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United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the D-Area Expanded Operable Unit (U)

CERCLIS Number: 67

WSRC-RP-2004-4007

Revision 1

August 2004

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
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Savannah River Site
Aiken, South Carolina

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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

D-Area Expanded Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 67

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy

The D-Area Expanded Operable Unit (DEXOU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

The FFA is a legally binding agreement between regulatory agencies [United States Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC)] and regulated entities [United States Department of Energy (USDOE)] that establishes the responsibilities and schedules for the comprehensive remediation of SRS. The DEXOU consists of two surface units: the D-Area Rubble Pit (DRP) and the 488-D Ash Basin (488-DAB). Contaminated media to be addressed by this remedy include soils at DRP and soils, sediment, and surface water at 488-DAB. The D-Area groundwater will be addressed as a separate operable unit.

Statement of Basis and Purpose

This decision document presents the selected remedies for the DEXOU, which were 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 USEPA, SCDHEC, and USDOE concur with the selected remedy.

Assessment of the Site

Characterization data indicates the DRP was used for surface disposal of metallic and construction debris; treated lumber and wood products; and coal rejects. Asbestos-containing material has been found in some of the waste piles. Contaminants of concern (COCs), including metals and polychlorinated biphenyls (PCBs), are present in surface and subsurface soils.

The 488-DAB includes several subunits that are known to have been contaminated by processes related to the 488-DAB. These subunits include the 488-DAB (Interior), the 488-D Pooled Basin, the 488-DAB (Exterior), the 488-D Drainage, and the Dead and Stressed Vegetation Area (DSVA). The coal ash and coal rejects present in the 488-DAB (Interior) have been identified as principal threat source material (PTSM). COCs within the waste material of the 488-DAB (Interior) and in the surface soils of the 488-DAB (Exterior) include coal-related metals and radionuclides. The surface water and sediment of the 488-D Pooled Basin, 488-D Drainage, and DSVA have been impacted by low pH conditions caused by the presence of coal rejects. Surface water and sediment COCs include coal-related metals and radionuclides.

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

Description of the Selected Remedy

A preferred alternative has been selected for each surface unit. The selected remedy for the DRP is excavation and consolidation of the wastes to the 488-DAB, and implementation of institutional controls and groundwater monitoring at the DRP (Alternative DRP-3). The selected remedy for the 488-DAB is consolidation of peripheral exposure areas (488-DAB [Exterior], 488-D Drainage, and DSVA) at the 488-DAB, installation of a low permeability geosynthetic cover system, and implementation of institutional controls and groundwater monitoring (Alternative 488-DAB-2).

The DEXOU is located within an industrially developed area, and future industrial land use is anticipated. Remedial action objectives (RAOs) and response actions were developed with the expectation that future land use will be industrial. Land use controls will be part of the remedial action to ensure protection against unrestricted use (e.g., residential or agricultural).

The selected remedy for the DRP is a removal remedy (Alternative DRP-3).

- Waste materials and soils containing coal rejects will be excavated to visual extent and verified laterally by arsenic and zinc remedial goals (RGs).
- A PCB hot spot will be removed and verified by the PCB RG.
- The excavated soils and waste materials will be transported to the 488-DAB for consolidation under a geosynthetic cover.
- The excavated area will be backfilled, graded, and vegetated to minimize erosion.
- Institutional controls (land use controls) consisting of access controls (warning signs and land use restrictions) will be implemented to prevent residential exposure.
- Groundwater monitoring will be performed to evaluate the long-term effectiveness of the action.
- Implementation of this selected remedy will require several years.

The selected remedy for the 488-DAB is a containment remedy (Alternative 488-DAB-2).

- Coal rejects and impacted soils and sediments outside the 488-DAB (from the 488-DAB [Exterior], 488-D Drainage, and DSVA) will be excavated to visual extent and verified laterally by the arsenic RG.
- The excavated material will be consolidated in the 488-DAB.

- The portion of the DSVA that is delineated as a wetland will be impacted by the action. The wetland will be replaced through the SRS wetland mitigation bank or by constructing/enhancing a wetland at another location.

- The existing standpipe in the west end of the 488-DAB will be covered, plugged, or removed to prevent further impact to the 488-D Drainage.

- Surface water in the 488-D Pooled Basin will be treated/managed based on the relevant action-specific applicable or relevant and appropriate requirement (ARAR) for land application or discharge to surface water.

- A low permeability geosynthetic cover system will be installed over the 488-DAB. The cover system will include an infiltration layer, an erosion layer of earthen material capable of sustaining native plant growth, and a geosynthetic layer with a maximum hydraulic conductivity of 1×10^{-8} cm/s.

- The excavated area will be backfilled, graded, and vegetated to minimize erosion.

- Institutional controls (land use controls) consisting of access controls (warning signs and land use restrictions) will be implemented to prevent residential and industrial worker exposure to the waste, and disturbance of the cover system.

- Groundwater monitoring will be performed to evaluate the long-term effectiveness of the action.

- Implementation of this selected remedy will require several years.

The selected remedy for the 488-DAB addresses the principal threat source material (PTSM) present in the ash and coal within the basin. Coal rejects containing arsenic and beryllium are identified as PTSM based on their mobility. Both constituents are present in groundwater above their respective maximum contaminant levels (MCLs), and both are known to be present in coal-

reject material. At DRP, the selected remedy addresses the low level threat source material with elevated metals and aroclor-1254. The selected remedy prevents groundwater impact by limiting infiltration through the waste.

These actions presented for the DRP and 488-DAB source units will be conducted as final actions. Contamination present in groundwater and the wetland will be addressed as part of the D-Area groundwater and D-Area Wetland operable unit investigations. The RCRA permit will be revised to reflect selection of the final remedy in accordance with the procedures under 40 CFR Part 270 and SCHWMR R.61-79.264.101, 270.

Statutory Determinations

Based on the RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment (RFI/RI/BRA) for the D-Area Expanded Operable Unit (DEXOU) (WSRC 2003a), the DEXOU poses a threat to human health and the environment. Remedial alternatives were reviewed in the Corrective Measures Study/Feasibility Study (CMS/FS) for the D-Area Expanded Operable Unit (WSRC 2003b). The Statement of Basis/Proposed Plan (SB/PP) for the D-Area Expanded Operable Unit (WSRC 2003c) identified Alternatives DRP-3 and 488-DAB-2 as the preferred remedies for the DRP and 488-DAB. The future land use of the DEXOU is assumed to be industrial.

Because the selected remedies will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years of initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. The remedies do not satisfy the statutory preference for treatment as a principal element of the remedy because such treatment would not be practicable due to the volume and nature of the contamination.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the unit. 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 to manage and dispose of waste. These requirements are 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 remedies for the DEXOU leave hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control and Assurance Plan (LUCAP) to ensure that the land use controls (LUCs) required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Control Implementation Plan (LUCIP) incorporated by reference into this ROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the Corrective Measures Implementation (CMI)/Remedial Action Implementation Plan (RAIP) as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and considered incorporated by reference into the ROD, establishing

LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved 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:

- COCs and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for the COCs and the basis for the levels
- Current and reasonably anticipated future land and groundwater use assumptions used in the Baseline Risk Assessment (BRA) and ROD
- Potential land and groundwater use that will be available at the site as a result of the selected remedy
- Estimated capital, operation and maintenance, and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected
- Key decision factor(s) that led to selecting the remedy (i.e., a description of the manner in which the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)
- The manner in which source materials constituting principal threats are addressed

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10/1/04
Date

Jeffrey M. Allison
Manager
U. S. Department of Energy
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10/13/04
Date

Winston A. Smith
Director
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11/15/04
Date

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

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Expanded Operable Unit (U)

CERCLIS Number: 67

WSRC-RP-2004-4007
Revision 1

August 2004

Savannah River Site
Aiken, South Carolina

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Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ac	acre
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
AWQC	Ambient Water Quality Criteria
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CM	contaminant migration
CMI	Corrective Measures Implementation
cm/s	centimeter per second
CMS	Corrective Measures Study
COC	constituent of concern
CSM	conceptual site model
488-DAB	488-D Ash Basin
DCPRB	D Area Coal Pile Runoff Basin
DEXOU	D Area Expanded Operable Unit
DRP	D Area Rubble Pit
DSVA	Dead and Stressed Vegetation Area
DWOF	D Area Waste Oil Facility
EPC	exposure point concentration
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
FRR	Final Remediation Report
FS	Feasibility Study
ft	feet
ft3	cubic feet
Ha	hectare
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendment
IC	Institutional Control
IOU	Integrator Operable Unit
IRIS	Integrated Risk Information System, USEPA

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

LLC	Limited Liability Company
LUC	Land Use Controls
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
M	meter
m^3	cubic meter
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mg/L	milligram per liter
Msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PCR	Post-Construction Report
PRG	preliminary remedial goals
PTSM	principal threat source material
PW	present worth
RAIP	Remedial Action Implementation Plan
RAO	remedial action objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RFI	RCRA Facility Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments Reauthorization Act
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SF	slope factor
SRFS	Savannah River Forest Service
SRS	Savannah River Site
SW	surface water
TCE	trichloroethylene
TSCA	Toxic Substance Control Act
UCL	upper confidence limit
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UTRA	Upper Three Runs aquifer
WSRC	Westinghouse Savannah River Company, LLC
yd^3	cubic yards
yr	year

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

Unit Name, Location, and Brief Description

D-Area Expanded Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 67

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy

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

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the D-Area Expanded Operable Unit (DEXOU) as a Resource Conservation and Recovery Act (RCRA) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit requiring further evaluation. The DEXOU was evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

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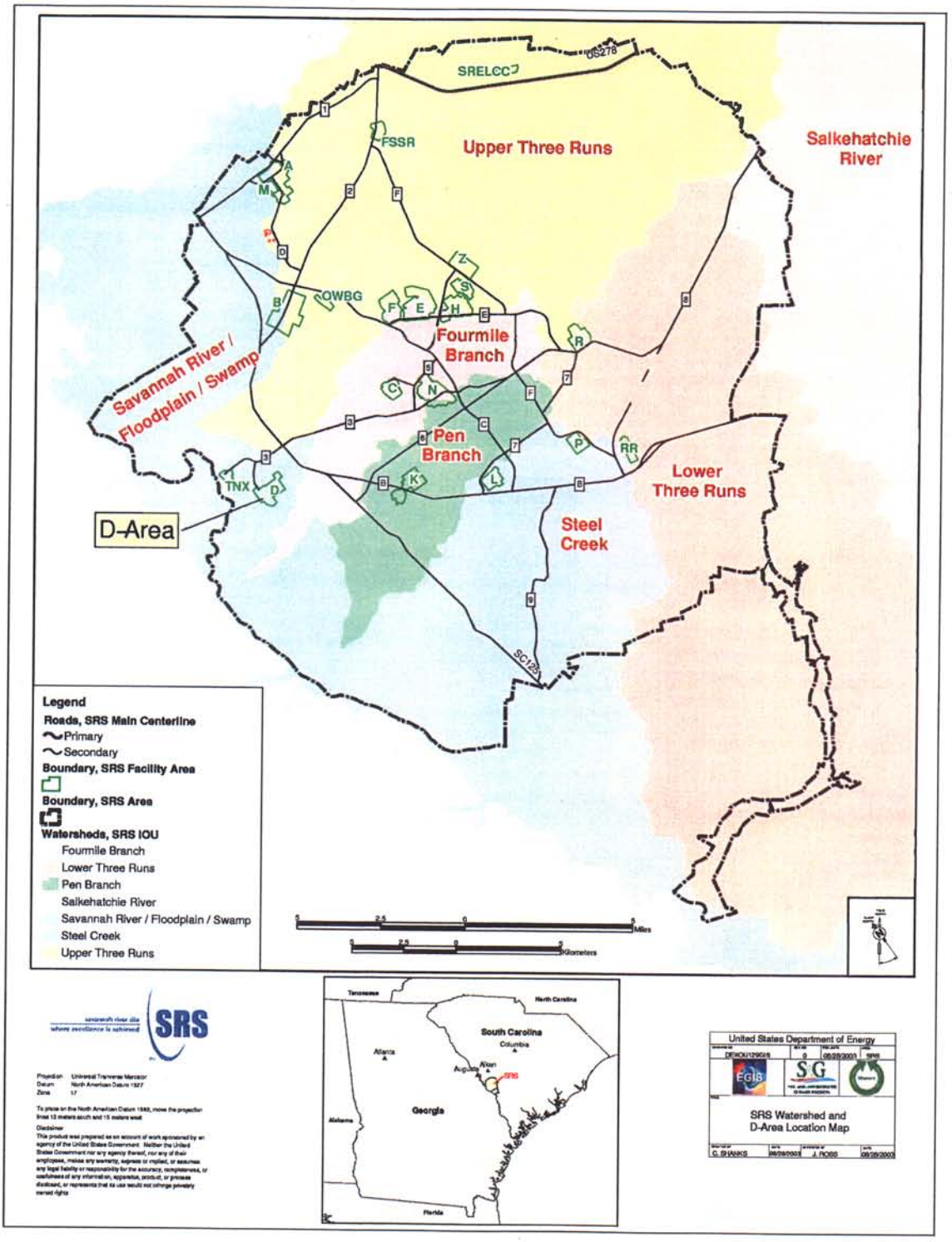

Figure 1. Location of the DEXOU within the Savannah River Site

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II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational and Compliance History

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

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from SCDHEC. The permit was most recently renewed on September 30, 2003. Module VIII of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

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

Operable Unit Operational and Compliance History

The DEXOU is located within D Area at SRS in Barnwell County, South Carolina. The unit lies approximately 3,000 ft east of the nearest site boundary, the Savannah River and includes two surface units: the D-Area Rubble Pit (DRP) and the 488-D Ash Basin (488-DAB) (Figure 2). The 488-DAB consists of five subunits: 488-DAB (Interior), 488-DAB (Exterior), 488-D Pooled Basin, 488-D Drainage, and the Dead and Stressed Vegetation Area (DSVA).

Due to the continued operation of the D Area powerhouse several units that were once part of the DEXOU were removed from the current scope. These units include the D-Area Coal Pile Runoff Basin, the D-Area Waste Oil Facility, and the Borrow Pit. Two units were removed from the DEXOU and placed into other regulatory programs: the D-Area Cinders Disposal Pit and the D-Area Gas Station Area. Additionally, three separate operable units were established: the D-Area Groundwater OU, the D-Area Wetland OU, and the D-006 Petroleum Release Site OU. The D-Area Wetland OU includes a portion of the 488-D Drainage and the D-006 Petroleum Release Site OU includes the DRP Stream Boundary. Additional discussion of each of these units is provided later in this section.

