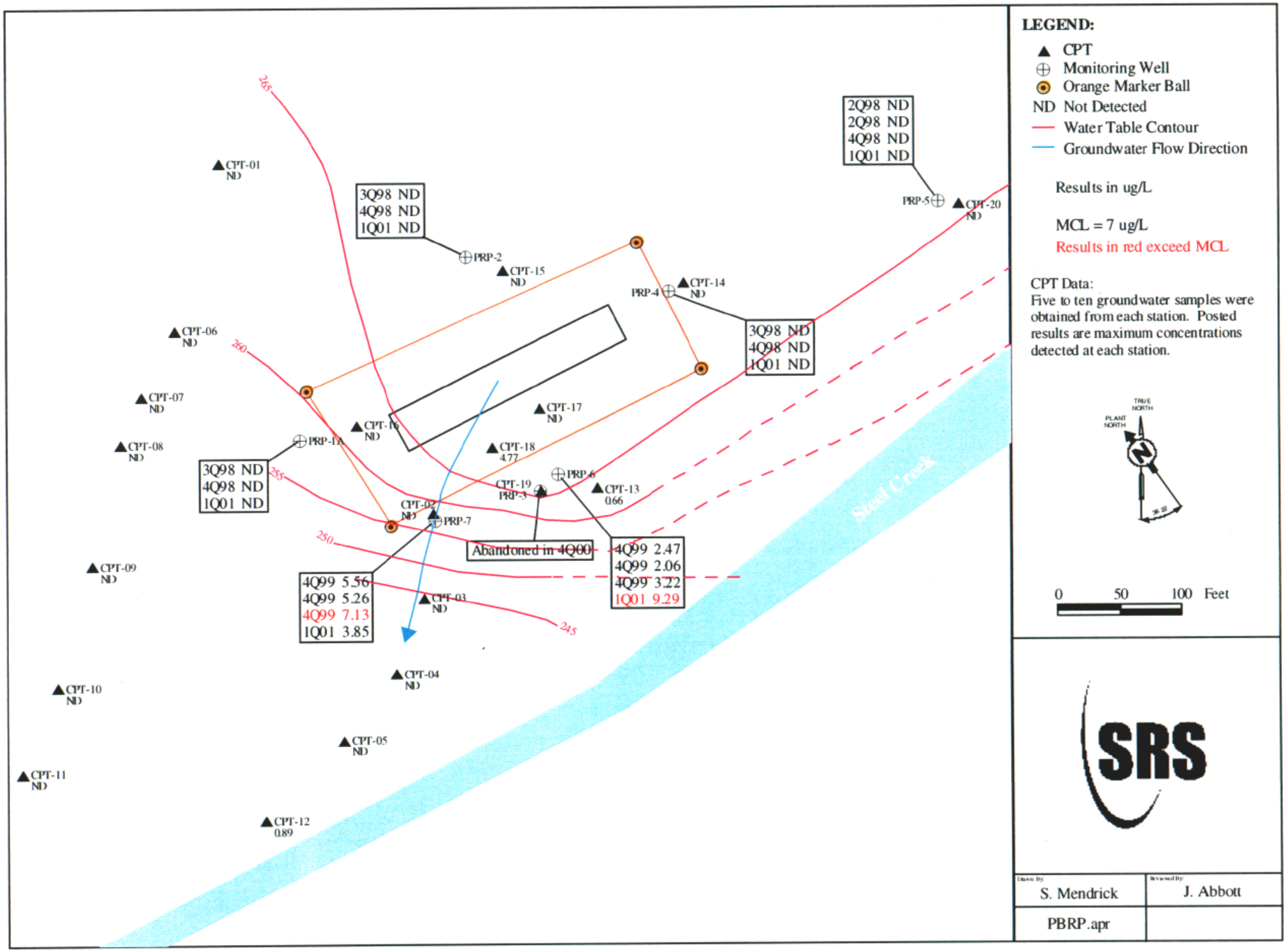


Figure 8. Groundwater Contamination (1,1-Dichloroethene)

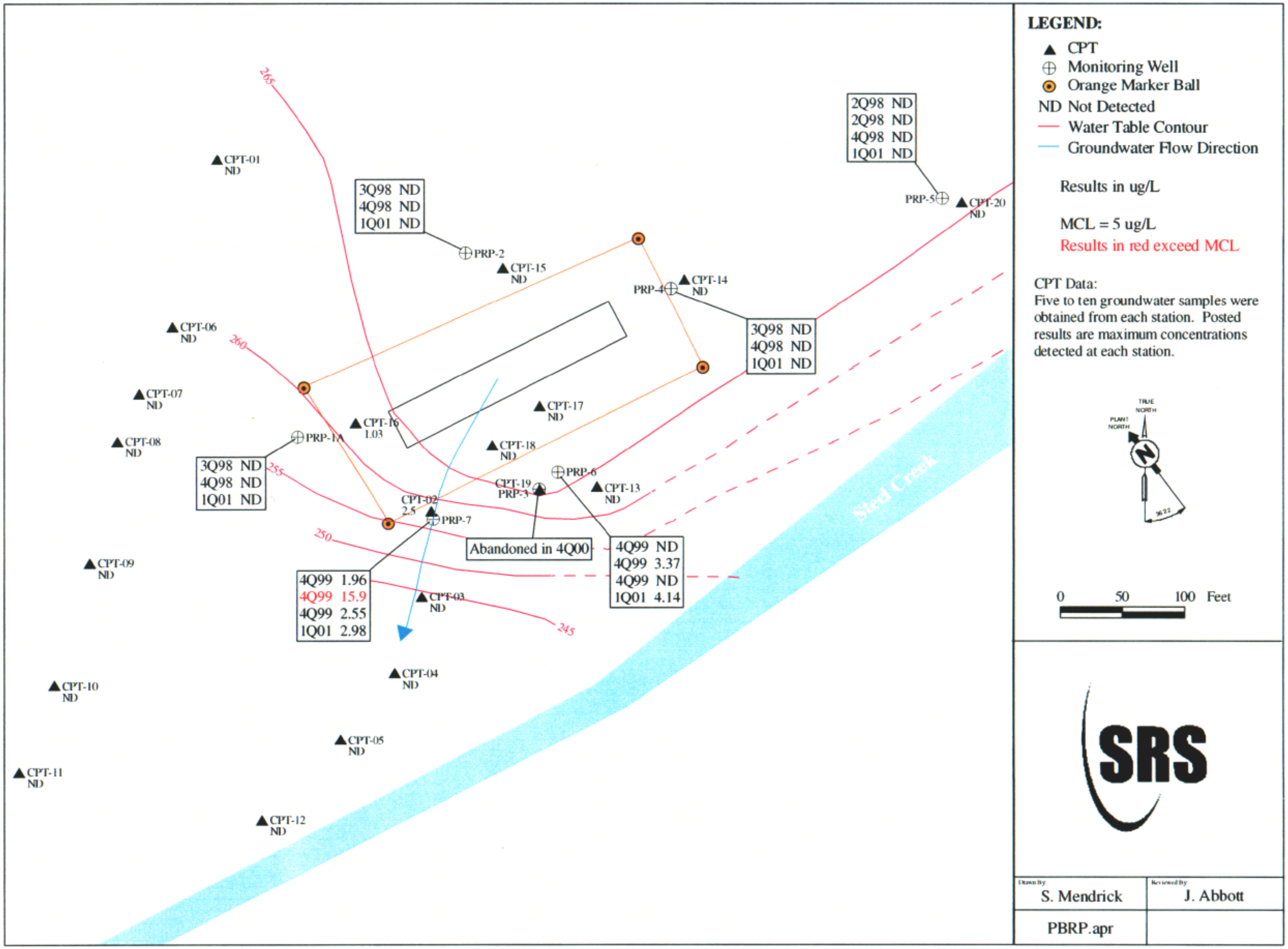


Figure 9. Groundwater Contamination (Trichloroethene)

There is no PTSM in groundwater. There is no free product (non-aqueous phase liquids).

Site Specific Factors

There are no site-specific factors that may affect the response action at the OU. There are no areas of archaeological or historical importance in the vicinity of the OU.

Contaminant Transport Analysis

Contaminant fate and transport modeling using the SESOIL computer model was performed to determine if any constituents in soil will leach through the vadose zone and impact groundwater above MCLs/risk-based concentrations (RBCs) within 1,000 years (WSRC 2001a). The input parameters used in the analysis were developed from site-specific data for PBRP. When a site-specific datum was not available, it was either taken from data for the SRS or from USEPA-suggested default values. In every case, conservative assumptions were used in order to bias the analysis toward a false positive rather than a false negative result. The main assumptions used in the analysis were:

- Infiltration of water through vadose zone soils consists of one-dimensional, steady flow through soil with uniform average soil properties.
- Soil sample analytical results accurately reflect the chemical, physical, and hydrologic characteristics of the transport media (vadose zone soils) and the contaminants that are present.
- Soil-water partitioning of constituents is linear, reversible, and at equilibrium.
- Default, generic, or literature values for selected parameters accurately reflect site conditions.
- Potential mechanisms that are excluded from the analysis (e.g., hydrolysis of organic compounds and biodegradation) do not significantly affect the predicted leachate concentrations.

- The dilution factor and mixing zone depth are reasonable.
- The human receptor is located in the immediate vicinity of the exposure unit, with no lateral transport occurring between the source and the point of exposure.

The modeling indicates that nine constituents at PBRP present a contaminant migration (leachability) threat to groundwater. These contaminant migration refined constituents of concern (CM RCOCs) include antimony, chromium, copper, nickel, zinc, dibenzofuran, tetrachloroethene, trichloroethene, and PCB-1242. These constituents are predicted to exceed MCLs or RBCs within 1,000 years (Table 2).

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

The OU is located in the interior of SRS approximately 5.2 miles from the nearest SRS boundary (Figure 1). SRS is a secured government facility with no residents. General public access to SRS is prohibited, with access limited by security personnel and fences. SRS's Site Use and Site Clearance Programs prevent exposure of SRS employees to contaminants in soil at depth by restricting invasive and permanent installation activities at the unit.

The OU is located close to the industrially developed area of P-Reactor Area, one of several inactive nuclear reactor areas at SRS. PBRP is approximately 1,200 ft west of the P-Reactor Area perimeter fence.