D-Area Rubble Pit

The DRP is located approximately 305 m (1,000 ft) northwest of the 488-DAB and covers about 3.2 ha (8 ac). The topography is relatively flat with an elevation range of approximately 38.1 to 39.9 m (125 to 131 ft) above mean sea level (msl). The area is heavily vegetated and bounded by a natural drainage (DRP Stream Boundary) both to the east and south of the unit. The DRP Stream Boundary is fed by the D-006 outfall, which receives stormwater runoff from the northwestern portion of D Area, including storage facilities, parking lots, the northwest side of the 484-D powerhouse, and other active and inactive facilities. Surface water runoff from the DRP occurs only during heavy rainfall events.

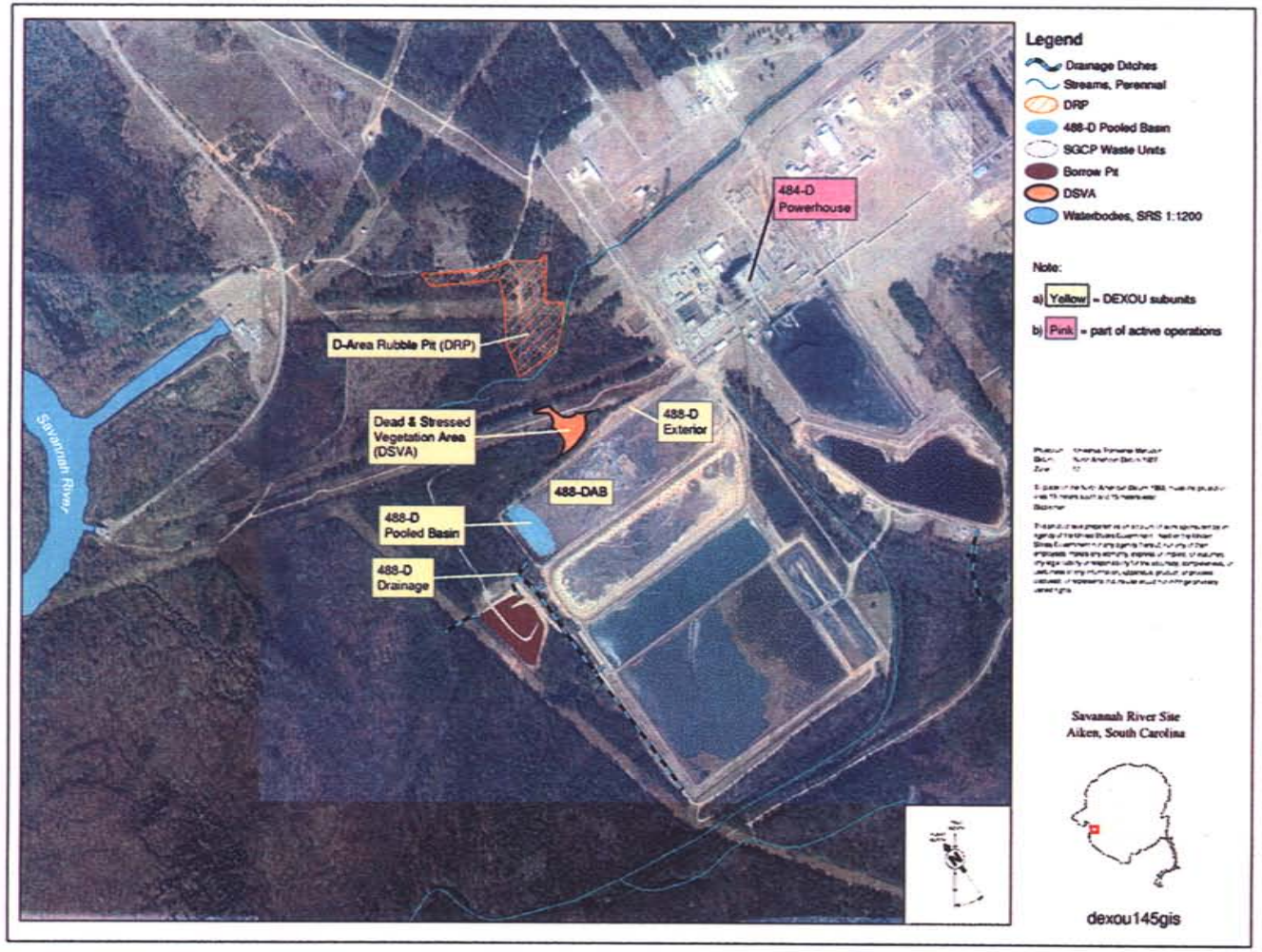

Figure 2. Layout of D-Area and the DEXOU

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The DRP Stream Boundary flows west into the flood plain of the Savannah River.

Historical records and aerial photographs indicate that disposal occurred at the DRP from 1951 through 1989. Detailed review of historical photographs and the absence of any observed pits during intrusive sampling indicate that waste was disposed of on the surface in piles and then graded rather than buried below grade in pits. There are no records of placement of any hazardous or radioactive materials at the unit. The current condition of the DRP is illustrated in Figure 3.

The characterization of the DRP indicated that the waste consisted of soil mixed with asphalt, coal, paper, metal, plastic, glass fragments, foam insulation, fiberboard, asbestos, roofing materials, wire, road gravel, and other miscellaneous debris. In some places, the waste piles are several feet high. In other places, the piles appear to have been reworked by heavy machinery. Waste is present up to 2.1 m (7 ft) below the current land surface.

The largest area of waste disposal covers approximately 1.8 ha (4.5 ac). The estimated volume, assuming an average thickness of 1.8 m (6 ft), is about 38,200 m^3 (50,000 yd^3). The soils area impacted adjacent to the road in the northwest portion of DRP covers about 0.8 ha (2 ac), which is typically contaminated to a depth of about 0.3 m (1 ft). Figure 4 shows the distribution of the contaminated soils and wastes.

488-D Ash Basin

Steam and electricity for several SRS facilities are produced by a coal-fired power plant that has been operating in D Area since 1952. It is assumed that the 488-DAB and the adjacent 488-4D ash basin were placed in operation in 1952 when the 484-D powerhouse began operating. The ash basins were used to intercept, stabilize, and provide passive treatment of ash-sluice water before it was discharged to local surface streams. In 1978, ash-sluice water was diverted to the newly constructed 488-1D and 488-2D ash basins.

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Figure 3. Photograph of DRP

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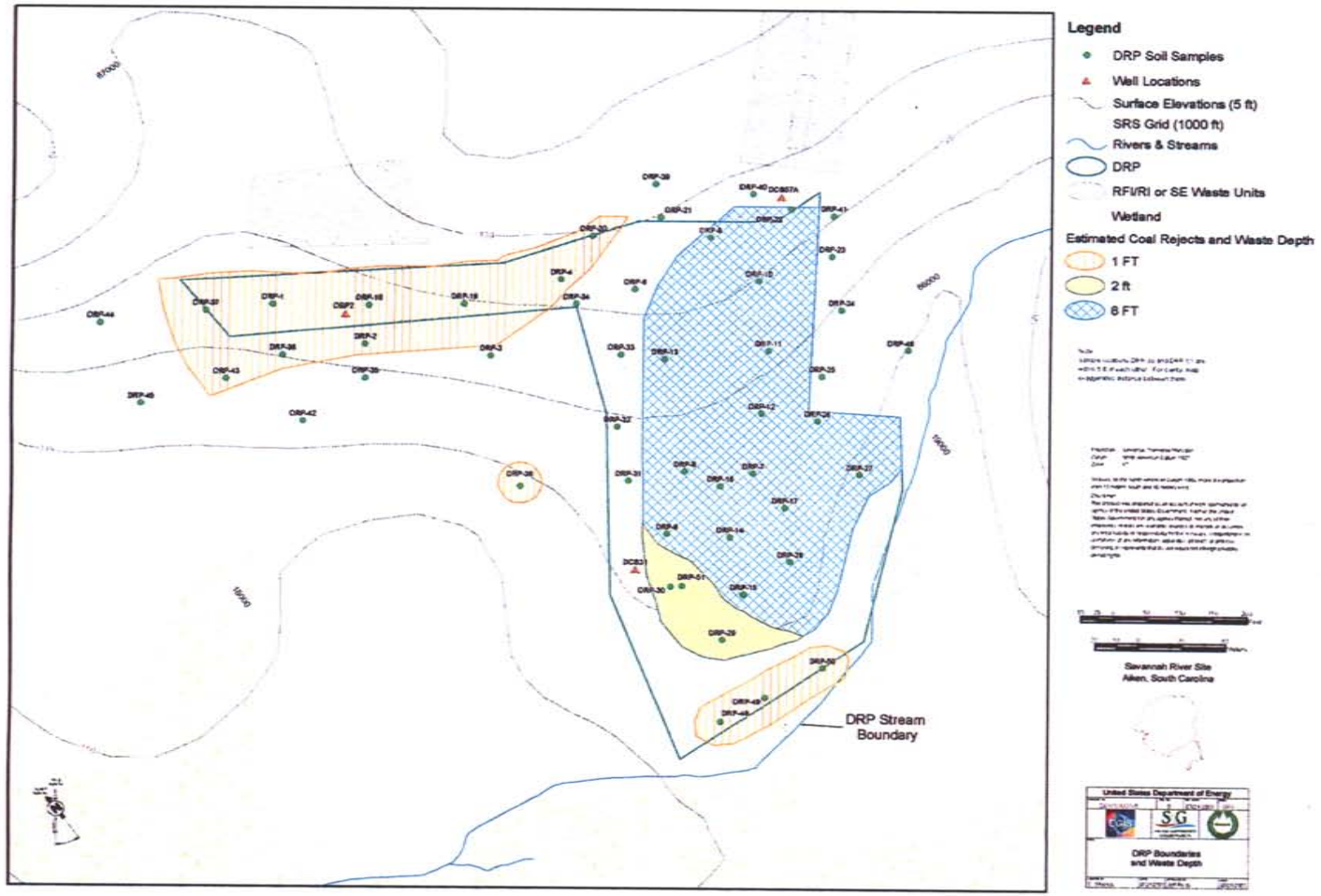

Figure 4. Extent of Contamination and Debris at DRP

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After 1978, the 488-DAB received only dry ash and coal-reject material until the early to mid-1990s.

The 488-DAB is an unlined, earthen containment basin located approximately 274 m (900 ft) south of the 484-D powerhouse. The 488-DAB is situated adjacent to the floodplain of the Savannah River on a terrace deposit with low relief. The 488-DAB is approximately 549 m (1,800 ft) long and 183 m (600 ft) wide. The basin was constructed above grade and the berms that form the walls of the basin are 5.5-m (18 ft) high. The berms are constructed of man-made fill consisting primarily of sand, silt, and clay. Elevations across the basin range from approximately 37 m (120 ft) msl in the western end to 40 m (130 ft) msl in the eastern end while the bottom is near original grade, approximately 34 to 35 m (110 to 115 ft) msl, which is about 6.1 m (20 ft) above the elevation of the Savannah River (28 m [92 ft] msl).

The bottom of the 488-DAB sits atop a dense, locally continuous, low permeability clay layer, which runs beneath both the 488-DAB and the DSVA. The vertical hydraulic conductivity of the clay layer averages about 1.0×10^{-7} cm/s, which has restricted vertical percolation across the clay layer. As a result, the perched water above the clay layer is elevated with respect to the "regional" water table. The regional water table potentiometric surface is within the clay layer under the basins; consequently, there is little to no unsaturated zone under the water that is mounded above the clay layer.

The perched zone in the 488-DAB extends from the floor of the basin locally up to 3 m (10 ft) above the floor of the basin (or approximately 10 ft below the surface). Data indicates that there is greater leakage through the clay layer at the western end of the basin, where pooled low pH surface water accumulates.

The 488-DAB unit is an inactive facility. The unit includes several subunits that are known or suspected to have been contaminated by processes related to the 488-DAB (Figure 2). These subunits are the 488-DAB (Interior), the 488-DAB (Exterior), the

488-D Pooled Basin (within the western end of the basin), the 488-D Drainage, and the Dead and Stressed Vegetation Area (DSVA).

The 488-DAB (Interior) subunit consists of the waste material within the 488-DAB and the basin berm (Figure 5). The waste material includes ash and coal rejects. The coal rejects are found primarily in the upper four feet of the eastern two-thirds of the basin. Zones of mineralization (hard pan) are present within the shallow section of the waste. The total volume of waste material is approximately 550,500 m^3 (720,000 yd^3).

The 488-DAB (Exterior) subunit consists of the area outside of the basin and along its perimeter (Figure 6). Coal rejects were identified in the exterior soils at the northeast end of the basin. These appear to have sloughed off of the basin berm. The estimated volume of coal rejects outside of the berm is about 7,650 to 15,300 m^3 (10,000 to 20,000 yd^3). The area between the DSVA and the D-003 outfall where coal rejects have sloughed into the drainage consists of about 0.8 ha (2 ac).

Surface water pools in the western end of the basin (488-D Pooled Basin) and is present at times even in drier months (Figure 7). The volume of pooled water is variable; the observed maximum is about 3.8 million liters (1 million gallons).

A standpipe in the western end of the 488-DAB was used to discharge pooled surface water from the 488-D Pooled Basin and to prevent basin overflow. Figure 7 is a photograph showing the pooled basin with the plugged standpipe and the 488-DAB in the background. Discharge from the standpipe goes into the 488-D Drainage, then to the Borrow Pit. The portion of the 488-D Drainage between the standpipe and the Borrow Pit to be addressed as part of the DEXOU is approximately 61 m (200 ft) long by 3 m (10 ft) wide (Figure 8). The standpipe was filled with cement in 1998 to eliminate release of low pH surface water from the Pooled Basin; however, minimal pipe leakage continues.

Figure 5. Photograph of 488-DAB (Interior)

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Figure 6. Photograph of 488-DAB (Exterior), North Side of Basin

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Figure 7. Photograph of the 488-D Pooled Basin and Standpipe

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Figure 8. Photograph of the 488-D Drainage

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The DSVA is about 0.7 ha (1.8 ac) with seasonally variable amounts of surface water along the northern edge of the 488-DAB. Stormwater runoff from the 484-D powerhouse is directed through a drainage (D-003 outfall) along the northern edge of the basin. Coal rejects have sloughed off of the basin into the drainage. The coal rejects have caused an acidification of the stormwater runoff. Coal rejects are also present over about 0.8 ha (2 ac) in the D-003 drainage prior to the ponded area. The low pH water has resulted in the zone of vegetative kill. There is about 9,175 m^3 (12,000 yds^3) of impacted sediment. Figure 9 show the DSVA with the berm of the 488-DAB in the background. Some overflow from the DSVA flows southwest toward the 488-D Wetland, while other overflow is diverted under an access road through a culvert and drains westward toward the Savannah River flood plain.

Project History

A RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan was submitted and approved as an operable unit consisting of the 488-DAB and the D-Area Coal Pile Runoff Basin (DCPRB) (WSRC 1998). During the course of the investigation, it was determined that other units were likely impacting the environment near the study area. An expanded characterization effort was approved in the RFI/RI Work Plan Addendum (WSRC 2001) to address additional sources of contamination and source units.

Several of the units investigated are associated with facilities in active operation. Therefore, they were removed from the original scope of DEXOU and set up as independent units. This agreement was made based on the planned continued use of the 484-D powerhouse facilities until 2015 when powerhouse operations will cease. The source units that were removed from the DEXOU include the DCPRB and the D-Area Waste Oil Facility (DWOF). While not established as an independent unit, the Borrow Pit was also removed from the scope of the DEXOU. The Borrow Pit will be used as part of the closure of other ash basins operated by South Carolina Electric and Gas.

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Figure 9. Photograph of the Dead and Stressed Vegetation Area, with the 488-DAB Berm in the Background

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Separate OUs were created for three subunits of the DEXOU. Groundwater, the 488-D Wetland, and the DRP Stream Boundary were each established as separate OUs (D-Area Groundwater OU, D-Area Wetland OU and D-006 Petroleum Release Site OU, respectively). The groundwater at DEXOU is principally contaminated with trichloroethylene (TCE), tritium, and metals. The three contaminant plumes that contribute to this contamination have separate sources and are commingled. The investigation showed active and inactive sources as likely groundwater contamination contributors along with data that indicated no significant source in the vadose zone still exists for TCE and tritium. Groundwater monitoring is on-going.

The D-Area Wetland OU was established after characterization data indicated that ash from the D-Area powerhouse was present over about 90 acres in the wetland west of the 488-DAB. The D-Area Wetland OU warrants further characterization to determine whether any ecological risks are present due to historic ash deposition. The portion of the 488-D Drainage between the Borrow Pit and the wetland has been included with the D-Area Wetland OU due to similar conditions.

The D-006 Petroleum Release Site OU was established due to contamination discovered up-gradient of the DRP, related to an unknown petroleum release. The D-006 Petroleum Release Site OU receives permitted storm water discharges from D-Area operating facilities.

Two additional units were removed from the DEXOU and placed into other regulatory programs. The D-Area Gas Station Area was also removed from the DEXOU after characterization and placed in the Underground Storage Tank Program. One remaining unit, the D-Area Cinders Disposal Pit, was removed from the investigation and listed as a Site Evaluation Area (Appendix G of the FFA) after groundwater data indicated it was not a source of groundwater contamination.

An RFI/RI/BRA (WSRC 2003a) was performed to assess the risks posed by the DEXOU to human health and the environment. The assessment included quantitative calculations

of human health risks, ecological risks, and the threat posed by future leaching to groundwater.

The principal sources of contamination for the DEXOU include:

- elevated metals and PCBs at the DRP,
- coal-related metals and radionuclides associated with coal rejects and ash in and near the 488-DAB,
- low pH pooled surface water in the 488-D Pooled Basin, and
- low pH surface water and sediments at the DSVA to the north of the 488-DAB.

A *Corrective Measures Study/Feasibility Study (CMS/FS) for the D-Area Expanded Operable Unit* was submitted (and approved) in 2004 (WSRC 2003b). The study provided an identification and screening of general response actions and technologies for the media of concern. A detailed analysis of alternatives based on the National Contingency Plan (NCP) criteria was performed. The preferred alternative for both the DRP and 488-DAB subunits were identified in the *Statement of Basis/Proposed Plan (SB/PP) for the D-Area Expanded Operable Unit* (WSRC 2003c). The SB/PP provides for involvement with the community through a document review process and public comment period. Approval of the SB/PP was received on January 30, 2004.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA (42 United States Code Sections 9613 and 9617). These requirements include establishment of an

Administrative Record File that documents the investigation and selection of the remedial alternative for addressing the DEXOU.

The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and 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 SB/PP (WSRC 2003c), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the DEXOU.

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

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

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

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

The South Carolina Department of
Health and Environmental Control
Bureau of Land and Waste
Management
8911 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

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

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

The SB/PP 45-day public comment period began on February 11, 2004 and ended on March 26, 2004. No comments were received during the public comment period.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT

To more effectively manage the comprehensive cleanup strategy for complex multiple contaminant areas, SRS is divided into integrator operable units (IOUs). Waste units within an IOU are evaluated and remediated individually. D-Area is located within the Savannah River Flood Plain Swamp IOU. Due to continued D-Area powerhouse operations expected to continue through 2015, evaluation of the DWOF and DCPRB will not be completed until that time. This rationale also applies for the D-006 Petroleum Release Site and the D-Area Groundwater OU. The evaluation of the D-Area Wetland OU will also occur separately. After implementation of remedial actions for D-Area, SRS will manage all source control units to prevent impact to the Savannah River Flood Plain Swamp Watershed. Upon disposition of all source control and groundwater units within the watershed, a final comprehensive ROD for the Savannah River Flood Plain Swamp IOU will be issued.

The overall strategy for addressing the DEXOU (DRP and 488-DAB source units) was to (1) characterize the waste unit, delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a BRA to evaluate the media of concern, COCs, and exposure pathways and to characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The contaminated soils, sediments, and surface water associated with the DEXOU are addressed in this ROD. The response actions discussed in this ROD are final remedial actions for the DEXOU. If the residual contamination following the soil and waste excavation at DRP and 488-DAB (consolidated portions) poses a risk less than 1×10^{-6} to the future resident, an Explanation of Significant Difference (ESD) will be submitted to eliminate the need for institutional controls. Groundwater monitoring to evaluate the performance of the remedy will be conducted as part of the D-Area Groundwater OU. The remedial action for DEXOU has been prioritized in accordance with the FFA process and is consistent with actions taken for other similar OUs.

V. OPERABLE UNIT CHARACTERISTICS

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

Conceptual Site Model for the DEXOU

The CSM for the DEXOU is presented in Figure 10. The CSM identifies the known and suspected sources of contamination, the known and potential routes of migration, and the types of contaminants and potentially affected media. The exposure routes and the known or potential human and ecological receptors will be presented in the summary of OU risks in Section VII.

Primary Sources of Contamination

The RFI/RI/BRA report for the DEXOU (WSRC 2003a) evaluated two primary source units: the DRP and the 488-DAB. The primary sources of contamination at the DRP include construction and metallic debris and coal rejects. The primary sources of contamination at the 488-DAB include the ash and coal rejects from the D-Area powerhouse.

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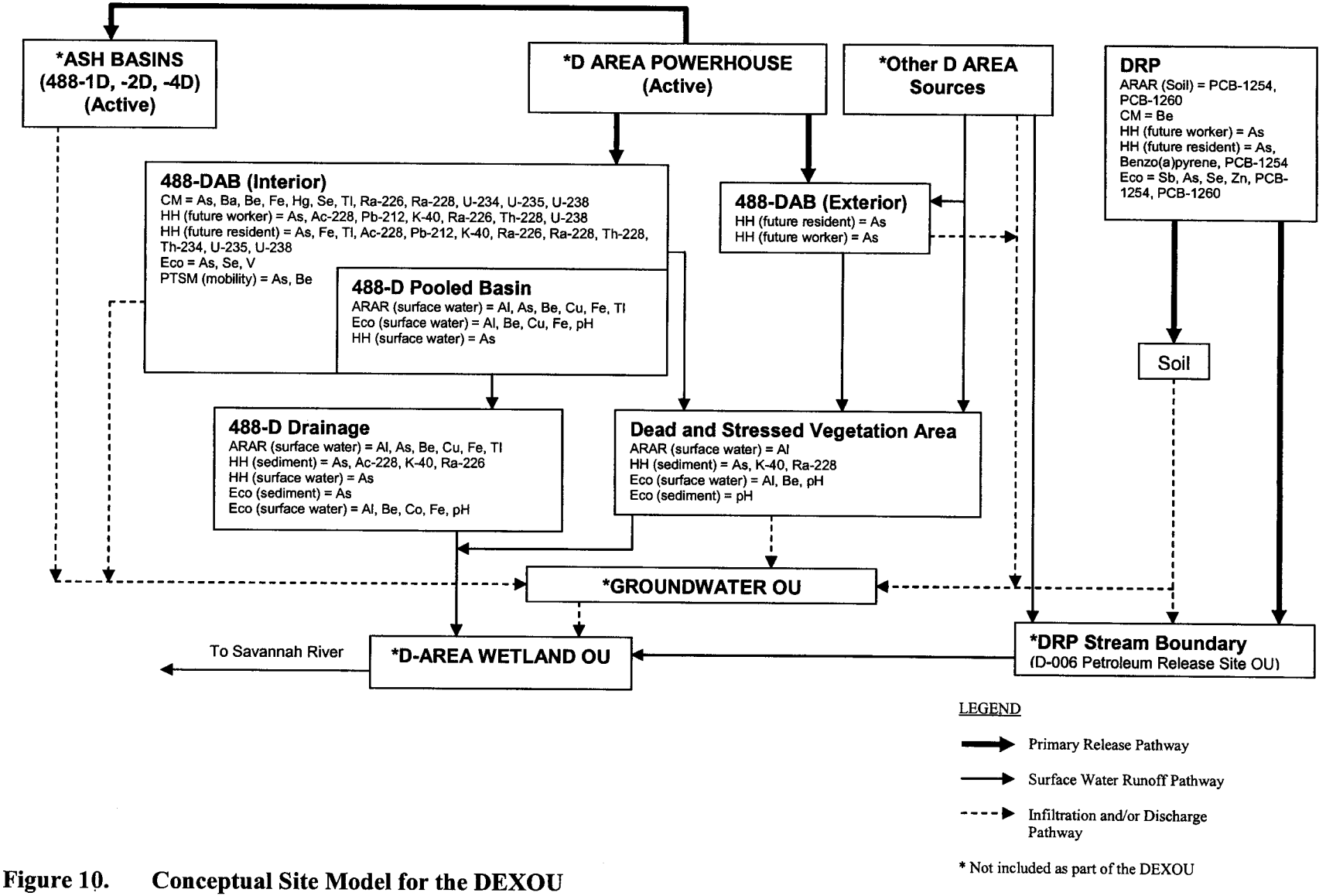

Figure 10. Conceptual Site Model for the DEXOU

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Primary Release Mechanisms

The primary release mechanism for the DRP was the deposition of the waste at the unit. The primary release mechanisms for the 488-DAB include deposition to the 488-DAB (Interior), as well as erosion and deposition to the 488-DAB (Exterior), 488-D Drainage, and the DSVA. Additionally, the basin standpipe acts as a transfer mechanism between the 488-D Pooled Basin and the 488-D Drainage.

Secondary Sources of Contamination

At the DRP, the surface soil (0 to 0.3 m [0 to 1 ft]), subsurface soil (0 to 1.2 m [0 to 4 ft]), and deep soil (greater than 1.2 m [4 ft]) are considered secondary sources of contamination. Infiltration and percolation are the principal transfer mechanisms between secondary source intervals.

At the 488-DAB, the surface soil (0 to 0.3 m [0 to 1 ft]), subsurface soil (0 to 1.2 m [0 to 4 ft]), and deep soil (greater than 1.2 m [4 ft]) are considered secondary sources of contamination for the 488-DAB (Interior) and 488-DAB (Exterior). While the 488-DAB (Interior) consists of approximately 5.5 m (18 ft) of primary source material, the waste was evaluated as a soil in the RFI/RI/BRA. Infiltration, percolation, and bioturbation, are the principal transfer mechanisms between secondary source (soil) intervals. Surface water in the 488-D Pooled Basin, 488-D Drainage, and the DSVA, and sediment in the 488-D Drainage and DSVA are also considered secondary sources of contamination.

Secondary Release Mechanisms and Exposure Media

Environmental media serve both as a reservoir via chemical bonding and biotic uptake, and as a secondary release mechanism for contaminants from the DEXOU. The following secondary release mechanisms and exposure routes for human and ecological exposure are addressed by the RFI/RI/BRA:

- Ingestion and dermal contact of surface and subsurface soil at the DRP, 488-DAB (Interior) and 488-DAB (Exterior).

- External radiation exposure to surface and subsurface soil at the DRP, 488-DAB (Interior) and 488-DAB (Exterior).

- Inhalation of vapors and particulates due to volatilization and dust generation of surface and subsurface soil at the DRP, 488-DAB (Interior) and 488-DAB (Exterior).

- Ingestion of biota exposed to surface and subsurface soil at the DRP, 488-DAB (Interior) and 488-DAB (Exterior).

- Ingestion of groundwater and dermal contact and inhalation of groundwater through showering. Contamination in the deep soil at the DRP, 488-DAB (Interior) and 488-DAB (Exterior) contributes to groundwater contamination through leaching. D-Area Groundwater has been established as a separate OU.

- Ingestion, dermal contact, and external radiation exposure of surface water at the 488-D Pooled Basin, 488-D Drainage, and DSVA. Stormwater flowing across the 488-DAB and through the coal rejects in the 488-DAB exterior result in acidified surface water.

- Ingestion and dermal contact of sediment at the 488-D Drainage and DSVA.

- Ingestion of biota exposed to surface water at the 488-D Pooled Basin, 488-D Drainage, and DSVA.

- Ingestion of biota exposed to sediment at the 488-D Drainage and DSVA.

Media Assessment

The RFI/RI/BRA (WSRC 2003a) contains the detailed information and analytical data for all investigations conducted and samples taken for the DEXOU. This document is

available in the Administrative Record File (see Section III of this document). The investigations conducted to characterize the DEXOU soils, sediment, and surface water are summarized in Table 1.

Media Assessment Results

DRP

The key contaminants present at the DRP [primarily metals and polychlorinated biphenyls (PCBs)] are consistent with the types of miscellaneous debris observed at the unit and with the major contaminants at other rubble piles at SRS. A summary of refined constituents of concern (RCOCs) for the DRP is provided in Table 2. No anthropogenic radionuclides associated with SRS isotope production or RCRA hazardous wastes have been identified at the DRP.

As anticipated, the highest contaminant concentrations at the DRP are located in the upper 2.1 m (7 ft) of the pile where the debris is present. Figure 11 shows the extent of zinc contamination above the ecological level of concern. Metals are primarily located where historical photographs indicate disposal occurred. Arsenic associated with coal rejects is also present at DRP. Figure 12 shows the extent of arsenic contamination above the human health industrial worker level of concern. In addition to the main area of fill, arsenic contamination is also present in the northwest portion of the DRP as shown in this figure. For some constituents, there are localized areas of contaminants (e.g., PCBs - Figure 13). This is consistent with the random disposal practices typically associated with rubble pile areas. The extent of the PCB contamination was determined to be approximately 57 m^3 (2,000 ft^3). The volume of waste to be managed as part of this ROD is determined by the remedial alternatives as presented in Section IX.