As outlined in the *Savannah River Site Future Use Project Report* (USDOE 1996a), the USDOE has taken steps to prohibit residential use of SRS, including land in the vicinity of the P-Reactor Area, through its plan for current and future use of the SRS. Therefore, future residential use of the area is not anticipated.

The USDOE, USEPA, and SCDHEC agree that industrial land use restrictions are appropriate for the PBRP OU. Industrial land use restrictions will include land use controls to ensure protection against unrestricted (residential) uses. The future land use of the PBRP OU is anticipated to be the same as the current land use (industrial use and control by the federal government).

Groundwater Uses/Surface Water Uses

Groundwater at the OU is not currently being used for human consumption or any other purpose. It is unlikely that drinking water wells will be installed in the future in the potentially affected area (from PBRP to the discharge point of Steel Creek) because (1) the potentially affected area is small and topographically steep, making it difficult to install wells; (2) residential use of the area is unlikely due to the proximity of the PBRP OU to the heavy industrial zone of P Area; and (3) water table wells in this area do not produce much water.

Steel Creek is the only source of significant surface water near the PBRP OU. Surface water is not used for irrigation, consumption, or other uses.

USDOE controls drilling and surface water use through SRS's Site Use and Site Clearance Programs. Therefore, as long as USDOE maintains control of SRS, neither surface water nor groundwater will be used as a potential drinking water source or for irrigation.

Future residential use of groundwater or surface water at the OU is not anticipated.

VII. SUMMARY OF OPERABLE UNIT RISKS

As a component of the RFI/RI process, a BRA (WSRC 2001a) was performed to evaluate risks associated with the PBRP OU. The BRA included human health and ecological risk assessments. A summary of risks and hazards is presented in Tables 2 and 3. A schematic illustration of baseline conditions is presented as Figure 10.

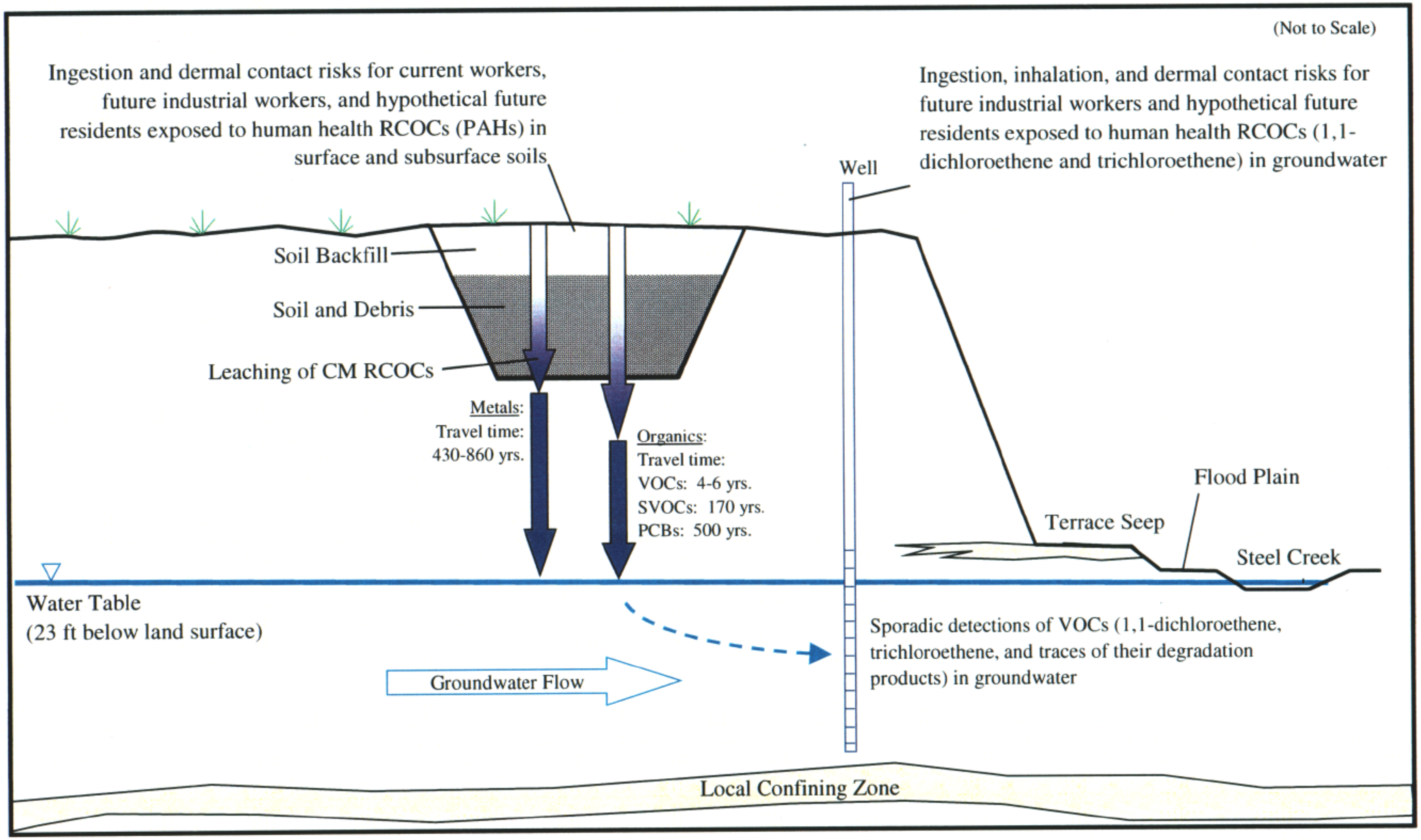


Figure 10. Conceptual Model of Baseline Conditions

Cancer risks are evaluated using the USEPA target range of 1 x 10^{-4} to 1 x 10^{-6} for incremental cancer risk. Risk levels above 1 x 10^{-4} are generally considered to require remediation. Cancer risks between 1 x 10^{-4} and 1 x 10^{-6} are generally considered to represent exposure levels requiring a risk management decision regarding the need for remediation. Cancer risks less than 1 x 10^{-6} are considered to be of little concern in terms of evaluating human health.

For noncancerous effects, USEPA has defined an HI greater than 1 as the initial level of concern for adverse noncarcinogenic health effects, and an HI of 3 as an additional higher level of concern. For noncarcinogens, these health effects are evaluated for the target organ within a given medium.

PBRP is undeveloped, and there are no drinking water wells currently located in the surrounding area. SRS workers occasionally visit the site to perform routine activities such as inspections, periodic maintenance, and environmental sampling. Based on this land use, the risk assessments in the BRA evaluated a current exposure scenario of an on-unit worker exposed to soil at the pit. PBRP is located in an area that has been recommended for future industrial (nuclear) use by the SRS Citizens' Advisory Board and USDOE (USDOE 1996a). For future land use, two receptors were evaluated, the hypothetical industrial worker and the hypothetical resident. Given that the future land use is expected to be similar to current conditions, the resident scenario is a conservative exposure scenario. Exposure to groundwater was included as part of the risk assessment for both future land-use scenarios.

At the ditch and seepline, no RCOCs were identified that necessitate remediation. Contaminants in Steel Creek are not identified as RCOCs for this OU because the contamination did not originate from PBRP. RCOCs are identified for PBRP and groundwater. The results of the risk assessments for PBRP and groundwater are summarized in the following paragraphs.

PBRP

At PBRP, miscellaneous inert debris remains in place at depth in the unit.

Human health risk calculations indicate benzo(a)pyrene would pose an unacceptable risk to a current on-unit worker (carcinogenic risks of up to 1 x 10^{-6} for a current on-unit worker equal the benchmark level of 1 x 10^{-6}). Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene would pose an unacceptable risk to a future industrial worker

(carcinogenic risks of up to 5 x 10^{-4} for a future industrial worker exceed the benchmark level of 1 x 10^{-6}). If future land use is unrestricted, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, and pyrene would pose an unacceptable risk to a future on-unit resident (carcinogenic risks of up to 2 x 10^{-3} and noncarcinogenic hazard quotients of up to 0.16 for a future on-unit resident exceed the benchmark levels of 1 x 10^{-6} and 0.1, respectively). Collectively, all of PBRPs RCOCs are hereafter referred to as polycyclic aromatic hydrocarbons (PAHs).

No ecological RCOCs are identified.

Contaminant fate and transport analyses indicate that nine constituents at PBRP present a contaminant migration (leachability) threat to groundwater. These CM RCOCs include antimony, chromium, copper, nickel, zinc, dibenzofuran, tetrachloroethene, trichloroethene, and PCB-1242. These constituents are predicted to exceed MCLs or RBCs within 1,000 years (Table 2).

The assessments conclude that no principal threat source material is present in soil. However, PBRP soil poses risks to human health. Hence, actual or threatened releases of hazardous substances, pollutants or contaminants from PBRP, if not addressed by the selected alternative or another active measure, will present a current or potential threat to public health, welfare, or the environment.

Groundwater

Groundwater has been locally impacted by the pit. RCOCs for groundwater include 1,1-dichloroethene and trichloroethene. Detections are low and sporadic, and there is no defined plume. Only 1,1-dichloroethene and trichloroethene exceed MCLs in groundwater. 1,1-Dichloroethene was detected above its MCL of 7 µg/L in well PRP-6 in one of four sampling events (9.29 µg/L in January 2001) and in well PRP-7 in one of four sampling events (7.13 µg/L in November 1999). Trichloroethene was detected above its MCL of 5 µg/L in well PRP-7 in one of four sampling events (15.9 µg/L in November 1999). Figures 8 and 9 present analytical results for 1,1-dichloroethene and trichloroethene.

The assessments conclude that no principal threat source material is present in groundwater. However, groundwater poses risks to human health. Hence, actual or threatened releases of hazardous substances, pollutants, or contaminants in groundwater, if not addressed by the selected alternative or another active measure, will present a current or potential threat to public health, welfare, or the environment.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

The RFI/RI/BRA (WSRC 2001a) concluded that only the PBRP and groundwater subunits have RCOCs and need remedial action. Remedial action objectives (RAOs) are developed for these subunits. No RCOCs were identified for the ditch, seepline, or Steel Creek; therefore, RAOs are not developed for these subunits.