Table 1. History of Environmental Activities Performed at the DEXOU

Location	Phase	Investigation Dates	Media Sampled	Number of Borings/ Samples/Description
488-DAB				
488-DAB (Interior)	Pre-characterization	June 1998	Soil	3 Borings, 19 Samples
Dead and Stressed Vegetation Area	Pre-characterization	1990	Surface Water	13 Locations
488-D Wetland	Pre-characterization	September & October, 1997	Surface Water	39 Locations
488-DAB (Interior)	Phase I	November 1998 - February 1999	Waste	6 Locations
488-DAB (Interior)	Phase I	November 1998 - February 1999	Soil	6 Locations
488-D Berm	Phase I	January - February 1999	Soil	4 Locations
488-D Pooled Basin	Phase I	January - February 1999	Sediment & Surface Water	2 Locations, 2 Sediment & 2 Surface Water Samples
488-D Drainage	Phase I	February 1999	Sediment & Surface Water	4 Sediment & 4 Surface Water Samples
488-DAB (Exterior)	Phase I	January - February 1999	Soil	8 Borings, 16 Samples
488-DAB (Exterior)	Other (SCDHEC)	April 2001	Sediment & Surface Water	3 Sediment & 3 Surface Water Samples
Dead and Stressed Vegetation Area	Phase I	January - February 1999	Soil, Sediment, & Surface Water	10 Soil, 8 Sediment, & 7 Surface Water Samples
488-D Wetland	Phase I	February 1999	Sediment & Surface Water	8 Sediment & 7 Surface Water Samples
488-D Wetland	Phase II	March 2001	Sediment & Surface Water	16 Sediment & 33 Surface Water Samples
488-D Wetland	Summer 2002	June 2002	Sediment	4 Sediment Samples
Dead and Stressed Vegetation Area, 488-D Drainage, and DCPRB	Summer 2002	September 2002	Surface Water	13 Surface Water Samples
DRP				
DRP	Pre-characterization	March, 1997	Soil	28 Locations, 50 Samples
DRP	Phase II	July - September 2001	Soil	51 Locations, 166 Soil Samples
DRP	Phase II	July - September 2001	Sediment & Surface Water	4 Sediment and 4 Surface Water Samples
DRP	Summer 2002	June 2002 - August 2002	Soil	14 Borings, 28 Samples

Table 2. Summary of Refined Constituents of Concern for Soils at 488-DAB (Interior), 488-DAB (Exterior), and DRP

Refined COC	488-DAB (Interior)	488-DAB (Exterior)	DRP
Antimony			ECO
Arsenic	PTSM, CM, HH, ECO	HH	HH, ECO
Barium	CM		
Beryllium	PTSM, CM		CM
Iron	CM, HH-res		
Mercury	CM		
Selenium	CM, ECO		ECO
Thallium	CM, HH-res		
Vanadium	ECO		
Zinc			ECO
Benzo(a)pyrene			HH-res
Aroclor-1254			ARAR, HH-res, ECO
Aroclor-1260			ARAR, ECO
Actinium-228	HH		
Lead-212	HH		
Potassium-40	HH		
Radium-226	CM, HH		
Radium-228	CM, HH		
Thorium-228	HH		
Thorium-234	HH-res		
Uranium-234	CM		
Uranium-235	CM, HH-res		
Uranium-238	CM, HH		

RCOC Designation:
PTSM = Principal Threat Source Material
ARAR = Applicable or Relevant and Appropriate Requirement
CM = Contaminant Migration RCOC
HH = Human Health RCOC
HH-res = Human Health RCOC for the future resident only
ECO = Ecological RCOC

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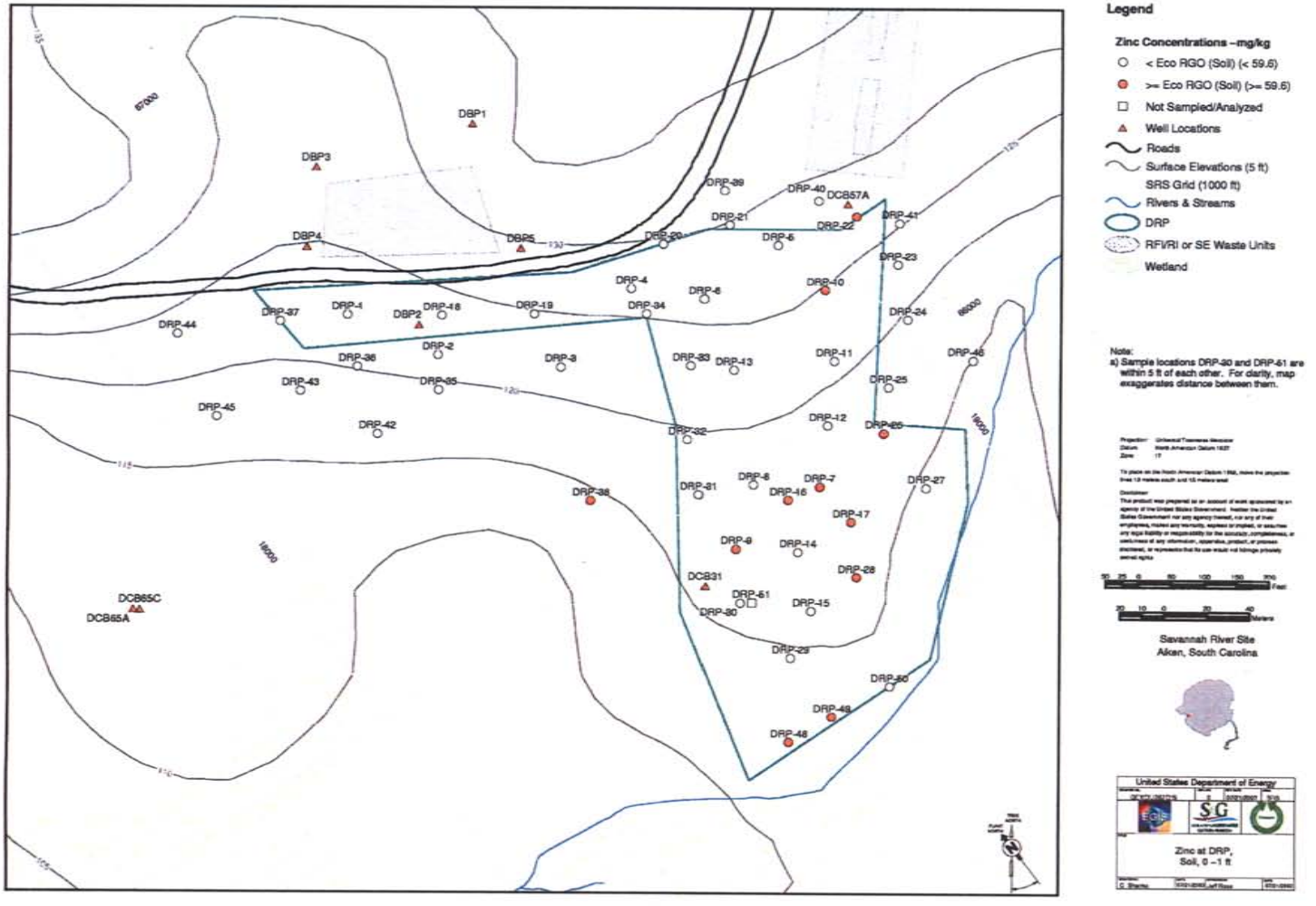

Figure 11. Extent of Zinc Contamination at the DRP

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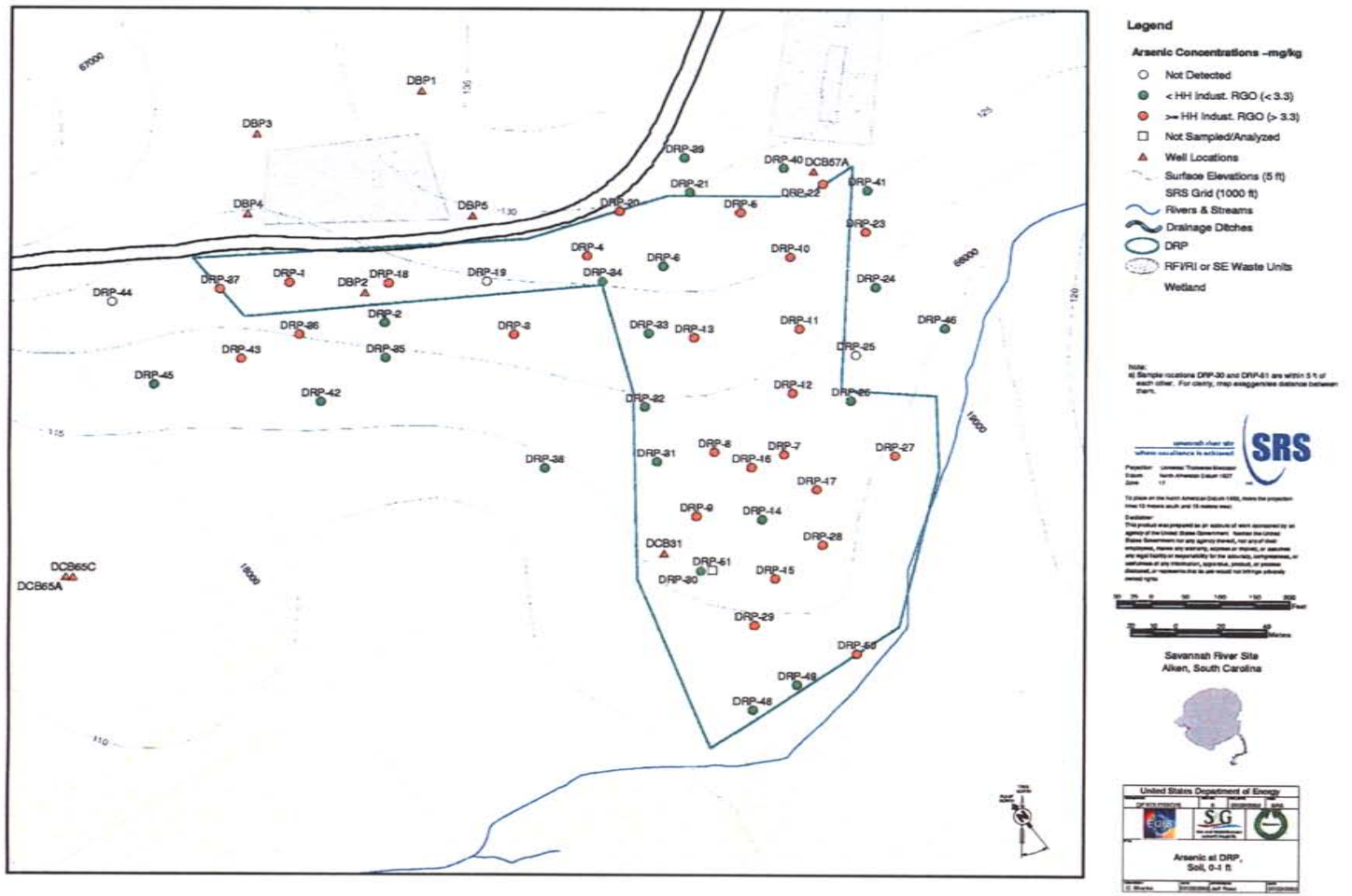

Figure 12. Extent of Arsenic Contamination at the DRP

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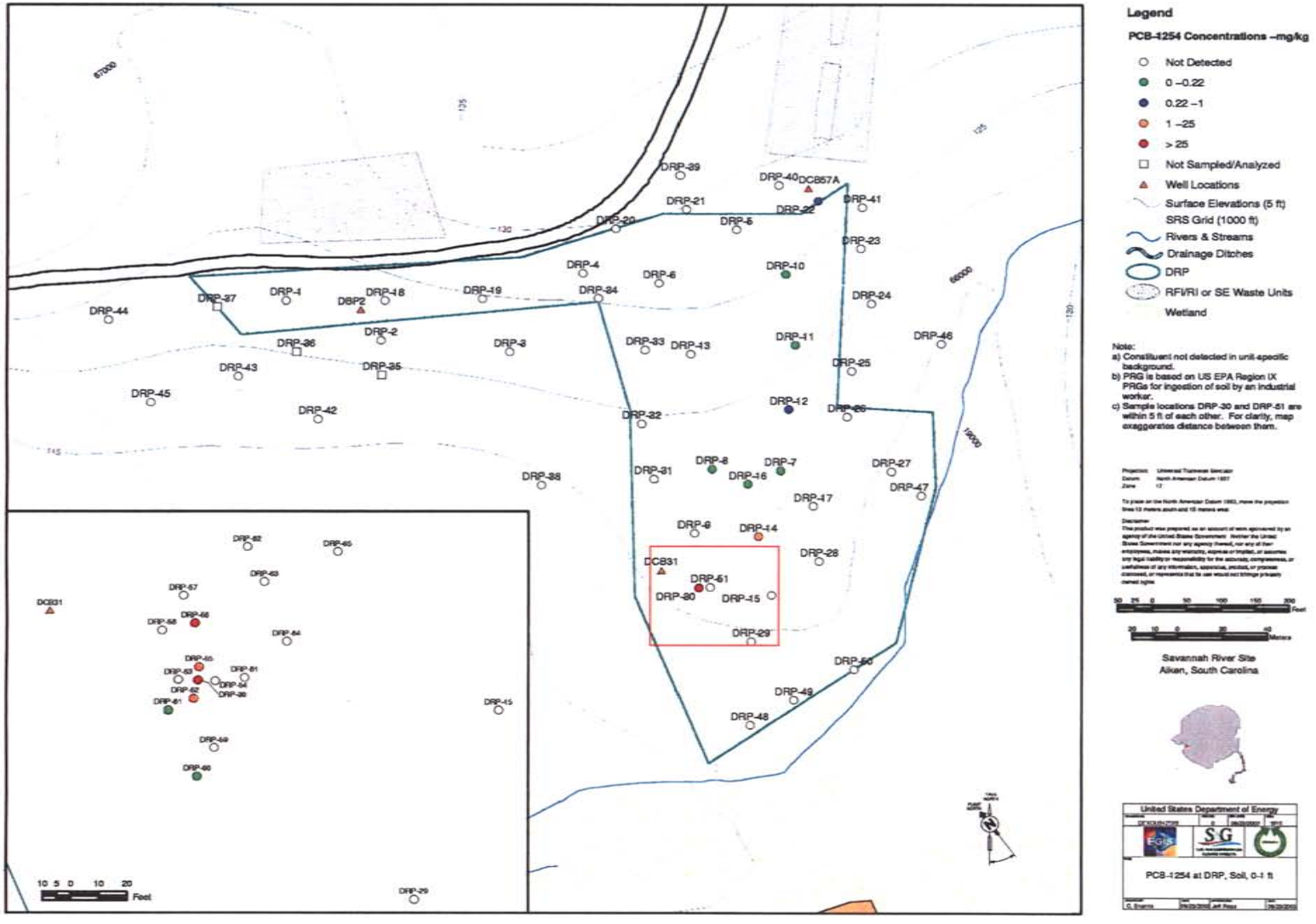

Figure 13. PCB Hotspot at DRP

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488-DAB

The contaminants identified during characterization are consistent with those from other studies of ash, coal, and associated leachate. The distribution of contaminants shows that primary source materials (ash and coal rejects) have impacted unit soils, as evidenced by the distribution of metals and coal-related radionuclides as well as areas of low surface water pH. Figure 14 shows the arsenic distribution in the 0 to 1 foot interval for the 488-DAB and all subunits. A summary of RCOCs for the 488-DAB is provided in Tables 2 and 3. There are no RCRA hazardous listed wastes associated with the 488-DAB unit.

As anticipated, the highest concentrations of constituents associated with ash and coal are typically present in the waste of the 488-DAB (Interior) (0 to 5.5 m [0 to 18 ft]). Concentrations/activities of metals and coal-related radionuclides typically decrease rapidly in the soils below the waste (depths below approximately 5.5 m [18 ft]), indicating that the clays below the basin are retarding vertical migration of contaminants (Figure 15).

In soil samples from the basin berm, concentrations/activities of metals and coal-related radionuclides are near unit-specific background levels in surface (0 to 0.3 m [0 to 1 ft]) soil but are elevated in the 0.3 to 3 m (1 to 10 ft) interval. Below 3 m (10 ft), concentrations/activities decrease and are comparable to unit-specific background. Surface water in the 488-D Pooled Basin has elevated metal concentrations and low pH. Figure 16 shows the pH distribution.

Impacted subunits outside of the 488-DAB (Interior) include the 488-D Drainage, 488-DAB (Exterior), and the DSVA. Affected media in these locations are primarily surface water and sediment. Contaminant concentrations decrease rapidly in the underlying (soil intervals). These areas receive low pH leachate from the 488-DAB and acidic runoff through coal-reject material.

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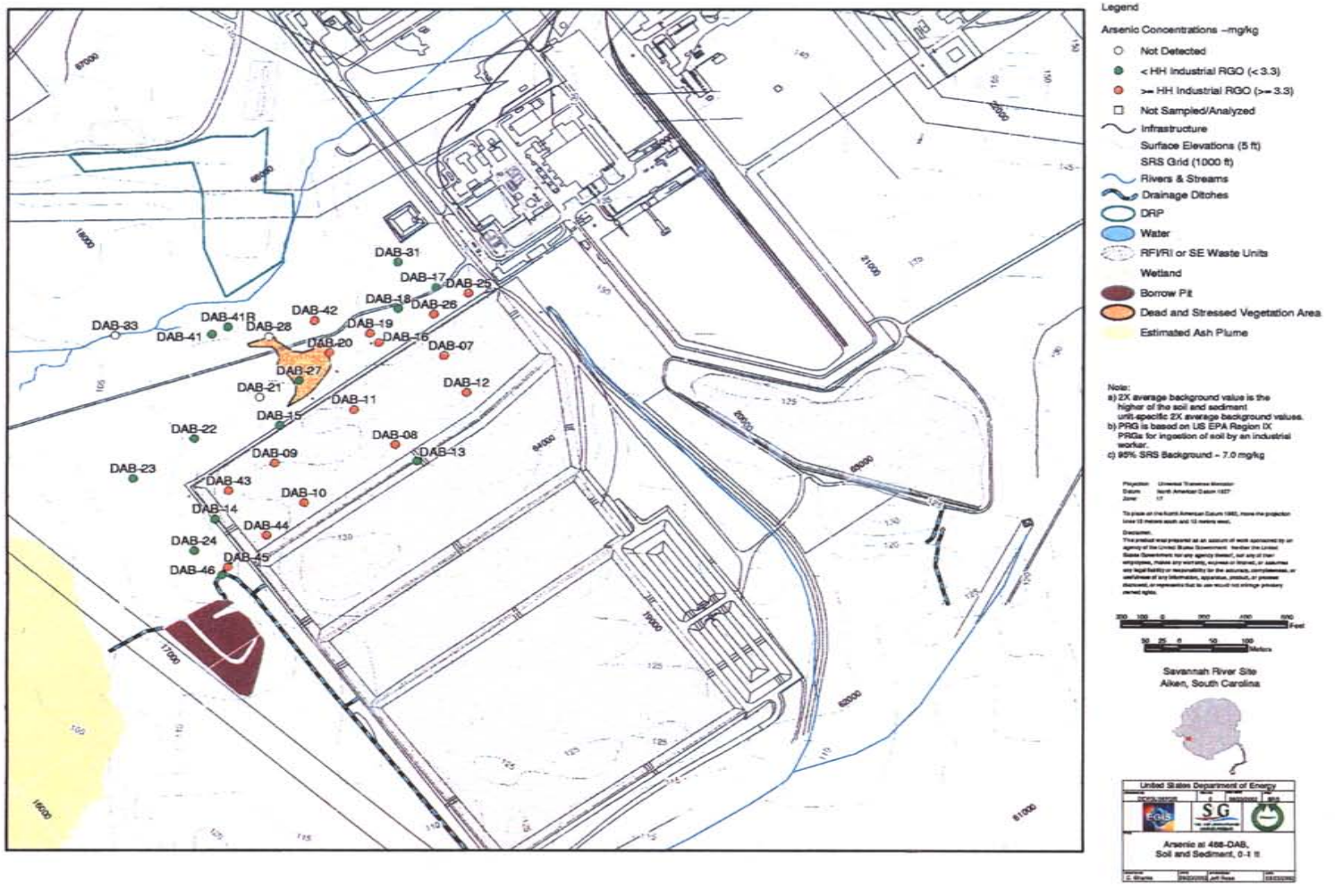

Figure 14. Arsenic Distribution for the 488-DAB and Subunits

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Table 3. Summary of Refined Constituents of Concern for Surface Water and Sediment at 488-D Pooled Basin, 488-D Drainage, and Dead and Stressed Vegetation Area

Refined COC	488-D Pooled Basin	488-D Drainage	Dead and Stressed Vegetation Area
Surface Water			
Aluminum	ARAR, ECO	ARAR, ECO	ARAR, ECO
Arsenic	ARAR, HH-res	ARAR, HH-res	
Beryllium	ARAR, ECO	ARAR, ECO	ECO
Cobalt		ECO	
Copper	ARAR, ECO	ARAR	
Iron	ARAR, ECO	ARAR, ECO	
Thallium	ARAR	ARAR	
pH	ECO	ECO	ECO
Sediment			
Arsenic		HH-res, ECO	HH-res
Actinium-228		HH-res	
Potassium-40		HH-res	HH-res
Radium-226		HH-res	
Radium-228			HH-res
pH			ECO

RCOC Designation:
ARAR = Applicable or Relevant and Appropriate Requirement
HH-res = Human Health RCOC for the future resident only
ECO = Ecological RCOC

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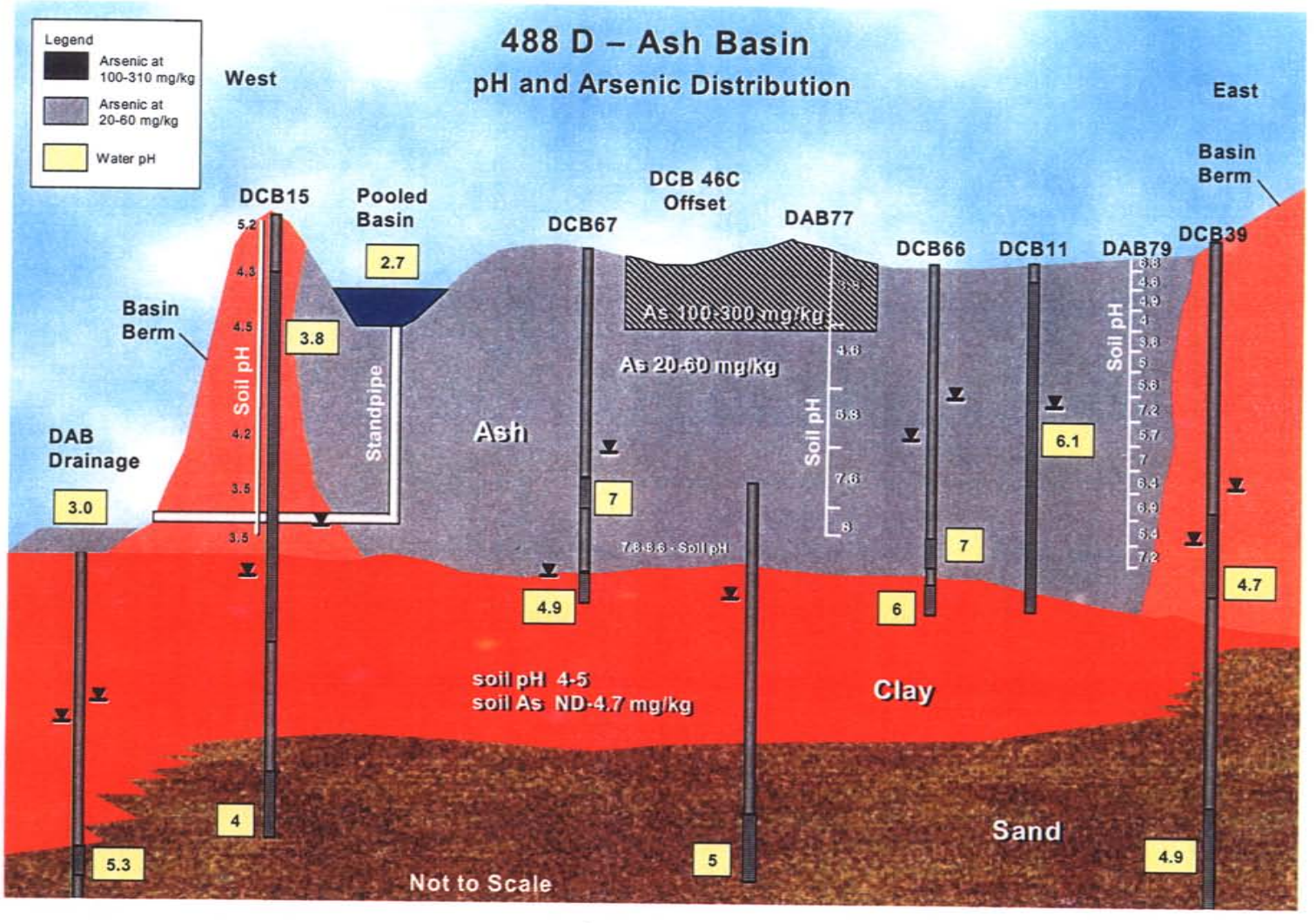

Figure 15. 488-DAB Cross-section

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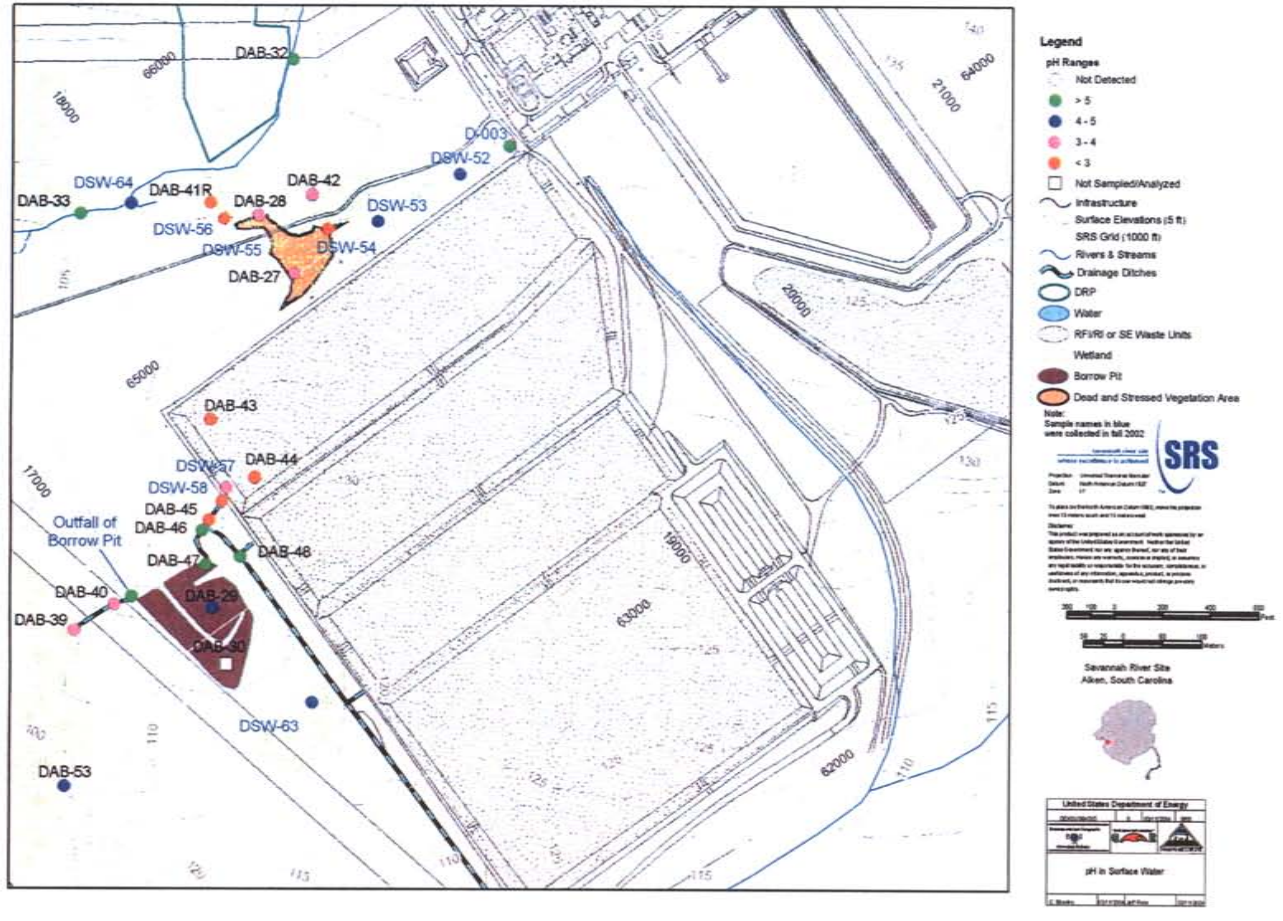

Figure 16. pH Distribution at 488-DAB and Subunits

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At the 488-D Drainage, the majority of RCOCs in sediment and surface water are metals. Highest concentrations are typically located in the gully immediately below the leaky 488-DAB standpipe.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

The current use for the DEXOU is for industrial powerhouse operation. Land use controls preventing unrestricted residential use are currently in place for two OUs in the general vicinity of DEXOU. These are the D-Area Burning Rubble Pit, located across the road from DRP, and the D-Area Oil Seepage Basin located about one-half mile to the northeast of the 488-DAB.