RAOs are based on the anticipated future land use. Because the anticipated future land use is industrial, the RAOs are specified to protect human and ecological receptors under an industrial scenario.

The RAOs and remedial goals (RGs) for the contaminated soil and debris at PBRP are as follows:

- Protect current workers at PBRP from exposure to benzo(a)pyrene in surface soil at concentrations that exceed 53.3 mg/kg.

- Protect hypothetical future industrial workers at PBRP from exposure to benzo(a)anthracene [2.56 mg/kg], benzo(a)pyrene [0.256 mg/kg], benzo(b)fluoranthene [2.56 mg/kg], benzo(k)fluoranthene [25.6 mg/kg], dibenzo(a,h)anthracene [0.256 mg/kg], and indeno(1,2,3-c,d)pyrene [2.56 mg/kg] in surface and subsurface soils at concentrations that exceed target risk levels (RGs specified in brackets).

The RAOs and RGs for groundwater are as follows:

- Protect hypothetical future industrial workers at PBRP from exposure to 1,1-dichloroethene [7.0 μg/L] and trichloroethene [5.0 μg/L] in groundwater at concentrations that exceed target risk levels (RGs specified in brackets).

- Protect groundwater resources from contaminant migration of antimony [4.588 mg/kg], chromium [35.22 mg/kg], copper [40.8 mg/kg], nickel [11.432 mg/kg], zinc [1,110 mg/kg], dibenzofuran [0.195 mg/kg], tetrachloroethene [0.00338 mg/kg], trichloroethene [0.00153 mg/kg], and PCB-1242 [0.00843 mg/kg] in PBRP soil that would impact the groundwater above MCLs or RBCs (RGs specified in brackets).

In the RFI/RI/BRA, remedial goal options (RGOs) were calculated for each RCOC (Table 4). RGOs are concentration goals for individual chemicals for specific media and land use combinations. They are designed to provide conservative, long-term targets for the selection and analysis of remedial alternatives. Final RGs are selected from the RGOs to be protective of both human health and the environment, as well as to comply with federal and state ARARs. ARARs and to-be-considered (TBC) criteria are identified in Table 5.

Table 4. Remedial Goals

RCOC	Type of RCOC	RGOs			Background Benchmarks			RG
		ARAR RGO	CM RGO	HH RGO	Unit-Specific Maximum	Unit-Specific 2X Average	SRS 95th Percentile	
PBRP Soil (mg/kg)								
Antimony	CM	--	0.259	--	0.374	0.374	4.588	4.588*
Chromium	CM	--	2.80	--	26.80	20.60	35.22	35.22*
Copper	CM	--	40.8	--	7.90	5.56	NA	40.8
Nickel	CM	--	2.05	--	4.80	2.88	11.432	11.432*
Zinc	CM	--	1110	--	6.90	6.32	20.475	1110
Benzo(a)anthracene	$HH_{res,\ ind}$	--	--	2.56	ND	ND	NA	2.56
Benzo(a)pyrene	$HH_{res,\ ind,\ cur}$	--	--	0.256	ND	ND	NA	0.256
Benzo(b)fluoranthene	$HH_{res,\ ind}$	--	--	2.56	ND	ND	NA	2.56
Benzo(k)fluoranthene	$HH_{res,\ ind}$	--	--	25.6	ND	ND	NA	25.6
Chrysene	HH_{res}	--	--	256	ND	ND	NA	256
Dibenzo(a,h)anthracene	$HH_{res,\ ind}$	--	--	0.256	ND	ND	NA	0.256
Dibenzofuran	CM	--	0.195	--	ND	ND	NA	0.195
Fluoranthene	HH_{res}	--	--	2670	ND	ND	NA	2670
Indeno(1,2,3-c,d)pyrene	$HH_{res,\ ind}$	--	--	2.56	ND	ND	NA	2.56
Phenanthrene	HH_{res}	--	--	3270	ND	ND	NA	3270
Pyrene	HH_{res}	--	--	2000	ND	ND	NA	2000
Tetrachloroethene	CM	--	0.00338	--	ND	ND	NA	0.00338
Trichloroethene	CM	--	0.00153	--	ND	ND	NA	0.00153
PCB-1242	CM	--	0.00843	--	ND	ND	NA	0.00843
Groundwater (μg/L)								
1,1-Dichloroethene	ARAR, $HH_{res,\ ind}$	7.0	--	0.477	ND	ND	NA	7.0
Trichloroethene	ARAR, HH_{res}	5.0	--	26.0	ND	ND	NA	5.0

Type of RCOC: ARAR = ARAR RCOC
CM = Contaminant Migration RCOC
$HH_{res,\ ind,\ cur}$ = Human health RCOC for the resident, industrial worker, current worker
"--" = not applicable. This chemical is not an RCOC for this assessment category.
ND = not detected
NA = not available
SRS 95th percentile from USDOE 1996.
HH RGO is based on future industrial worker exposure scenario.
* Risk-based RGO is less than the concentration that would be expected under ambient background conditions. In order to be technically achievable, RG defaults to background.

Table 5. ARARs and TBC Criteria

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Chemical				
40 CFR 141 – MCLs and MCLGs	Relevant and Appropriate	MCLs and MCLGs for groundwater that may be a source of drinking water	MCLs should generally be met for cleanup of groundwater under the CERCLA program	GW1, GW2, PBRP1, PBRP2
SC R.61-58.5 – MCLs and MCLGs	Relevant and Appropriate	MCLs and MCLGs for groundwater that may be a source of drinking water	State regulations implementing MCLs.	GW1, GW2, PBRP1, PBRP2
SC R.61-68 Water Classification	Relevant and Appropriate	States official classified water uses for all surface and groundwater in South Carolina	Mandates meeting MCLs for groundwater.	GW1, GW2, PBRP1, PBRP2
40 CFR 143.3 Secondary Drinking Water Standards	Relevant and Appropriate	Establishes levels for contaminants that affect the aesthetic qualities of drinking water.	Secondary Drinking Water Standards relevant for setting remediation levels.	GW1, GW2, PBRP1, PBRP2
40 CFR 260-268 and SC R.61-79.260-268 Federal and State Hazardous Waste Regulations	Applicable	Defines criteria for determining whether a waste is RCRA hazardous waste and provides treatment, storage and disposal requirements.	Would apply if specific chemicals are found to be present.	PBRP1, PBRP2
SC R.61-62.5 Air Quality Standard	Applicable	Establishes air quality standards for emissions.	Would apply to air emissions of Standard 2 Toxic Air Pollutants and Standard 8 Ambient Air Quality Standards.	PBRP2
SC R.61-107.16 Solid Waste Management: Industrial Solid Waste Landfills	Relevant and Appropriate	Establishes design standards for non-hazardous industrial solid waste landfills.	Would apply if contamination is left in place.	PBRP1, PBRP2
Action				
40 CFR 50.6 National Primary and Secondary Ambient Air Quality Standards	Applicable	The concentration of particulate matter (PM_{10}) in ambient air shall not exceed 50 ug/m^3 (annual arithmetic mean) or 150 ug/m^3 (24-hour average concentration).	Dust suppression will likely be required to minimize dust emissions during construction/remedial action.	PBRP2
SC R.61-62.1 Air Permit Requirements	Applicable	Requires construction and operating permits for sources of air pollution.	If remedial action creates point source of air pollutants, permits may be required.	PBRP2

Table 5. ARARs and TBC Criteria (Continued)

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Action				
SC R.61-62.6 Fugitive Dust	Applicable	Fugitive particulate material shall be controlled.	Construction/remedial action may be required for dust suppression.	PBRP2
SC R.61-9 NPDES Permits	Applicable	Requirements for control of storm water discharges.	Any storm water discharges must meet these standards.	PBRP1, PBRP2
SC R.61-71 Well Construction Standards	Applicable	Prescribes minimum standards for the construction of wells.	Standards for installation and abandonment of wells.	PBRP2, GW2
SC R.72-300 Standards for Stormwater Management and Sediment Reduction	Applicable	Stormwater management and sediment control plan for land disturbances.	Construction/remedial action may require an erosion control plan.	PBRP2

CFR = Code of Federal Regulations
SCR = South Carolina Regulations
MCLG = Maximum Contaminant Level Goal
There are no location-specific ARARs for the PBRP OU.

Human health RGOs were calculated for various land use/receptor scenarios including current and future industrial workers and hypothetical on-unit residents. A range of RGOs is provided, corresponding to target hazard quotients (HQs) of 0.1, 1, and 3 as well as target cancer risks of 1×10^{-6}, 1×10^{-5}, and 1×10^{-4}. In situations where both noncarcinogenic and carcinogenic toxicity values are available, human health RGOs were calculated using both values.

Ecological RGOs were not calculated because no ecological RCOCs were identified.

CM RGOs were calculated for each CM RCOC. The CM RGO is the highest concentration that can be left in soil without posing a leachability threat to groundwater at levels that will exceed MCLs or RBCs (under baseline conditions).

To be protective of both human health and the environment, the RG is selected as the lower of the (1) most restrictive human health RGO for the expected future land use (future industrial), and (2) the CM RGO. If available, additional information such as chemical-specific ARARs and other guidance (e.g., MCLs) may also be considered in selecting RGs.

Because of the generally conservative assumptions used in the RGO calculations, it is possible for a risk-based RGO to be less than what occurs naturally in unimpacted ambient background conditions. This RG would not be technically possible to achieve. To avoid this, the RGs are compared to background benchmarks. Table 4 presents three benchmarks: the maximum result in the unit-specific background soil, the unit-specific 2X average background concentration, and the 95th percentile for unimpacted background soils at SRS (USDOE 1996b).

Comparison of the risk-based RGOs to these background benchmarks indicates that all RGOs except antimony, chromium, and nickel are above background levels and can be attained. The RGs for antimony, chromium, and nickel default to background levels (Table 4).

For groundwater, two RGOs are available: an ARAR RGO (the MCL) and a risk-based human health RGO (calculated using unit-specific exposure assumptions for the future industrial worker). For groundwater, the RG is set to the MCL because MCLs are substantive for environmental protection requirements promulgated under Federal and State law. Table 4 presents the RGs.