The DEXOU is located in an area that has been recommended for future industrial (non-nuclear) use by the SRS Citizens Advisory Board (CAB). According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited. The *Savannah River Site Federal Facility Agreement Implementation Plan* (WSRC 1996) designates the DEXOU as being within an industrial-use area with an industrial buffer zone.

Groundwater and Surface Water Uses

SRS does not use the water table aquifer for drinking water or irrigation purposes and currently controls any drilling in this area. Therefore, as long as USDOE maintains control of SRS, the aquifer beneath the DEXOU will not be used as a potential drinking water source or for irrigation. Groundwater monitoring is on-going and will be addressed as a separate OU.

Pooled surface water associated with the 488-D Pooled Basin is present due to the clay layer beneath the 488-DAB and provides no beneficial use. The 488-D Drainage receives

stormwater runoff and surface water from the 488-DAB and the 488-D Pooled Basin via the leaking standpipe. The 488-D Drainage provides a drainage path to the Borrow Pit but provides no other beneficial use. Surface water is present at the DSVA due to stormwater runoff from the 484-D powerhouse that has pooled in the drainage down from the D-003 outfall. The surface water at the DSVA provides no beneficial use. Surface water associated with the 488-DAB subunits will be addressed through the remedial actions presented in this document.

The Savannah River is the nearest surface water body that has beneficial use. It is used recreationally and supplies downstream users with drinking water. It is located 3000 feet to the west of DRP and 488-DAB, and cannot be directly impacted by contaminants at these two units. Groundwater monitoring as part of the D-Area Groundwater OU is ongoing to assess groundwater interaction with the Savannah River.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment

As a component of the RFI/RI process, a BRA (WSRC 2003a) was performed to evaluate risks associated with the DEXOU. The BRA determines what risks would be posed by the unit if no action were taken. The BRA provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The findings of the BRA include human health and ecological risk assessments and are summarized in the following paragraphs.

Summary of Human Health Risk Assessment

Identification of COCs

The following tables (Tables 4 through 10) present the COCs and exposure point concentrations (EPCs) for each of the COCs identified at the DEXOU. The EPC is the concentration used to estimate the exposure and risk for each COC. The tables include the range of concentrations detected for each COC, as well as the frequency of detection,

the EPC, and the statistical method used to derive the EPC. The EPC is determined as the lesser of the maximum detected concentrations and the 95th percent upper confidence limit (95% UCL) on the mean. Additional information regarding selection of the appropriate EPC is provided in Chapter 5 of the RFI/RI/BRA (WSRC 2003a).

Table 4. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the DRP Soil

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: DRP Surface Soil

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	6.84E-01	7.61E+01	mg/kg	47 / 50	1.56E+01	mg/kg	95% UCL
	Benzo(a)pyrene	1.87E-02	3.43E-01	mg/kg	8 / 47	1.03E-01	mg/kg	95% UCL
	Aroclor-1254	3.90E-02	2.52E+01	mg/kg	9 / 48	1.48E+00	mg/kg	95% UCL

Key
95% UCL: 95% Upper Confidence Limit

Table 5. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the 488-DAB (Interior) Soil

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: 488-DAB (Interior) Surface Soil

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	4.28E-01	3.10E+02	mg/kg	11 / 11	3.10E+02	mg/kg	MAX
	Iron	3.34E+03	1.08E+05	mg/kg	11 / 11	9.36E+04	mg/kg	95% UCL
	Thallium	9.65E-02	6.57E+00	mg/kg	11 / 11	6.57E+00	mg/kg	MAX
	Actinium-228	5.00E-01	3.71E+00	pCi/g	11 / 11	2.65E+00	pCi/g	95% UCL
	Lead-212	4.80E-01	3.65E+00	pCi/g	7 / 11	3.65E+00	pCi/g	MAX
	Potassium-40	2.54E+00	2.42E+01	pCi/g	11 / 11	1.72E+01	pCi/g	95% UCL
	Radium-226	5.90E-01	3.25E+00	pCi/g	10 / 11	2.27E+00	pCi/g	95% UCL
	Radium-228	1.34E+00	2.67E+00	pCi/g	6 / 11	2.16E+00	pCi/g	95% UCL
	Thorium-228	6.40E-01	3.78E+00	pCi/g	10 / 11	2.46E+00	pCi/g	95% UCL
	Thorium-234	3.91E+00	5.18E+00	pCi/g	3 / 7	5.04E+00	pCi/g	95% UCL
	Uranium-235	1.50E-01	4.70E-01	pCi/g	2 / 8	2.23E-01	pCi/g	95% UCL
	Uranium-238	2.17E+00	4.46E+00	pCi/g	6 / 10	3.32E+00	pCi/g	95% UCL

Key
95% UCL: 95% Upper Confidence Limit
MAX: maximum concentration

Table 6. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the 488-DAB (Exterior) Soil

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: 488-DAB (Exterior) Surface Soil

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	4.01E-01	1.92E+01	mg/kg	7 / 8	1.92E+01	mg/kg	MAX

Key
MAX: maximum concentration

Table 7. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the 488-D Pooled Basin Surface Water

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: 488-D Pooled Basin Surface Water

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	2.17E-02	2.62E-02	mg/L	2 / 2	2.62E-02	mg/L	MAX

Key
MAX: maximum concentration

Table 8. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the 488-D Drainage Surface Water

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: 488-D Drainage Surface Water

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	1.15E-03	1.73E-02	mg/L	2 / 4	1.73E-02	mg/L	MAX

Key
MAX: maximum concentration

Table 9. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the 488-D Drainage Sediment

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: 488-D Drainage Sediment

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	4.32E-01	7.78E+01	mg/kg	4 / 4	7.78E+01	mg/kg	MAX
	Actinium-228	1.06E+00	2.75E+00	pCi/g	3 / 4	2.75E+00	pCi/g	MAX
	Potassium-40	8.45E+00	2.16E+01	pCi/g	3 / 4	2.06E+01	pCi/g	95% UCL
	Radium-226	1.40E+00	2.13E+00	pCi/g	4 / 4	2.13E+00	pCi/g	MAX

Key
95% UCL: 95% Upper Confidence Limit
MAX: maximum concentration

Table 10. Summary of Human Health Constituents of Concern and Medium-Specific Exposure Point Concentrations for the Dead and Stressed Vegetation Area Sediment

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Dead and Stressed Vegetation Area Sediment

Exposure Route	Constituent of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Direct Contact	Arsenic	4.98E-01	3.58E+01	mg/kg	4 / 5	2.27E+01	mg/kg	95% UCL
	Potassium-40	2.49E+00	6.94E+00	pCi/g	5 / 5	6.94E+00	pCi/g	MAX
	Radium-228	1.45E+00	3.00E+00	pCi/g	5 / 5	2.97E+00	pCi/g	95% UCL

Key
95% UCL: 95% Upper Confidence Limit
MAX: maximum concentration

Exposure Assessment

Potential receptors are expected to differ for the current and future land use scenarios. The possible receptor under the current land use scenario is the known on-unit worker. Possible receptors under the future land use scenario include the hypothetical on-unit industrial worker and hypothetical on-unit residents (adult and child).

Current Land Use

The current potential receptor for exposure to constituents associated with the DEXOU is the on-unit worker who comes to the area on an infrequent or occasional basis. Known on-unit workers are defined as SRS employees who work at or in the vicinity of the DEXOU under current land use conditions. A known on-unit worker may be a researcher, environmental sampler, or personnel in close proximity to the unit. Although any of these receptors may be involved in the excavation or collection of contaminated media, they would follow SRS safety procedures and protocols for sampling at hazardous waste units. Nevertheless, limited exposure to unit media is a possibility.

Future Land Use

The potentially exposed receptors evaluated for the future land use scenario include the hypothetical on-unit industrial worker (adult) and hypothetical on-unit resident (adult and child). D Area has been designated as a non-nuclear industrial area surrounded by an industrial buffer zone. Although residential development is unlikely, a hypothetical residential exposure scenario for both adults and children was performed for comparative purposes (WSRC 2003a) in accordance with USEPA Region IV guidance (USEPA 1995). The hypothetical on-unit industrial exposure scenario addresses long-term risks to workers who are exposed to unit-related constituents while working within an industrial setting. The hypothetical on-unit industrial worker is an adult who works in an outdoor industrial setting in direct proximity to the contaminated media for the majority of his or her working time.

The hypothetical on-unit resident exposure scenario evaluates long-term risks to individuals expected to have unrestricted use of the unit. It assumes that residents live on-unit and are chronically exposed (both indoors and outdoors) to unit-related constituents. The hypothetical on-unit resident includes adults and children who are routinely exposed to contaminated media. For noncarcinogenic exposures for residents, a child and an adult are the receptors evaluated. For carcinogenic exposures for residents, a

weighted average child/adult is evaluated. This scenario assumes that a portion of the overall lifetime exposure to carcinogens occurs at a higher level of intensity during the first six years of a child's life (i.e., accounts for increased soil ingestion during child years). This receptor is exposed to all unit media, including soil, sediment, and surface water. Sediment and surface water exposure would occur while playing/wading in the local streams/wetlands.

Exposure routes describe the way a chemical or physical agent comes into contact with a receptor (i.e., by means of ingestion, inhalation, or dermal exposure). Exposure points are locations where contact between contaminant and receptor may occur. If a complete exposure route is suspected, the exposure assessment attempts to quantify contaminant concentrations and uptake at the exposure point. Hazard and risk estimates are then calculated for exposures occurring to environmental media at the exposure point via the relevant exposure routes. Identified below are the probable exposure routes for the DEXOU based on the contaminated media and anticipated activities at the exposure points:

- Ingestion (soil, sediment, biota, and surface water)
- Inhalation (of particles and vapors from soil)
- Dermal exposure (soil, sediment, and surface water)
- External Radiation (soil and sediment)

Toxicity Assessment

Tables 11 and 12 summarize the cancer and non-cancer toxicity data used in the risk calculations for the COCs identified at the DEXOU.

Table 11. Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Constituent of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Cancer Guideline Description	Source	Date (M/D/Y)
Arsenic	1.50E+00	3.66E+00	1/(mg/kg)/day	A	IRIS	4/15/02
Iron	--	--	--	D	--	--
Thallium	--	--	--	D	--	--
Benzo(a)pyrene	7.30E+00	2.35E+01	1/(mg/kg)/day	B2	IRIS	4/15/02
Aroclor-1254	2.00E+00	2.22E+00	1/(mg/kg)/day	B2	IRIS	4/15/02
Actinium-228	5.55E-12	--	Risk/pCi	A	HEAST	8/1/01
Lead-212	6.70E-11	--	Risk/pCi	A	HEAST	8/1/01
Potassium-40	6.18E-11	--	Risk/pCi	A	HEAST	8/1/01
Radium-226	7.30E-10	--	Risk/pCi	A	HEAST	8/1/01
Radium-228	2.29E-09	--	Risk/pCi	A	HEAST	8/1/01
Thorium-228	8.09E-10	--	Risk/pCi	A	HEAST	8/1/01
Thorium-234	6.70E-11	--	Risk/pCi	A	HEAST	8/1/01
Uranium-235	1.63E-10	--	Risk/pCi	A	HEAST	8/1/01
Uranium-238	2.10E-10	--	Risk/pCi	A	HEAST	8/1/01

Pathway: Inhalation

Constituent of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Cancer Guideline Description	Source	Date (M/D/Y)
Arsenic	4.3E-03	m^3/ug	1.51E+01	1/(mg/kg)/day	A	IRIS	4/15/02
Iron	None	--	None	--	D	--	--
Thallium	None	--	None	--	D	--	--

Pathway: Inhalation

Constituent of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Cancer Guideline Description	Source	Date (M/D/Y)
Benzo(a)pyrene	8.8E-04	m^3/ug	3.08E+00	1/(mg/kg)/day	B2	NCEA	1995
Aroclor-1254	5.7E-04	m^3/ug	2.00E+00	1/(mg/kg)/day	B2	IRIS	4/15/02
Actinium-228	--	--	4.92E-11	Risk/pCi	A	HEAST	8/1/01
Lead-212	--	--	5.77E-10	Risk/pCi	A	HEAST	8/1/01
Potassium-40	--	--	1.03E-11	Risk/pCi	A	HEAST	8/1/01
Radium-226	--	--	1.16E-08	Risk/pCi	A	HEAST	8/1/01
Radium-228	--	--	5.23E-09	Risk/pCi	A	HEAST	8/1/01
Thorium-228	--	--	1.43E-07	Risk/pCi	A	HEAST	8/1/01
Thorium-234	--	--	3.07E-11	Risk/pCi	A	HEAST	8/1/01
Uranium-235	--	--	1.01E-08	Risk/pCi	A	HEAST	8/1/01
Uranium-238	--	--	9.35E-09	Risk/pCi	A	HEAST	8/1/01

Pathway: External (Radiation)

Constituent of Concern	Cancer Slope Factor	Exposure Route	Units	Cancer Guideline Description	Source	Date (M/D/Y)
Actinium-228	4.53E-06	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Lead-212	5.09E-07	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Potassium-40	7.97E-07	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Radium-226	8.49E-06	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Radium-228	4.53E-06	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Thorium-228	7.76E-06	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Thorium-234	1.63E-08	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Uranium-235	5.43E-07	--	Risk/yr-pCi/g	A	HEAST	8/1/01
Uranium-238	1.14E-07	--	Risk/yr-pCi/g	A	HEAST	8/1/01

Key **USEPA Group**
---: **No information available**
HEAST: **Health Effects Assessment Summary Tables**
IRIS: **Integrated Risk Information System, USEPA**
NCEA: **National Center for Environmental Assessment**
NA: Not Applicable

A- Human carcinogen
B1- Probable human carcinogen – indicates that limited human data are available
B2- Probable human carcinogen – indicates sufficient evidence in animals and inadequate or no evidence in humans
C- Possible human carcinogen
D- Not classifiable as a human carcinogen
E- Evidence of non-carcinogenicity