IX. DESCRIPTION OF ALTERNATIVES

Throughout the RFI/RI process, USDOE, SCDHEC, and USEPA have evaluated a range of possible response actions for the subunits that require remediation (PBRP and groundwater). The information regarding the development and evaluation of remedial alternatives and their cost estimates is presented in Appendices A and B of the SB/PP (WSRC 2001b).

Two alternatives are identified for PBRP (No Action; and Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls), and two alternatives are identified for groundwater (No Action; and Continued Monitoring and Reporting).

The alternatives are briefly summarized in the following paragraphs.

PBRP

<u>PBRP1: No Action.</u>

Total Present Worth Cost: $32,000

Construction Time to Complete: 0 years

No Action would consist of no remedial activities at PBRP. Institutional controls would not be implemented. The No Action alternative is required by the National Oil and Hazardous Substances Contingency Plan (NCP) to serve as a baseline for comparison with other remedial alternatives. The No Action alternative would not be protective of human health. The key ARARs for this alternative are federal (40 CFR 141) and state

(SC R.61-58.5) regulations implementing MCLs; this alternative would not comply with these ARARs because leaching may impact groundwater above MCLs. There would be no reduction of risk, and potential exposure pathways would remain. A review of the remedial action would be conducted every five years to determine whether the remedy is meeting RAOs. If this alternative were selected, the expected outcome would be that soil contamination would remain at the surface above industrial risk-based standards and continued leaching may impact groundwater above MCLs/RBCs. PBRP would not be available for industrial or residential land use.

For consistency in the comparative analysis, the cost includes the cost for the five-year review of the remedial action, which is also presented with the groundwater subunit alternative cost. However, this cost is an OU-wide cost that is not duplicated for each subunit (PBRP and groundwater).

PBRP2: Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls.

Total Present Worth Cost: $526,000

Construction Time to Complete: approximately 1 year

Under this alternative, an engineered cover (e.g., native soil cover with a hydraulic conductivity of approximately 10^{-5} cm/sec) would be emplaced over the pit to reduce infiltration and associated leaching. The cover would also provide a barrier between human receptors and the buried human health RCOCs.

Contaminant fate and transport calculations indicate that an engineered cover would provide sufficient infiltration control to prevent inorganics and PCBs from leaching to groundwater above MCLs/RBCs within 1,000 years. As long as biodegradation and volatilization are occurring, they, along with the cover's infiltration reduction, would also prevent VOCs and SVOCs from migrating to groundwater above MCLs/RBCs. There is evidence of biodegradation at the unit because sampling during the RFI/RI confirmed the presence of organic biodegradation products at the unit. Volatilization of organics to the atmosphere (via soil gas) is occurring through natural processes under current baseline conditions. However, if a low permeability cover were to be placed, volatilization would be reduced by the cover. A soil vapor extraction system such as BaroBalls™ would need to be constructed to offset reduced volatilization due to the low permeability cover. The BaroBalls™ system is a simple valve that opens and closes based on differences between atmospheric and soil-gas pressures, allowing gas to flow from a well to the atmosphere. The BaroBalls™ system increases the effectiveness of barometric pumping by preventing the inflow of air into a venting well when atmospheric pressure reverses, a condition that can reduce contaminant removal by diluting and dispersing the pollutant. The key ARARs for this alternative are federal (40 CFR 141) and state (SC R.61-58.5) regulations implementing MCLs; this alternative would comply with these ARARs because the cover would mitigate leaching to groundwater above MCLs.

Institutional controls would be implemented. Institutional controls would consist of site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit). Institutional controls will maintain the integrity of the engineered cover, which in turn will maintain the effectiveness of the cover to mitigate leaching. A review of the remedial action would be conducted every five years to determine whether the remedy is meeting RAOs. The time to the start of construction would be approximately 1 year after the ROD is approved; the time until protection is achieved would be approximately 1-2 years. If this alternative were selected, the expected outcome would be that the cover system would provide a barrier between human receptors and the buried human health RCOCs, and groundwater would not exceed MCLs/RBCs. PBRP would be available for industrial land use with land use restrictions.

For consistency in the comparative analysis, total costs include the cost for the five-year review of the remedial action ($32,000), which is also presented with the groundwater subunit costs. However, this cost is an OU-wide cost that is not duplicated for each subunit (PBRP and groundwater).

Groundwater

GW1: No Action.

Total Present Worth Cost: $32,000

Construction Time to Complete: 0 years

No Action would consist of no remedial activities to groundwater. The No Action alternative is required by the NCP to serve as a baseline for comparison with other remedial alternatives. The No Action alternative would not be protective of human health. The key ARARs for this alternative are federal (40 CFR 141) and state (SC R.61-58.5) regulations implementing MCLs; this alternative would not comply with these ARARs because detections of contaminants above MCLs would be left unmonitored. There would be no reduction of risk, and potential exposure pathways would remain. A review of the remedial action would be conducted every five years, as needed, to determine whether the remedy is meeting RAOs. The time to construction would be 0 months; the time until protection is achieved is not applicable because RAOs are not met. If this alternative were selected, the expected outcome would be that groundwater concentrations will drop below MCLs and a groundwater plume above MCLs will not develop. Upon attenuation of groundwater contamination to levels below MCLs, groundwater would be available for unrestricted use.

For consistency in the comparative analysis, this cost includes the cost for the five-year review of the remedial action, which is also presented with the PBRP subunit alternative costs. However, this cost is an OU-wide cost that is not duplicated for each subunit (PBRP and groundwater).

GW2: Continued Monitoring and Reporting.

Total Present Worth Cost: $71,000

Construction Time to Complete: 0 months

1,1-Dichloroethene and trichloroethene have been detected sporadically above MCLs in the groundwater and it is anticipated that groundwater concentrations will decrease with time through natural processes. This alternative relies on natural processes to attenuate contaminants. Natural processes may reduce contaminant mass (through destructive processes such as biodegradation and chemical transformations), reduce contaminant concentrations (through simple dilution or dispersion), or bind contaminants to soil particles so the contamination does not spread or migrate very far (absorption). Under this alternative, groundwater would be monitored to verify that concentrations of 1,1-dichloroethene and trichloroethene continue to decline and that a discernable plume above MCLs does not develop. This would be achieved by continued quarterly monitoring of selected wells (PRP-5, PRP-6, and PRP-7). If four quarters of no MCL exceedances are observed, sampling would be reduced to semi-annual sampling. Reporting would be annually. Sampling would continue until there are no MCL exceedances in the downgradient wells (PRP-6 and PRP-7) for a period of three consecutive years (six semi-annual sampling events). Institutional controls would be implemented as long as groundwater concentrations exceed MCLs. The key ARARs for this alternative are federal (40 CFR 141) and state (SC R.61-58.5) regulations implementing MCLs. GW2 should eventually comply with ARARs; monitoring would evaluate RCOC concentrations for compliance with 40 CFR 141 and SC R.61-58.5. The time to the start of construction would be 0 months after the ROD is approved; the time until protection is not known with certainty, but, based on past trends, it may be approximately 5 years. If this alternative were selected, the expected outcome would be that groundwater concentrations would drop below MCLs, and a groundwater plume above MCLs would not develop. Use of groundwater would be controlled until concentrations attenuate to levels below MCLs. Upon attenuation of groundwater contamination to levels below MCLs, groundwater would be available for unrestricted use.

For consistency in the comparative analysis, the total costs include the cost for the five-year review of the remedial action ($32,000), which is also presented with the PBRP subunit alternative costs. However, this cost is an OU-wide cost that is not duplicated for each subunit (PBRP and groundwater).

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

Description of the Nine Evaluation Criteria

Each of the remedial alternatives is evaluated against the nine criteria established by the NCP, 40 CFR 300. The criteria are derived from the statutory requirements of CERCLA Section 121. The criteria provide the basis for evaluating the alternatives and selecting a remedy. The nine criteria are:

Threshold criteria:

1. Overall protection of human health and the environment
2. Compliance with ARARs

Balancing criteria:

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost

Modifying criteria:

8. State acceptance
9. Community acceptance

Tables 6 and 7 present a summary of this evaluation. The results of the evaluations are briefly summarized below. Industrial land use is assumed as the future land use when stating that a remedy is protective and when evaluating remedial alternatives against the nine criteria.

PBRP

Overall Protection of Human Health and the Environment: Alternative PBRP2 would be protective because human health RCOCs would be covered to prevent exposure; infiltration and leaching of CM RCOCs would be reduced enough to prevent groundwater from being impacted above MCLs/RBCs in the future; and the cover over the contaminated soils would mitigate erosion and redistribution of pit soils. Alternative PBRP1 is not protective because human health RCOCs (PAHs) would remain at the unit in surface and subsurface soils and would pose an unacceptable risk to current workers, future industrial workers, and hypothetical residents. Also, CM RCOCs would remain at the unit under current conditions and would pose a leachability threat to groundwater. Further, erosion of pit soils could spread contamination.

Compliance with ARARs: Alternative PBRP2 would comply with ARARs (Table 5). Alternative PBRP2 would comply with 40 CFR 141 and SC R.61-58.5 by preventing leaching of contaminants to the groundwater in excess of MCLs. Alternative PBRP1 would not comply with these regulations because leaching of contaminants to the groundwater would not be prevented.

Long-term Effectiveness and Permanence: PBRP2 offers greater long-term effectiveness compared to PBRP1. Whereas the residual risk associated with PBRP1 would be the same as current conditions, the residual risk associated with PBRP2 would be less than the target risk range. The risk from RCOCs would be mitigated by isolation of contaminated soils under the cover, and the leachability risk would be mitigated by infiltration control. An assessment of permanence for PBRP1 is not applicable because RAOs are not met, and there are no remedy components. PBRP2 is permanent as long as the cover system is maintained. If the cover system were not maintained and the cover were to erode, the remedy would gradually become less effective.