Table 12. Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal									
Constituent of Concern	**Chronic/ Subchronic**	**Oral RfD Value**	**Oral RfD Units**	**Dermal RfD**	**Dermal RfD Units**	**Primary Target Organ**	**Combined Uncertainty/ Modifying Factors**	**Sources of RfD: Target Organ**	**Dates of RfD: Target Organ (M/D/Y)**
Arsenic	Chronic	3.00E-04	mg/kg-day	1.23E-04	mg/kg-day	Skin	3	IRIS	4/15/02
Iron	Chronic	3.00E-01	mg/kg-day	4.50E-02	mg/kg-day	Liver	1	NCEA: ATSDR	8/1/96: 1997
Thallium	Chronic	8.00E-05	mg/kg-day	1.20E-05	mg/kg-day	Blood	3000	IRIS	4/15/02
Benzo(a)pyrene	Chronic	3.00E-02	mg/kg-day	9.30E-03	mg/kg-day	Kidney	3000	IRIS	4/15/02
Aroclor-1254	Chronic	2.00E-05	mg/kg-day	1.80E-05	mg/kg-day	Eye	300	IRIS	4/15/02
Pathway: Inhalation									
Constituent of Concern	**Chronic/ Subchronic**	**Inhalation RfC**	**Inhalation RfC Units**	**Inhalation RfD**	**Inhalation RfD Units**	**Primary Target Organ**	**Combined Uncertainty/ Modifying Factors**	**Sources of RfC:RfD: Target Organ**	**Dates (M/D/Y)**
Arsenic	Chronic	None	---	None	---	---	---	---	---
Iron	Chronic	None	---	None	---	---	---	---	---
Thallium	Chronic	None	---	None	---	---	---	---	---
Benzo(a)pyrene	Chronic	None	---	None	---	---	---	---	---
Aroclor-1254	Chronic	None	---	None	---	---	---	---	---

Key
---: **no information available**
IRIS: **Integrated Risk Information System, USEPA**
NCEA: **National Center for Environmental Assessment**
ATSDR: **Agency of Toxic Substances and Disease Registry**
RfDs: **reference dose**
RfC: **reference concentration**

Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

where: risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing

the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of unit-related exposure. This is referred to as an "excess lifetime cancer risk" because it is in addition to the cancer risks individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. USEPA's generally acceptable risk range for unit-related exposures is 10^{-4} to 10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI> 1 indicates that unit-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD
where: CDI = Chronic daily intake`
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Tables 13 through 24 provide cancer and non-cancer risk characterization summaries for the COCs identified at the DEXOU.

Table 13. Risk Characterization Summary for the DRP - Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	4.09E-06	--	6.38E-07	N/A	4.73E-06
			Benzo(a)pyrene	1.31E-07	--	2.71E-07	N/A	4.03E-07
			Aroclor-1254	5.17E-07	--	3.68E-07	N/A	8.85E-07
							Surface Soil Direct Contact Risk Total =	5.38E-06
	Air Particulates	Inhalation of Soil as Dust	Arsenic	--	3.59E-09	--	N/A	3.59E-09
			Benzo(a)pyrene	--	4.79E-12	--	N/A	4.79E-12
			Aroclor-1254	--	4.46E-11	--	N/A	4.46E-11
							Air Particulate Risk Total =	3.64E-09
							Soil Risk Total =	5.38E-06
							Total Risk =	4.98E-06

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the DRP, arsenic, benzo(a)pyrene, and aroclor-1254 were identified as human health COCs. Only arsenic presents a risk to the future industrial worker.

Table 14. Risk Characterization Summary for the 488-DAB (Interior) - Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	8.12E-05	--	1.27E-05	N/A	9.39E-05
			Actinium-228	4.60E-09	--	--	5.48E-05	5.48E-05
			Lead-212	7.64E-08	--	--	8.48E-06	8.56E-06
			Potassium-40	3.32E-07	--	--	6.26E-05	6.29E-05
			Radium-226	5.18E-07	--	--	8.80E-05	8.85E-05
			Radium-228	1.55E-06	--	--	4.47E-05	4.62E-05
			Thorium-228	6.22E-07	--	--	8.72E-05	8.78E-05
			Thorium-234	1.06E-07	--	--	3.75E-07	4.81E-07
			Uranium-235	1.14E-08	--	--	5.53E-07	5.64E-07
			Uranium-238	2.18E-07	--	--	1.73E-06	1.95E-06
							Surface Soil Direct Contact Risk Total =	4.46E-04
	Air Particulates	Inhalation of Soil as Dust	Arsenic	--	2.21E-05	--	N/A	2.21E-05
			Actinium-228	--	1.10E-09	--	--	1.10E-09
			Lead-212	--	1.78E-08	--	--	1.78E-08
			Potassium-40	--	1.50E-09	--	--	1.50E-09
			Radium-226	--	2.22E-07	--	--	2.22E-07
			Radium-228	--	9.54E-08	--	--	9.54E-08
			Thorium-228	--	2.97E-06	--	--	2.97E-06
			Thorium-234	--	1.31E-09	--	--	1.31E-09
			Uranium-235	--	1.90E-08	--	--	1.90E-08
			Uranium-238	--	2.62E-07	--	--	2.62E-07
							Air Particulate Risk Total =	2.57E-05
							Soil Risk Total =	4.71E-04
							Total Risk =	4.71E-04

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the 488-DAB (Interior), metals and coal-related radionuclides present a risk to the future industrial worker. Thorium-234 and Uranium-235 do not present a risk to a future industrial worker, but are included as they are identified as human health COCs due to the risk posed to a future resident.

Table 15. Risk Characterization Summary for the 488-DAB (Exterior) - Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	5.03E-06	--	7.86E-07	N/A	5.82E-06
							Surface Soil Direct Contact Risk Total =	5.82E-06
	Air Particulates	Inhalation of Soil as Dust	Arsenic	--	4.38E-09	--	N/A	4.38E-09
							Air Particulate Risk Total =	4.38E-09
							Soil Risk Total =	5.82E-06
							Total Risk =	5.82E-06

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the 488-DAB (Exterior), arsenic was identified as a human health COC and presents a risk to the future industrial worker.

Table 16. Risk Characterization Summary for the 488-D Pooled Basin - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Contact	Arsenic	3.60E-06	--	9.13E-07	--	4.52E-06
							Surface Water Contact Risk Total =	4.52E-06
							Surface Water Risk Total =	4.52E-06
							Total Risk =	4.52E-06

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the 488-D Pooled Basin, surface water concentrations of arsenic present a risk to the future resident. Surface water does not present an exposure pathway for the future industrial worker, therefore a risk calculation has not been performed.

Table 17. Risk Characterization Summary for the 488-D Drainage - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Sediment	Sediment	Contact	Arsenic	2.61E-05	--	1.36E-06	--	2.75E-05
			Actinium-228	2.75E-09	--	--	3.41E-06	3.42E-06
			Potassium-40	2.29E-07	--	--	4.50E-06	4.73E-06
			Radium-226	2.80E-07	--	--	4.95E-06	5.23E-06
							Sediment Contact Risk Total =	4.09E-05
Surface Water	Surface Water	Contact	Arsenic	2.01E-06	--	5.09E-07	--	2.52E-06
							Surface Water Risk Total =	2.52E-06
							Total Risk =	4.34E-05

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the 488-D Drainage, sediment concentrations of arsenic and coal-related radionuclides present a risk to the future resident. Sediment does not present an exposure pathway for the future industrial worker, therefore a risk calculation has not been performed.

Surface water concentrations of arsenic presents a risk to the future resident. Surface water does not present an exposure pathway for the future industrial worker, therefore a risk calculation has not been performed.

Table 18. Risk Characterization Summary for the Dead and Stressed Vegetation Area - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Sediment	Sediment	Contact	Arsenic	7.62E-06	--	3.96E-07	N/A	8.01E-06
			Potassium-40	7.72E-08	--	--	1.52E-06	1.59E-06
			Radium-226	1.22E-06	--	--	3.69E-06	4.91E-06
							Sediment Contact Risk Total =	1.45E-05
							Sediment Risk Total =	1.45E-05
							Total Risk =	1.45E-05

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

At the DSVA, surface water concentrations of arsenic and coal-related radionuclides present a risk to the future resident. Surface water does not present an exposure pathway for the future industrial worker, therefore a risk calculation has not been performed.

Table 19. Risk Characterization Summary for the DRP – Non-Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	Skin	2.54E-02	N/A	3.97E-03	2.94E-02
			Benzo(a)pyrene	Kidney	1.68E-06	N/A	3.47E-06	5.15E-06
			Aroclor-1254	Eye	3.62E-02	N/A	2.57E-02	6.19E-02
							Soil Hazard Index Total =	9.13E-02
							Receptor Hazard Index =	9.13E-02

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Table 20. Risk Characterization Summary for the 488-DAB (Interior) - Non-Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	Skin	5.06E-01	N/A	7.89E-02	5.84E-01
			Iron	Liver	1.53E-01	N/A	6.51E-02	2.18E-01
			Thallium	Blood	4.02E-02	N/A	1.71E-02	5.73E-02
							Soil Hazard Index Total =	8.59E-01
							Receptor Hazard Index =	8.59E-01

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Table 21. Risk Characterization Summary for the 488-DAB (Exterior) – Non-Carcinogens

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

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Direct Contact	Arsenic	Skin	3.13E-02	N/A	4.89E-03	3.62E-02
							Soil Hazard Index Total =	3.62E-02
							Receptor Hazard Index =	3.62E-02

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Table 22. Risk Characterization Summary for the 488-D Pooled Basin – Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Direct Contact	Arsenic	Skin	7.98E-02	N/A	7.00E-03	8.68E-02
							Surface Water Hazard Index Total =	8.68E-02
							Receptor Hazard Index =	8.68E-02

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Table 23. Risk Characterization Summary for the 488-D Drainage – Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Direct Contact	Arsenic	Skin	4.74E-01	N/A	1.04E-02	4.84E-01
							Sediment Hazard Index Total =	4.84E-01
Surface Water	Surface Water	Direct Contact	Arsenic	Skin	4.44E-02	N/A	3.90E-03	4.83E-02
							Surface Water Hazard Index Total =	4.83E-02
							Receptor Hazard Index =	5.32E-01

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Table 24. Risk Characterization Summary for the Dead and Stressed Vegetation Area – Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Route	Constituent of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Direct Contact	Arsenic	Skin	1.38E-01	N/A	3.03E-03	1.41E-01
							Sediment Hazard Index Total =	1.41E-01
							Receptor Hazard Index =	1.41E-01

Key
---: Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

The receptor hazard index is less than 1, indicating the potential for adverse non-cancer effects is low.

Ecological Risk Assessment

Exposure Assessment

Based on field observations and literature review, major vegetative community types are identified within the study area. Vegetative community type patterns at SRS are dependent on topography, soil type, moisture, and degree of disturbance. Three primary plant community types were identified at the DEXOU: mixed pine/hardwood forest; mixed composition wetlands; and old field community.

Wildlife species inhabiting the DEXOU include white-tailed deer, wild turkey, feral hogs, squirrels, beavers, raccoons, small rodents, frogs, toads, and many songbirds. A variety of reptiles and other amphibians can also be expected to occur in this area. The diversity of habitats in the mixed pine/hardwood forest and the diversity of moisture regimes from dry hills to small water courses and wetlands allow many animal species to thrive.

The ecosystem potentially at risk includes both terrestrial and aquatic habitats at subunits across the DEXOU. The terrestrial areas associated with the DEXOU include the DRP and two subunits of the 488-DAB, the 488-DAB (Interior) (which consists entirely of primary source material) and the 488-DAB (Exterior). The aquatic areas potentially impacted include the DSVA, the 488-D Pooled Basin, and the 488-D Drainage.

The terrestrial portion of the DRP contains old field habitat as well as stands of mixed pine/hardwoods. The majority of the 488-DAB (Interior) is devoid of any vegetation with the exception of some very sparse grasses. The 488-DAB (Exterior) encompasses the area immediately to the north and west of the 488-DAB (Interior). This unit is entirely terrestrial and comprises mixed pine/hardwood forest.

The 488-D Pooled Basin consists of a depression in the southwest corner of the 488-DAB (Interior) that collects water during rain events. A standpipe in the pooled area historically discharged directly to the 488-D Drainage. The standpipe was capped to prevent any further migration of primary source material. The 488-D Pooled Basin is

devoid of any aquatic vegetation, has a pH of less than 3, and is likely capable of supporting only a limited diversity of aquatic life, if any.

The 488-D Drainage is located on the southwest side of the 488-DAB (Interior). The 488-D Drainage historically received runoff from the 488-D Pooled Basin. Currently, only a limited amount of seepage discharges to the drainage ditch. The ditch does not contain established aquatic vegetation but does pass through mixed forest and field/edge habitats as it flows west and downgradient to the 488-D Wetland.

The DSVA is a wetland area containing a number of decaying tree stumps and standing dead trees. It is located on the west side of the 488-DAB (Interior). In general, this area is capable of supporting a limited diversity of aquatic life due to seasonal fluctuations in water levels. The DSVA has been extensively studied and a summary is provided in the RFI/RI/BRA (WSRC 2003a). Plant species in the area are located on slightly higher ground, and include sweetgum, willow oak, black gum, loblolly pine, wax myrtle and sumac. Herbaceous vegetation in the area consists primarily of broomsedge and various rushes.

Threatened, endangered, and sensitive species field surveys have been performed at the 488-DAB (Interior), D-Area Coal Pile Runoff Basin (near the DEXOU), the D-Area Burning/Rubble Pits (adjacent to the DRP) and the nearby D-Area Oil Seepage Basin (approximately 1.6 km [1 mi]) northeast of the DEXOU). These surveys were performed by the Savannah River Forest Station (SRFS) in June and July of 1993/1994 and covered approximately 24.8 ha (62 acres). No threatened, endangered, or sensitive plants or animals were documented in these surveys.

Ecological exposure pathways, and the associated assessment and measurement endpoints, are presented in Table 25.

Table 25. Ecological Exposure Pathways of Concern

Exposure Medium	Sensitive Environment Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Soil	N	Insectivorous Mammals	N	Ingestion, direct contact, and indirect ingestion of chemicals in soil	Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival, and reproduction	Measured concentrations in soil used to model food chain uptake and compared to literature-based toxicity reference values
Soil	N	Insectivorous Birds	N	Ingestion, direct contact, and indirect ingestion of chemicals in soil	Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival, and reproduction	Measured concentrations in soil used to model food chain uptake and compared to literature-based toxicity reference values
Surface Water	N	Aquatic Invertebrates	N	Ingestion, respiration, and direct contact with chemicals in surface water	Maintain species diversity	Measured concentrations in surface water compared to ambient water quality criteria
Surface Water	N	Plants	N	Contact with low pH surface water	Maintenance of a balanced aquatic plant community	Measured pH compared to background
Surface Water	N	Mammals	N	Ingestion of low pH surface water	Ensure that exposure of low pH conditions do not have an acute toxicity effect or avoidance response	Measured pH compared to background
Surface Water	N	Birds	N	Ingestion of low pH surface water	Ensure that exposure of low pH conditions do not have an acute toxicity effect or avoidance response	Measured pH compared to background
Sediment	N	Benthic Invertebrates	N	Ingestion, respiration, and direct contact with chemicals in sediment	Maintenance of a balanced, indigenous benthic invertebrate community	Measured concentrations compared to literature-based toxicity reference values
Sediment	N	Plants	N	Contact with low pH sediment	Maintenance of a balanced aquatic plant community	Measured pH compared to background

Ecological Risk Characterization

Ecological risks due to soil exposure were assessed for soil invertebrates, herbivorous mammals, insectivorous mammals, omnivorous mammals, insectivorous birds, and carnivorous birds. Ecological risks due to sediment exposure were assessed for benthic invertebrates, mammalian aquatic predators, and avian aquatic predators. Ecological risks due to surface water exposure were assessed for aquatic organisms, mammalian aquatic predators, and avian aquatic predators. Available ecological research, including threatened, endangered, and sensitive species surveys, was used to identify specific ecological concerns.