Table 6. Comparative Analysis of Alternatives – PBRP

EVALUATION CRITERIA	Alternative PBRP1 No Action	Alternative PBRP2 Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls
Overall Protection of Human Health and the Environment		
Human Health	Not Protective. Human health RCOCs remaining at unit would pose an unacceptable risk to current workers, future industrial workers, and hypothetical future residents.	Protective. The cover system would provide a barrier between human receptors and the buried human health RCOCs. Institutional controls would protect against unrestricted land use (e.g., unauthorized excavation).
Environment	Not Protective. CM RCOCs remaining at unit would pose an unacceptable leachability risk to groundwater. Future leaching could impact groundwater above MCLs/RBCs. Also, erosion of pit soils could spread contamination.	Protective. The cover system would reduce infiltration and associated leaching of CM RCOCs. Although a cover can trap VOCs in the soil, BaroBalls™ would allow the VOCs to be released to the atmosphere instead of migrating downward to groundwater. Covering the contaminated soils and site maintenance would mitigate threat of redistribution of pit soils by erosion.
Compliance with ARARs		
Chemical-Specific	Does not comply with SDWA because leaching may impact groundwater above MCLs.	Complies. There are no constituents above standards (lead, PCBs, etc). PBRP2 would prevent leaching to groundwater above SDWA MCLs.
Location-Specific	None.	None.
Action-Specific	None.	Complies with all ARARs if standard construction practices are followed during remediation.
Long-Term Effectiveness and Permanence		
Magnitude of Residual Risks	High. PAHs would pose an unacceptable risk to current workers, future industrial workers, and future residents. Also, metals, SVOCs, VOCs, and PCBs are predicted to leach to groundwater at concentrations above MCLs/RBCs.	Low. The cover would isolate PAHs from exposure. The cover would reduce leaching of metals, SVOCs, and PCBs. The cover would allow more time for biodegradation to occur. BaroBalls™ would allow VOCs to be released to the atmosphere instead of migrating to groundwater. Collectively, these mechanisms of PBRP2 would prevent exceedances of MCLs/RBCs in groundwater. Institutional controls would prevent unauthorized land use.
Permanence	Not Applicable. Does not meet RAOs, and there are no remedy components.	Permanent as long as the cover is maintained. VOCs would be permanently removed from the unit. Land use controls are generally considered permanent, but there is some uncertainty with the ability to maintain them in the very long-term (>100 years).

Table 6. Comparative Analysis of Alternatives – PBRP (Continued)

EVALUATION CRITERIA	Alternative PBRP1 No Action	Alternative PBRP2 Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls
Reduction in Toxicity, Mobility, or Volume Through Treatment		
Degree of Expected Reduction in Toxicity	None.	High. Toxicity reduced through isolation of contaminants. Toxicity of the cover material would be ambient background levels.
Degree of Expected Reduction in Mobility	None.	High. Mobility reduced through infiltration control and removal of VOCs.
Degree of Expected Reduction in Volume	None.	None.
Short-Term Effectiveness		
Risk to Workers	None. No onsite activity.	Negligible risk associated with heavy equipment use.
Risk to Community	None. No onsite activity.	No exposure concerns; unit is located several miles from the nearest SRS boundary. Negligible increase in off-SRS vehicular traffic.
Time until Protection is Achieved	Protection not achieved.	12 months after ROD is approved (time required to design and construct cover system).
Implementability		
Availability of Materials, Equipment, Contractors	No materials, equipment, or contractors required.	Construction materials and equipment are standard. Qualified contractors are available.
Administrative Feasibility/ Regulatory Requirements	None.	Some engineering work will be needed to design the cover system, but this does not pose an administrative constraint to implementation.
Technical Feasibility	Implementable. There are no remedy components to implement.	Implementable. The techniques used for capping and installation of BaroBalls™ are well understood.
Monitoring Considerations	None.	The cover system will require periodic monitoring and repair/refurbishment.
Cost		
Total Present Worth Cost	Five-Year Review Requirement: $32,000	Engineered Cover System: $308,000 BaroBalls™: $72,000 Institutional Controls: $114,000 Five-Year Review Requirement: $32,000

Table 7. Comparative Analysis of Alternatives – Groundwater

EVALUATION CRITERIA	**GW1** **No Action**	**GW2** **Continued Monitoring and Reporting**
Overall Protection of Human Health and the Environment		
Human Health	Not Protective. Groundwater contamination above MCLs would be left unmonitored.	Protective. Monitoring would track the groundwater quality.
Environment	Not Protective. It would be unknown if the groundwater contamination attenuated.	Protective. Monitoring would track the groundwater quality.
Compliance with ARARs		
Chemical-Specific	Does not comply with SDWA.	GW2 should eventually comply with ARARs; monitoring would evaluate RCOC concentrations for compliance with 40 CFR 141 and SC R.61-58.5.
Location-Specific	None.	None.
Action-Specific	None.	Complies if standard practices are followed.
Long-Term Effectiveness and Permanence		
Magnitude of Residual Risks	Moderate. Although concentrations are low, there would be some uncertainty with the magnitude of residual risk if monitoring was not performed.	Low. Monitoring would confirm that residual risks remain low.
Permanence	Not Applicable. Does not meet RAOs.	Permanent in that once RGs are met, the concentrations are expected to remain below MCLs.
Reduction in Toxicity, Mobility, or Volume Through Treatment		
Degree of Expected Reduction in Toxicity	High. Toxicity would decrease with time through natural processes, including biodegradation.	High. Toxicity would decrease with time through natural processes, including biodegradation.
Degree of Expected Reduction in Mobility	None.	None.
Degree of Expected Reduction in Volume	High. The volume of groundwater contaminated above standards is expected to decrease to zero.	High. The volume of groundwater contaminated above standards is expected to decrease to zero.

Table 7. Comparative Analysis of Alternatives – Groundwater (Continued)

EVALUATION CRITERIA	GW1 No Action	GW2 Continued Monitoring and Reporting
Short-Term Effectiveness		
Risk to Workers	None. No onsite activity.	Negligible. Negligible exposure risk during sampling managed through standard health and safety procedures.
Risk to Community	None. No onsite activity.	None. No exposure concerns; unit is located several miles from the nearest SRS boundary.
Time until Protection is Achieved	It would be unknown when protection is actually achieved.	Based on past trends, may be approximately 5 years. Monitoring would establish when protection is actually achieved.
Implementability		
Availability of Materials, Equipment, Contractors	No materials, equipment, or contractors required.	Materials and equipment are standard. Qualified contractors for monitoring and reporting are available.
Administrative Feasibility/ Regulatory Requirements	None.	None.
Technical Feasibility	Implementable. There are no remedy components to implement.	Implementable. The techniques for monitoring and reporting are well understood.
Monitoring Considerations	None.	Monitoring will be required until concentrations are consistently below standards.
Cost		
Total Present Worth Cost	Five-Year Review Requirement: $32,000*	Monitoring and Reporting: $39,000 Five-Year Review Requirement: $32,000*

*For consistency in the comparative analysis, the cost for the Five-Year Review of the remedial action (CERCLA requirement) is also shown with the costs for the PBRP source unit. However, this cost is an OU-wide cost that is not duplicated for each subunit.

Reduction of Toxicity, Mobility, or Volume Through Treatment: Neither alternative offers reduction in toxicity, mobility, or volume *through treatment.* However, PBRP2 reduces toxicity in surface and subsurface soils through isolation under the cover and reduces mobility in the vadose zone through containment. Also, removal of VOCs to the atmosphere reduces the mobility of VOCs to groundwater.

Short-term Effectiveness: PBRP2 offers greater short-term effectiveness compared to PBRP1 because PBRP2 is the only alternative that achieves protection. PBRP1 does not achieve RAOs and is therefore not effective. PBRP2 presents negligible risks to remedial workers or to the community. Release of VOCs through the BaroBalls™ to the atmosphere presents negligible risk to workers or the community because the concentrations are low and will be readily dispersed to concentrations below detection limits. Once in the atmosphere, VOCs are rapidly broken down into harmless components by natural processes.

Implementability: Both alternatives are implementable. PBRP1 does not involve any action; therefore, it is readily implementable. PBRP2 would require some engineering design for the cover system and periodic repairs, but there are no implementability restrictions.

Cost: PBRP1 is less expensive than PBRP2.

State Acceptance: Approval of the ROD by SCDHEC and USEPA constitutes acceptance of the selected alternative.

Community Acceptance: The SB/PP provided for community involvement through a document review process and a public comment period. Public input is documented in the Responsiveness Summary section of this ROD (Appendix A).

Groundwater

Overall Protection of Human Health and the Environment: Alternative GW2 is protective because monitoring would track the attenuation of contaminants and would identify a plume in the unlikely event that a discernable plume develops. Alternative GW1 is not protective because groundwater contamination above MCLs would be left unmonitored.

Compliance with ARARs: GW2 should eventually comply with ARARs; monitoring would evaluate RCOC concentrations for compliance with 40 CFR 141 and SC R.61-58.5. GW1 would not comply with the Safe Drinking Water Act because groundwater contamination above MCLs would be left unmonitored.

Long-term Effectiveness and Permanence: GW2 offers greater long-term effectiveness because monitoring will reduce uncertainty with the magnitude of residual risks. An assessment of permanence for GW1 is not applicable because it would be uncertain if protection is achieved and there are no remedy components. GW2 is permanent in that once RGs are met, the concentrations are expected to remain below MCLs; an increase in concentrations above MCLs is not anticipated.

Reduction of Toxicity, Mobility, or Volume Through Treatment: Neither alternative offers reduction in toxicity, mobility, or volume *through treatment*. However, reduction is expected as a result of natural processes, including biodegradation.

Short-term Effectiveness: GW2 offers greater short-term effectiveness compared to GW1. Although GW2 presents some minor exposure risks to remedial workers, this is offset by the fact that the time until GW1 achieves protection is unknown. Therefore, the short-term effectiveness of GW1 is unknown. Risks to remedial workers performing GW2 (groundwater sample crews) can be managed using standard health and safety measures. There are no exposure concerns for the community.

Implementability: Both alternatives are implementable. GW1 does not involve any action; therefore, it is readily implementable. GW2 is also readily implementable, as monitoring uses standard equipment and techniques.

Cost: GW1 is less expensive than GW2.

State Acceptance: Approval of the ROD by SCDHEC and USEPA constitutes acceptance of the selected alternative.

Community Acceptance: The SB/PP provided for community involvement through a document review process and a public comment period. Public input is documented in the Responsiveness Summary section of this ROD (Appendix A).

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

Based upon the characterization data and risk assessments in the RFI/RI/BRA (WSRC 2001a), the RAOs, and the evaluation of alternatives, the selected remedy for PBRP is Alternative PBRP2 (Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls) and the selected remedy for groundwater is Alternative GW2 (Continued Monitoring and Reporting). Figure 11 is a schematic illustration of the selected remedy.

This remedy was selected because it provides overall protectiveness of human health and the environment, and it complies with ARARs. The other alternatives considered fail to meet the threshold criteria of overall protectiveness of human health and the environment and compliance with ARARs.

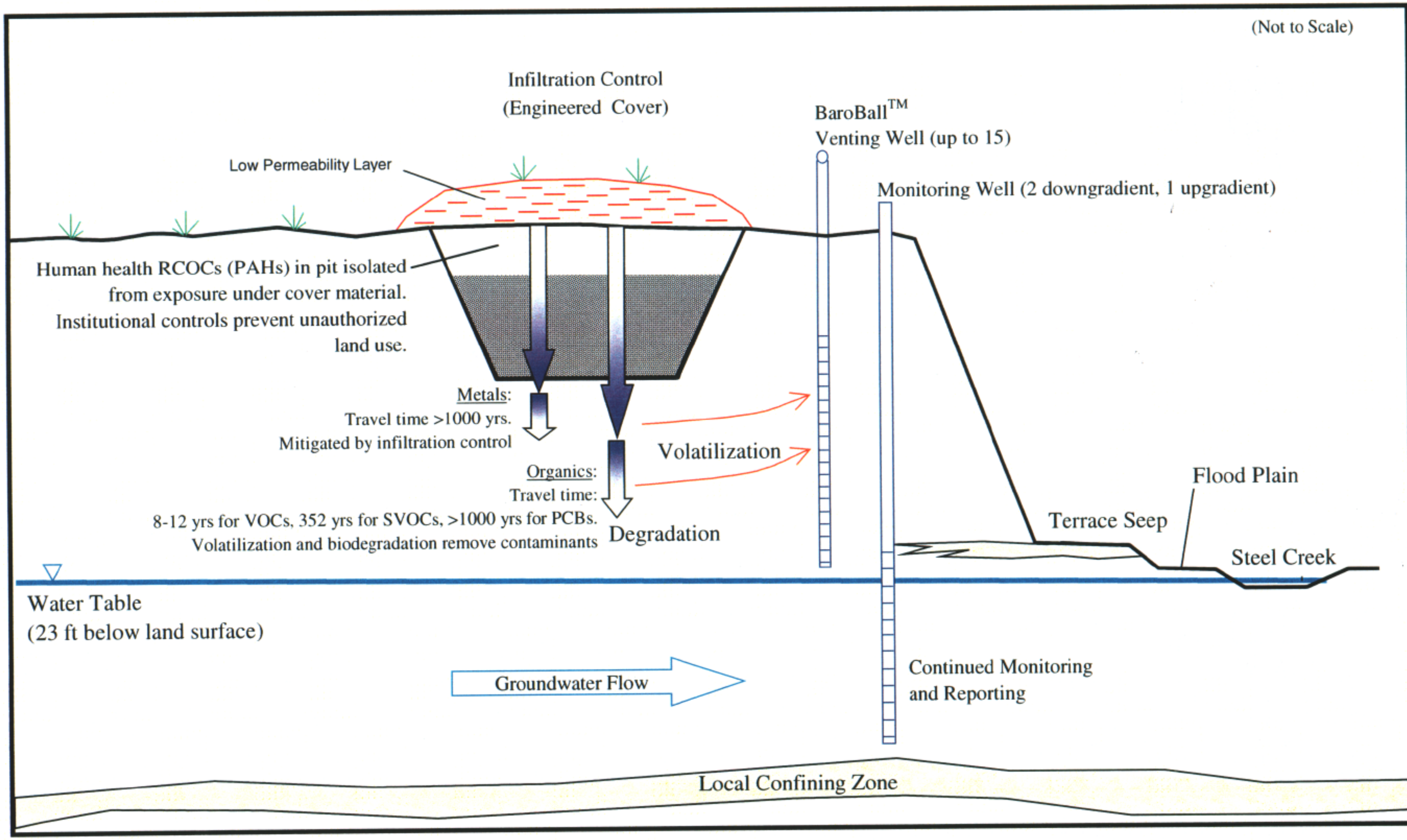


Figure 11. Schematic Illustration of the Selected Remedy

The selected remedy will meet the RAOs for contaminated soil and debris at PBRP as follows:

- *Protect current workers at PBRP from exposure to benzo(a)pyrene in surface soil at concentrations that exceed 53.3 mg/kg:* The cover will provide a barrier between current workers and the buried human health RCOCs; institutional controls will prevent unauthorized intrusive activities.

- *Protect hypothetical future industrial workers at PBRP from exposure to benzo(a)anthracene [2.56 mg/kg], benzo(a)pyrene [0.256 mg/kg], benzo(b)fluoranthene [2.56 mg/kg], benzo(k)fluoranthene [25.6 mg/kg], dibenzo(a,h)anthracene [0.256 mg/kg], and indeno(1,2,3-c,d)pyrene [2.56 mg/kg] in surface and subsurface soils at concentrations that exceed target risk levels (RGs specified in brackets):* The cover will provide a barrier between future industrial workers and the buried human health RCOCs; institutional controls will prevent unauthorized intrusive activities.

The selected remedy will meet the RAOs for groundwater as follows:

- *Protect hypothetical future industrial workers at PBRP from exposure to 1,1-dichloroethene [7.0 µg/L] and trichloroethene [5.0 µg/L] in groundwater at concentrations that exceed target risk levels (RGs specified in brackets):* Institutional controls will prevent unauthorized groundwater usage.

- *Protect groundwater resources from contaminant migration of antimony [4.588 mg/kg], chromium [35.22 mg/kg], copper [40.8 mg/kg], nickel [11.432 mg/kg], zinc [1,110 mg/kg], dibenzofuran [0.195 mg/kg], tetrachloroethene [0.00338 mg/kg], trichloroethene [0.00153 mg/kg], and PCB-1242 [0.00843 mg/kg] in PBRP soil that would impact the groundwater above MCLs or RBCs (RGs specified in brackets):* The cover would reduce leaching of metals, SVOCs, and

PCBs. The cover would allow more time for biodegradation to occur. BaroBalls^{TM} would allow VOCs to be released to the atmosphere instead of migrating to groundwater. Collectively, these mechanisms of PBRP2 would prevent exceedances of MCLs/RBCs in groundwater.

An engineered cover system (e.g., native soil cover with a hydraulic conductivity of approximately 10^{-5} cm/sec) will be emplaced over the pit to reduce infiltration and associated leaching. The cover will also provide a barrier between human receptors and the buried human health RCOCs. Contaminant fate and transport calculations indicate that an engineered cover would provide sufficient infiltration control to prevent inorganics and PCBs from leaching to groundwater above MCLs/RBCs within 1,000 years. As long as biodegradation and volatilization are occurring, it would also prevent VOCs and SVOCs from migrating to groundwater above MCLs/RBCs. There is evidence for biodegradation at the unit because sampling during the RFI/RI confirmed the presence of organic biodegradation products at the unit. Volatilization of organics to the atmosphere (via soil gas) is occurring through natural processes under current baseline conditions. However, when the low permeability cover is placed, volatilization will be reduced by the cover. A passive soil vapor extraction system (i.e., BaroBalls^{TM}) will be constructed in order to offset reduced volatilization due to the low permeability cover.

Site maintenance will consist of repair of erosion damage, maintenance of drainage features, and maintenance of the soil cover integrity to maintain the effectiveness of the cover at mitigating infiltration and leaching. Site maintenance will also include maintenance of signs around the unit.

The groundwater will be monitored to verify that concentrations of 1,1-dichloroethene and trichloroethene continue to decline and that a discernable plume above MCLs does not develop. This will be achieved by continued quarterly monitoring of selected wells (PRP-5, PRP-6, and PRP-7). If four quarters of no MCL exceedances are observed, sampling will be reduced to semi-annual sampling. Reporting will be annually. Sampling will continue until there are no MCL exceedances in the downgradient wells (PRP-6 and PRP-7) for a period of three consecutive years (six semi-annual sampling events). Institutional controls will be implemented as long as groundwater concentrations exceed MCLs.

Per the USEPA – Region IV Land Use Controls (LUCs) Policy, a LUC Assurance Plan (LUCAP) for SRS has been developed and approved by the regulators (WSRC 1999). In addition, a LUC Implementation Plan (LUCIP) for the PBRP OU will be developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the land use control elements of the OU selected alternative to ensure that the remedy remains protective of human health and the environment. The institutional controls will be implemented by (1) providing access controls for on-site workers via the Site Use Program, Site Clearance Program, work control, worker training, worker briefing of health and safety requirements, and identification signs posted at the waste unit access points, (2) notifying the USEPA and SCDHEC in advance of any changes in use or disturbance of waste, and (3) providing access controls against trespassers via the 1992 RCRA Part B Permit Renewal Application 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. Signs will be posted around the facility with a legend warning of the hazard. They will be posted at each entrance to the restricted portion of the unit and at other appropriate locations in sufficient numbers to be seen from any approach.

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 in accordance with the LUCAP disclosing former waste management and disposal activities as well as remedial actions taken on the OU. The contract for sale and the deed will contain the notification required by

CERCLA Section 120(h). The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination remains at the OU.

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 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 leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As negotiated with USEPA, and in accordance with USEPA Region IV policy (Johnston 1998), SRS has developed a LUCAP (WSRC 1999) to ensure that land use restrictions are maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide detail and specific measures required for the land use controls selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the land use control selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP), as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The

LUCIP will remain in effect until modified as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

A review of the remedial action will be conducted every five years to determine whether the remedy is meeting RAOs.

The remedy may change as a result of the remedial design or construction processes. Changes to the remedy described in the ROD will be documented in the Administrative Record File utilizing a memo, an Explanation of Significant Difference (ESD), or a ROD Amendment.

Cost Estimate for the Selected Remedy

The present worth costs for this remedy are as follows:

Capital Cost: $377,000

Operations and Maintenance (O&M) Cost: $188,000

Total Present Worth Cost: $565,000

These costs include the cost of placing an engineered cover ($308,000), installation of BaroBalls™ ($72,000), groundwater monitoring ($39,000), implementation of institutional controls ($114,000), and the five-year review of the remedial action ($32,000). Because the waste unit is owned by USDOE, the source of the cleanup monies will be USDOE.

Present worth costs for each alternative were generated using a 7% discount rate and a 30-year time period. For five-year reviews of the remedial action and institutional controls, the 30-year time period was used for cost estimating purposes, however, there is no time limit on the five-year review of the remedial action or institutional controls. For more details on cost estimates, refer to Tables 8 through 12.

Table 8. Cost Estimate for Five-Year Reviews of the Remedial Action (CERCLA Requirement)

DESCRIPTION		QUANTITY	UNITS	UNIT COST	TOTAL COST
Direct Capital Costs					$0
Total Direct Capital Costs					$0
Indirect Capital Costs					
Engineering and design					$0
Project/construction management					$0
Health and safety					$0
Overhead & markups					$0
Contingency					$0
Total Indirect Capital Costs					$0
TOTAL CAPITAL COSTS					$0
O&M Costs					
Remedial Action Reviews (every five years for 30 years)		6	ea	$15,000	
Discount Rate (i)	0.07				
O&M Present Worth					$32,367
TOTAL O&M COSTS					$32,367
TOTAL PRESENT WORTH COST					$32,367

O&M Present Worth = Sum $[1/(1+i)^{n_a}]$ x periodic cost] where n_a are the years at which the periodic cost is incurred (5, 10, 15, 20, 25, & 30 yrs)

Table 9. Cost Estimate for Institutional Controls

DESCRIPTION		QUANTITY	UNITS	UNIT COST	TOTAL COST
Direct Capital Costs					
Miscellaneous Control Items					
Documentation		1	ea	$10,000	$10,000
Final Survey		1	ea	$25,000	$25,000
Access Restrictions					
Furnish and Install Signs		15	ea	$90	$1,350
Site Controls					
Site Controls		1	ea	$5,000	$5,000
Total Direct Capital Costs					$41,350
Indirect Capital Costs					
Engineering and design					$0
Project/construction management (25% of total direct capital cost)					$10,338
Health and safety					$0
Overhead & markups (30% of total direct capital cost)					$12,405
Contingency (15% of total direct capital cost)					$6,203
Total Indirect Capital Costs					$28,945
TOTAL CAPITAL COSTS					$70,295
O&M Costs					
Inspection		1	/yr	$1,000	$1,000
Maintain Signs		1	ls/yr	$500	$500
Mowing		2	/yr	$250	$500
Repairs (erosion control, reseeding, etc.)		1	ac/yr	$1,500	$1,500
Subtotal Annual O&M Costs					$3,500
Discount Rate (i)	0.07				
Number of Years (n)	30				
Present Worth Factor = {[(1+i)^n]-1} / {i[(1+i)^n]}	12.409				
O&M Present Worth (Annual O&M x PWF)					$43,432
TOTAL O&M COSTS					$43,432
TOTAL PRESENT WORTH COST					$113,727

Table 10. Cost Estimate for Engineered Cover

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL COST
Direct Capital Costs				
Construction of Soil Cover				
Mobilization/Demobilization	1	ls	$8,000	$8,000
Site Preparation (tree/brush removal)	34,800	sq. ft	$0.12	$4,176
Clay Layer (borrow and delivery)	3,000	cu. yd	$8.00	$24,000
Topsoil (purchase and delivery) (1.5 over extra AOC)	1,600	cu. yd	$10.00	$16,000
Cap Construction	34,800	sq. ft	$1.50	$52,200
Vegetation (seeding)	34,800	sq. ft	$0.10	$3,480
Total Direct Capital Costs				$107,856
Indirect Capital Costs				
Engineering and design (55% of total direct capital cost)				$59,321
Project/construction management (20% of total direct capital cost)				$21,571
Health and safety (10% of total direct capital cost)				$10,786
Overhead & markups (30% of total direct capital cost)				$32,357
Contingency (20% of total direct capital cost)				$21,571
Total Indirect Capital Costs				$145,606
TOTAL CAPITAL COSTS				$253,462
O&M Costs				
Soil Cover repairs (10% of initial cost every 5 yrs for 30 yrs)	6	ea	$25,346	
Discount Rate (i) 0.07				
O&M Present Worth				$54,692
TOTAL O&M COSTS				$54,692
TOTAL PRESENT WORTH COST				$308,154

O&M Present Worth = Sum [1/(1+i)^n_a] x periodic cost] where n_a are the years at which the periodic cost is incurred (5, 10, 15, 20, 25, & 30 yrs)

Table 11. Cost Estimate for Wells and BaroBalls™

DESCRIPTION		QUANTITY	UNITS	UNIT COST	TOTAL COST
Direct Capital Costs					
Installation of wells and BaroBalls™		9	ea	$2,500	$22,500
Total Direct Capital Costs					$22,500
Indirect Capital Costs					
Engineering and design (55% of total direct capital cost)					$12,375
Project/construction management (20% of total direct capital cost)					$4,500
Health and safety (10% of total direct capital cost)					$2,250
Overhead & markups (30% of total direct capital cost)					$6,750
Contingency (20% of total direct capital cost)					$4,500
Total Indirect Capital Costs					$30,375
TOTAL CAPITAL COSTS					$52,875
O&M Costs					
Maintenance and repair		1	/yr	$1,000	$1,000
Monitoring		18	/yr	$200	$3,600
Subtotal O&M Costs					$4,600
Discount Rate (i)	0.07				
Number of Years (n)	5				
Present Worth Factor = {[(1+i)^n]-1} / {i[(1+i)^n]}	4.100				
O&M Present Worth (Annual O&M x PWF)					$18,861
TOTAL O&M COSTS					$18,861
TOTAL PRESENT WORTH COST					$71,736

Table 12. Cost Estimate for Groundwater Monitoring and Reporting

DESCRIPTION		QUANTITY	UNITS	UNIT COST	TOTAL COST
Direct Capital Costs					
Installation of wells		0	ea	$0	$0
Total Direct Capital Costs					$0
Indirect Capital Costs					
Engineering and design					$0
Project/construction management					$0
Health and safety					$0
Overhead & markups					$0
Contingency					$0
Total Indirect Capital Costs					$0
TOTAL CAPITAL COSTS					$0
O&M Costs					
Sampling (3 wells)		6	/yr	$550	$3,300
Analysis		6	/yr	$700	$4,200
Reporting		1	/yr	$2,000	$2,000
Subtotal O&M Costs					$9,500
Discount Rate (i)	0.07				
Number of Years (n)	5				
Present Worth Factor = {[(1+i)^n]-1} / {i[(1+i)^n]}	4.100				
O&M Present Worth (Annual O&M x PWF)					$38,952
TOTAL O&M COSTS					$38,952
TOTAL PRESENT WORTH COST					$38,952

Estimated Outcomes of Selected Remedy

The expected condition after the selected alternative for PBRP soil is implemented is that the cover will provide a barrier between human receptors and the buried human health RCOCs, and groundwater will not exceed MCLs/RBCs. The cover will reduce leaching of metals, SVOCs, and PCBs, and will allow more time for biodegradation to occur. BaroBalls™ will allow VOCs to be released to the atmosphere instead of migrating to groundwater. Collectively, these mechanisms will prevent exceedances of MCLs/RBCs in groundwater. The time to achieve RGs is approximately 1 year. Upon achieving remediation goals, PBRP will be available for industrial land use with land use restrictions.

The expected condition after the selected alternative for PBRP groundwater is implemented is that a discernable groundwater plume above MCLs will not develop and groundwater concentrations will drop below MCLs. Upon attenuation of groundwater contamination to levels below MCLs, groundwater will be available for unrestricted use.

The engineered cover is considered a reasonable remedy to mitigate all PBRP risks; however, there are always uncertainties. The primary uncertainty with the selected remedy for PBRP is whether the cover system will provide sufficient infiltration control to prevent CM RCOCs from leaching to groundwater above MCLs/RBCs. This uncertainty is managed by the selected remedy for groundwater, which includes groundwater monitoring. As depicted on Figures 8 and 9, there is no history of a discernable plume. MCL exceedances have been sporadic and limited to PRP-6 and PRP-7 only. In fact, 1,1-dichloroethene was detected above its MCL of 7 μg/L in well PRP-6 in only one of four sampling events (9.29 μg/L in January 2001) and in well PRP-7 also in only one of four sampling events (7.13 μg/L in November 1999). Trichloroethene was detected above its MCL of 5 μg/L in well PRP-7 also in only one of four sampling events (15.9 μg/L in November 1999). The condition that will trigger USDOE, USEPA, and SCDHEC to convene to evaluate options shall be the development of a consistent and discernable plume. The selected remedy may be changed if the RGs are not being met.

Waste Management

Waste generated during remediation will likely be limited to well-cutting materials, decontamination fluids, development water, purge water, and cleared local vegetation. These wastes should be non-toxic and non-hazardous in nature. Wastes generated will be managed and dispositioned in accordance with an SRS Environmental Restoration Division Waste Management Plan. Included therein will be a reference to the approved Investigation-Derived Waste (IDW) Management Plan (WSRC 1994) for well drill cuttings, decontamination fluids, development water, and purge water.

Contamination in the PBRP area is limited to the soil and groundwater. Based upon process history and soil sampling results, the vegetation is not considered contaminated; therefore, the trees and brush are not considered to be waste material. However, material below grade (i.e., soil, roots) will remain on unit. Merchantable trees will be harvested and sold. All other trees will be removed from the OU and dispositioned off unit. Secondary waste will be managed consistent with Table 13.

The approach used to apply a clean cover will be to work (with machinery, etc) from clean areas toward contaminated areas, thus avoiding contact with the contaminated soils. Wheels, tracks, blades, etc., will always be in contact with clean soil. If a vehicle should come in contact with contaminated soil, it will be decontaminated by brushing until clean. The soil moved during equipment decontamination will be returned to the area of contamination. After the first clean layer is applied, the remaining work will be performed in clean medium. Spoil material brought to the unit that cannot be used as clean backfill in the cover will be disposed of as clean material.

Well drill cuttings, decontamination fluids, development water, and purge water will be managed and dispositioned in accordance with the health-based limits taken from the approved IDW Management Plan (WSRC 1994). Any decontamination fluids or purge

Table 13. Waste Disposition

Secondary Waste Stream	Waste Type	Description	Method of Disposal
Soil	Hazardous	As needed monitoring wells	Well drill cuttings above the water table will be disposed in the vicinity of the work site. The remaining well drill cuttings will be containerized, sampled and compared to IDW Management Plan Non-Aqueous health-based limits. Well drill cuttings below health-based limits will be disposed of in the vicinity of generation. Well drill cuttings exceeding health-based limits but below RCRA characteristically hazardous limits will be managed as CERCLA sanitary waste. Well drill cuttings exceeding RCRA characteristically hazardous limits will be managed as hazardous waste.
	Hazardous	As needed lab sample returns	Lab sample returns will be placed on the PBRP and covered.
Well development water	Hazardous	Development water from as needed monitoring wells	Water will be managed and dispositioned in accordance with the approved IDW Management Plan. Any containerized development water found to exceed plan values will be sent to either the M-1 Air Stripper, the Effluent Treatment Facility, or the TNX facility at SRS, depending on the constituents found in the fluids. Both the Effluent Treatment Facility and the M-1 Air Stripper facilities are CERCLA Offsite Rule-approved. The TNX facility will serve as an alternate pending CERCLA Offsite Rule approval.
Job Control	Nonhazardous	Disposable personal protective equipment (PPE)	PPE will be disposed of at PBRP and covered.
	Nonhazardous	Rinse water	Rinse water will be managed and dispositioned in accordance with the approved IDW Management Plan. Any containerized decontamination fluids found to exceed these values will be sent to either the M-1 Air Stripper, the Effluent Treatment Facility, or the TNX facility at SRS, depending on the constituents found in the fluids. Both the Effluent Treatment Facility and the M-1 Air Stripper facilities are CERCLA Offsite Rule-approved. The TNX facility will serve as an alternate pending CERCLA Offsite Rule approval.

water found to exceed these values will be sent to either the M-1 Air Stripper, the Effluent Treatment Facility, or the TNX facility at SRS. Both the M-1 Air Stripper and the Effluent Treatment Facility are CERCLA Offsite Rule Approved. The TNX facility will be an alternate pending CERCLA Offsite Rule Approval and regulator notification requirements.

XII. STATUTORY DETERMINATIONS

Based on the unit RFI/RI/BRA report, the PBRP OU poses a threat to human health. Therefore, Alternative PBRP2 (Engineered Cover System with BaroBalls™, Natural Biodegradation, and Institutional Controls) has been selected as the remedy for PBRP and Alternative GW2 (Continued Monitoring and Reporting) has been selected as the remedy for the groundwater.

There is no PTSM at the OU. The contamination that is present is categorized as a low-level threat.

Based on information currently available, USDOE, USEPA, and SCDHEC believe the selected alternative provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. USDOE, USEPA, and SCDHEC expect the selected alternative to satisfy the statutory requirements in CERCLA Section 121(b) to: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element (removal using passive soil vapor extraction).

Section 300.430(f)(2) of the NCP requires that a 5-year remedy review be performed if hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure remain in the OU. The three parties, SCDHEC, USEPA, and USDOE, have determined that a 5-year remedy review for the PBRP OU will be performed to ensure that the remedy continues to provide adequate protection of human health and the environment.

XIII. EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes made to the ROD based on the comments received during the public comment period for the SB/PP. Comments that were received during the public comment period are addressed in the Responsiveness Summary included in Appendix A of this document.

XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary is included as Appendix A of this document.

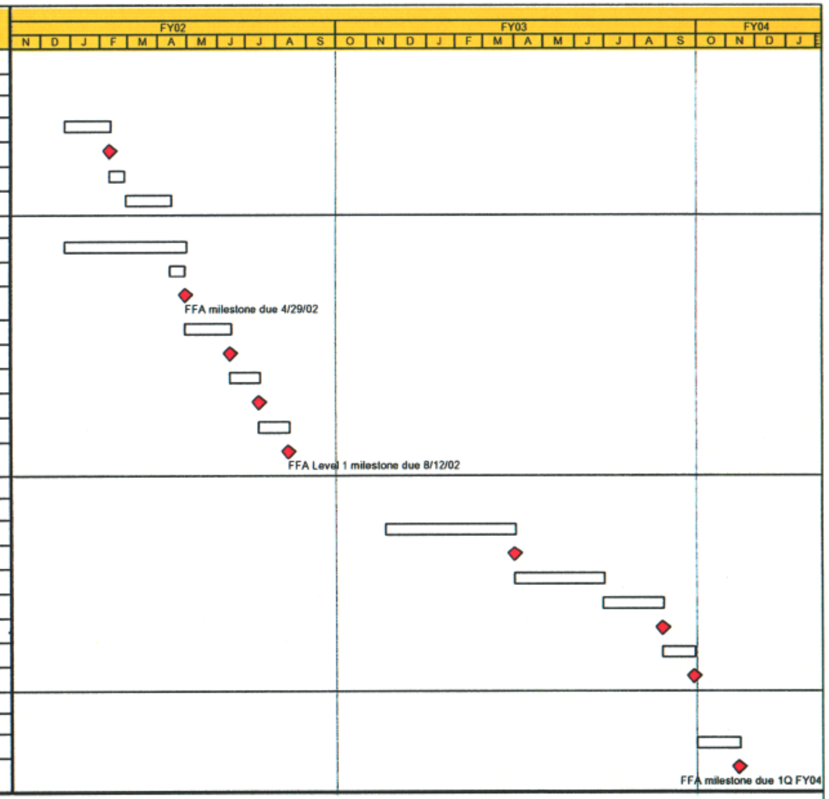
XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

Table 14 is an implementation schedule for the OU showing the post-ROD document submittals and the remedial action start date. Major milestones are as follows:

- After the ROD is signed, SRS will submit a CMI/RAIP to SCDHEC and USEPA in accordance with FFA requirements.
- The remedial action start date is anticipated to be November 2003.
- Construction is anticipated to be completed approximately one year after the remedial action start date.
- SRS will submit a post-construction report 90 days after construction is complete (i.e., after completion of a post-construction walkdown and acceptance by the core team [USDOE, USEPA, and SCDHEC]).

Table 14. Implementation Schedule

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
CA 1221 P-AREA B/R/P (131-P)				
LCS 14 - STATEMENT OF BASIS/PROPOSED PLAN & ROD				
STATEMENT OF BASIS/PROPOSED PLAN				
BJP0500920	EPA/SCDHEC FINAL REVIEW AND APPROVAL	44	27DEC01	08FEB02
BJP0500940	RECEIPT OF EPA/SCDHEC REV.1 SB/PP APPROVAL	0		08FEB02
BJP0500960	NOTIFICATION OF PUBLIC COMMENT	14	09FEB02	22FEB02
BJP0500962	PUBLIC COMMENT PERIOD	45	28FEB02	13APR02
RECORD OF DECISION				
BJP0500909	DEVELOP REV.0 ROD	86	26DEC01	29APR02
BJP0500963	RESPONSIVENESS SUMMARY	14	14APR02	27APR02
BJP0501050	SUBMIT REV. 0 ROD	0		29APR02
BJP0501055	EPA/SCDHEC REVIEW OF REV.0 ROD	45	30APR02	13JUN02
BJP0501056	EPA/SCDHEC RETURNS REV.0 COMMENTS FOR ROD	0		13JUN02
BJP0501135	SRS INCORPORATES EPA/SCDHEC COMMENTS ROD	30	14JUN02	13JUL02
BJP0501060	SRS SUBMITTAL OF REV.1 ROD	0		13JUL02
BJP0501040	EPA/SCDHEC FINAL REVIEW AND APPROVAL OF ROD	30	14JUL02	12AUG02
BJP0501020	SUBMIT SIGNED ROD TO EPA/SCDHEC	0		12AUG02
LCS 15 - DETAILED ENG & PRECONST ACTIVITIES				
POST - RECORD OF DECISION DOC				
BJP0502000	DEVELOP REV.0 CMI/RAIP	88	20NOV02	31MAR03
BJP0502010	SRS SUBMITTAL OF REV. 0 CMI/RAIP	0		31MAR03
BJP0502020	EPA/SCDHEC REVIEW REV. 0 CMI/RAIP	90	01APR03	29JUN03
BJP0502030	SRS INCORP EPA/SCDHEC COMMENTS CMI/RAIP	60	30JUN03	28AUG03
BJP0502040	SRS SUBMITTAL OF REV. 1 CMI/RAIP	0		28AUG03
BJP0502050	EPA/SCDHEC FINAL REVIEW CMI/RAIP	30	29AUG03	27SEP03
BJP0502060	EPA/SCDHEC APPROVAL REV.1 CMI/RAIP	0		27SEP03
LCS 16 - REMEDIAL ACTION IMPLEMENTATION				
BJP0501355	MOBILIZATION	30	03OCT03	13NOV03
BJP0501360	REMEDIAL ACTION (RA) START DATE	0	14NOV03	



Start Date	01OCT92	Early Bar	IMPL - BJPC
Finish Date	12APR10	Progress Bar	Sheet 1 of 1
Data Date	01SEP99	Critical Activity	Environmental Restoration
Run Date	12MAR02 16:54		CA 1221 P-AREA IHMU (131-P)
			RCRA/CERCLA Implementation Schedule

Date	Revision	Checked	Approved
11FEB02	Submit Signed ROD to EPA/SCDHEC 8/12/02		
26FEB02	Rev. 0 RAIP Submittal 3/31/03		

XVI. REFERENCES

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APPENDIX A -

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

The 45-day public comment period for the SB/PP for the PBRP OU began on February 28, 2002 and ended on April 13, 2002. No comments were received from the public. The Environmental Remediation Committee of the SRS Citizens' Advisory Board was given a briefing on the preferred alternative on March 18, 2001. There were no comments.