At the DRP surface and subsurface soil exposure groups, antimony, arsenic, selenium, zinc, Aroclor-1254, and Aroclor-1260 are identified as ecological RCOCs. Based on food chain modeling, selenium and Aroclor-1254 have HQs greater than one for the insectivorous mammal community (HQ = 6 and 3, respectively). Selenium, zinc, and Aroclor-1254 have HQs greater than one for the insectivorous bird community (HQ = 4, 1, and 2, respectively). Aroclor-1260 was occasionally identified co-located with Aroclor-1254, and was retained as an ecological RCOC. The protective level for the PCB congeners is based on a total for all congeners. Based on the complete data set, antimony and arsenic have HQs less than one. However, a qualitative evaluation of the data and its distribution identified concentrations consistently elevated above protective levels (Table 26). For this reason, antimony and arsenic were identified as RCOCs. The insectivorous mammal and bird communities are expected to be exposed to the RCOCs through ingestion of soil invertebrates and incidental ingestion of soil material. Protective concentrations for the ecological RCOCs at the DRP are presented in Table 26.

At the 488-DAB (Interior) surface and subsurface soil exposure groups, arsenic, selenium, and vanadium are identified as ecological RCOCs. Based on food chain modeling, each constituent has an HQ greater than one for the insectivorous mammal community (HQ = 5, 9, and 2, respectively). Selenium is also identified as an RCOC for the insectivorous bird community (HQ = 6). These ecological communities are expected

to be exposed to the COCs through ingestion of soil invertebrates and incidental ingestion of soil material.

At the 488-DAB (Exterior) surface and subsurface soil exposure groups, there are no ecological RCOCs.

Table 26. COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors at DRP

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment / Measurement Endpoint
DRP	Soil	Antimony	11.7	mg/kg	HQ=1	Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival, and reproduction
		Arsenic	15.4	mg/kg	HQ=1	
		Selenium	0.7	mg/kg	HQ=1	
		Zinc	59.6	mg/kg	HQ=1	
		Total PCBs	4.38	mg/kg	HQ=1, UFF adjusted for 2,000 ft^2 area of contamination	

At the 488-D Pooled Basin surface water exposure group, aluminum, beryllium, copper, iron, and pH are identified as RCOCs for aquatic organisms and amphibians. Surface water concentrations of these constituents and the low pH conditions exceed state ambient water quality criteria (SCDHEC, 2001) for chronic exposure. Additionally, pH is identified as an RCOC for mammals and birds due to concerns over acute effects from the low pH conditions (pH range of 2.66 – 2.75).

At the 488-D Drainage surface water exposure group, aluminum, beryllium, cobalt, iron, and pH are identified as RCOCs for aquatic organisms and amphibians. Surface water concentrations of these constituents and the low pH conditions (pH range of 2.96 – 6.6) exceed state ambient water quality criteria (SCDHEC, 2001) for chronic exposure. Arsenic is identified as an RCOC for benthic organisms for the sediment exposure group.

At the DSVA surface water exposure group, aluminum, beryllium, and pH are identified as RCOCs for aquatic organisms and amphibians. Surface water concentrations of these

constituents and the low pH conditions (pH range of 3.0 – 3.75) exceed state ambient water quality criteria (SCDHEC, 2001) for chronic exposure. Additionally, pH is identified as an RCOC for plant communities. The sediment exposure group pH (pH range of 3.4 – 3.7) is also identified as an RCOC for benthic organisms and plant communities.

Protective concentrations for the ecological RCOCs for the 488-DAB subunits are presented in Table 27.

Table 27. COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors at 488-DAB

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment/Measurement Endpoint
488-DAB	Soil	Arsenic	15.4	mg/kg	HQ=1	Ensure that exposure of contaminants in prey, forage, and soils do not have a negative impact on growth, survival, and reproduction.
		Selenium	0.7	mg/kg	HQ=1	
		Vanadium	14.4 – 18.8	mg/kg	HQ=1; Background	
	Surface Water	Aluminum	8.70E-02	mg/L	AWQC	Maintain species diversity. Ensure that exposure of low pH conditions do not have an acute toxicity effect or avoidance response. (AWQC = South Carolina Ambient Water Quality Criteria (SCDHEC, 2001)
		Beryllium	5.30E-04	mg/L	AWQC	
		Cobalt	2.82E-02	mg/L	AWQC	
		Copper	1.69E-02	mg/L	AWQC	
		Iron	9.80E-01	mg/L	AWQC	
		pH	5.8	Units	Background	Maintenance of a balanced aquatic plant community
	Sediment	Arsenic	8.2	mg/kg	HQ=1	Maintain species diversity Ensure that exposure of low pH conditions do not have an acute toxicity effect.
		pH	5.01	Units	Background	Maintenance of a balanced aquatic plant community

Summary of the Fate and Transport Analysis

A contaminant migration analysis was performed to identify refined contaminant migration constituents of concern (CMCOCs). The contaminant migration analysis was performed only for the soil exposure groups. A constituent is identified as a CMCOC if leachability modeling predicts the constituent will leach to groundwater and exceed maximum contaminant levels (MCLs), preliminary remediation goals (PRGs), or risk-based activities (RBAs) within 1000 years.

DRP

CM RCOCs identified for the DRP in the RFI/RI/BRA include arsenic, beryllium, iron, lead, mercury, and selenium. The RFI/RI/BRA CM RCOCs were identified based on vadose zone transport modeling using conservative default soil-water partitioning coefficients (Kds). The analysis overestimated the leachability threat posed by unit soils (except for beryllium) as determined through comparison of current groundwater concentrations in a well located directly underneath the waste unit (DCB 31). The modeling was conducted again using refined Kds for all CM RCOCs (except beryllium) that are calculated and/or chosen based on D-Area-specific, SRS-specific, and/or other literature sources in order to obtain more accurate model predictions (WSRC 2003b).

The Kd for beryllium was not reevaluated in this analysis because the Kd in the RFI/RI/BRA was deemed consistent with D-Area conditions. Based on the revised leachability analysis, none of the CM RCOCs modeled are predicted to impact groundwater above MCLs or PRGs in the next 1000 years, and thus should not have RGs established for them (except for beryllium).

488-DAB

For the 488-DAB (Interior), two fate and transport modeling scenarios were evaluated: lateral flow (leaching to the clay under the basin and lateral transport above the clay with discharge to surface water) and vertical flow (leaching to the clay under the basin and

then through the clay to the water table aquifer). At the 488-DAB (Interior), there are no lateral CM RCOCs. However, vertical CM RCOCs are the following: arsenic; barium; beryllium; iron; mercury; selenium; thallium; radium-226; radium-228; uranium-234; uranium-235; and, uranium-238. There is some uncertainty as to whether these constituents pose an actual leachability threat. The following empirical observations indicate that over most of the basin, vertical migration of metals is not occurring from the basin to the Upper Three Runs Aquifer (UTRA):

- a significant difference in potentiometric head between the perched water above the clay and the UTRA below the clay, indicating that flow from the perched water into the UTRA occurs very slowly,

- a significant increase in both soil and water pH with depth in the basin, indicating that low pH surface water is not infiltrating through the basin and mobilizing metals at depth

- a significant decrease in concentrations of metals in the clay under the basin

- compared to concentrations in the basin waste, indicating limited migration of metals into the clay. The exception is in the southwest end of the basin in the vicinity of the 488-D Pooled Basin, where low pH leachate may be migrating through the bottom of the basin and into the UTRA.

Discussion of Principal Threat Source Material

There is no PTSM based on toxicity present at the DEXOU. There is no PTSM based on mobility at the DRP. PTSM based on mobility has only been identified at the 488-DAB (Interior). Arsenic and beryllium are identified as PTSM based on mobility due to a leachability threat. Arsenic and beryllium are currently present in groundwater above their respective MCL, and both are known to be present in coal reject material.

Conclusions

Actual or threatened releases of hazardous substances from these subunits, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

At the DRP, current site conditions present an unacceptable risk to ecological receptors. The presence of coal rejects at the unit has resulted in low pH leachate which has impacted groundwater through mobilizing beryllium, and concentrations are predicted to exceed the MCL.

At the 488-DAB (Interior), arsenic and beryllium have been identified as PTSM based on their mobility, and these constituents are currently present in groundwater above their respective MCLs. Current conditions present an elevated risk to the future industrial worker (4.7×10^{-4}). Constituents associated with the waste material also present an unacceptable risk to ecological receptors.

At the 488-D Pooled Basin, constituents in the surface water present an unacceptable risk to ecological receptors. At the 488-D Drainage and the DSVA, constituents associated with surface water and sediment also present an unacceptable risk to ecological receptors. At the 488-DAB (Exterior), the presence of coal rejects contributes to the low pH conditions observed in groundwater and at the DSVA. Current conditions in the 488-DAB (Exterior), upgradient of the DSVA, and in the DSVA have adversely impacted the local plant community. The contact of surface water with exposed coal rejects has led to a generation of low pH conditions in the surface water and sediments in the DSVA. These low pH conditions have contributed to the destruction of the plant community in this area.

The remedial actions selected for the 488-DAB and the DRP have been designed to attain an acceptable risk level for the future industrial worker (i.e., less than 1×10^{-6}), prevent ecological exposure to contaminants, and to protect groundwater.

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

The DEXOU is located in an area that has been recommended for industrial use by the SRS CAB. The *Savannah River Site Future Use Report Stakeholder Recommendations for SRS Land and Facilities* (USDOE 1996) recommends that residential uses of SRS land should be prohibited, and the *Federal Facility Agreement Implementation Plan* (WSRC 1996) designated the DEXOU as being within an industrial use area with buffer. The planned future use of the DEXOU by USDOE is continued industrial usage. Therefore, the specific concentration-based remedial goals (RGs) and remedial action objectives (RAOs) identified for the DEXOU are based on protecting the future industrial worker. For DEXOU, land use controls will be used to prevent unrestricted (residential or agricultural) use. RAOs specify the receptor, unit-specific contaminants, and media of concern. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure to contaminants.

The development of RGs for cleanup actions is intended to protect human health and the environment and to prevent further migration of contaminants. Remedial goal options (RGOs) are developed during the RFI/RI/BRA. RGOs are risk-based chemical concentration ranges that are used as target cleanup criteria. RGOs are developed for all RCOCs. In addition, RGOs are also developed considering chemical-specific applicable or relevant and appropriate requirement (ARAR) (See Appendix B) (e.g., promulgated regulatory level), where the risk-based RGO is less than background values. Table 28 presents the RGs for the DRP. Tables 29 and 30 present the RGs for the 488-DAB.

Table 28. Summary of Proposed Remedial Goals for Soils at DRP

Refined COC	Refined COC Type	Proposed RG	Units
Antimony	ECO	Visual Extent[1]	--
Arsenic	HH, ECO	3.30E+00[2]	mg/kg
Beryllium	CM	Visual Extent[1]	--
Selenium	ECO	Visual Extent[1]	--
Zinc	ECO	5.96E+01[3]	mg/kg
Benzo(a)pyrene	HH-res	Visual Extent[1]	--
Aroclor-1254	ARAR, HH-res, ECO	1.00E+00[4]	mg/kg
Aroclor-1260	ARAR, ECO	1.00E+00[4]	mg/kg

1. "Visual Extent" as determined by the presence of coal rejects or waste material and verified in the 0-1 foot interval by the arsenic and zinc RGs.
2. RG based on human health – future industrial worker risk (1.0E-06).
3. RG based on ecological risk (LOAEL-based HQ = 1).
4. RG based on total PCBs, rather than individual aroclors. RG based on the high occupancy use ARAR established under TSCA.

HH – Human Health,

HH-res – Human Health residential only,

ECO – Ecological,

CM – Contaminant Migration,

ARAR – Applicable or Relevant and Appropriate Requirements

Table 29. Summary of Proposed Remedial Goals for Soils at 488-DAB (Interior) and 488-DAB (Exterior)

Refined COC	488-DAB (Interior) Refined COC Type	488-DAB (Exterior) Refined COC Type	Proposed RG	Units
Arsenic	PTSM, CM, HH, ECO	HH	3.30E+00[1]	mg/kg
Barium	CM		4.18E+01[2]	mg/kg
Beryllium	PTSM, CM		3.32E-01[2]	mg/kg
Iron	CM, HH-res		8.34E+03[2]	mg/kg
Mercury	CM		5.4E-01[2]	mg/kg
Selenium	CM, ECO		7.00E-01[3]	mg/kg
Thallium	CM, HH-res		1.59E-01[2]	mg/kg
Vanadium	ECO		1.88E+01[2]	mg/kg
Actinium-228	HH		Visual Extent[4]	--
Lead-212	HH		Visual Extent[4]	--
Potassium-40	HH		Visual Extent[4]	--
Radium-226	CM, HH		Visual Extent[4]	--
Radium-228	CM, HH		Visual Extent[4]	--
Thorium-228	HH		Visual Extent[4]	--
Thorium-234	HH-res		Visual Extent[4]	--
Uranium-234	CM		Visual Extent[4]	--
Uranium-235	CM, HH-res		Visual Extent[4]	--
Uranium-238	CM, HH		Visual Extent[4]	--

1. RG based on human health – future industrial worker risk (1.0E-06).
2. RG based on two times unit-specific background average.
3. RG based on ecological risk (LOAEL-based HQ = 1).
4. Coal-related radionuclides will be addressed through removal of coal rejects (Visual Extent) and verified in the 0-1 foot interval by the arsenic RG.

HH – Human Health,

HH-res – Human Health resident only,

ECO – Ecological, CM – Contaminant Migration,

ARAR – Applicable or Relevant and Appropriate Requirements,

PTSM – Principal Threat Source Material

Table 30. Summary of Proposed Remedial Goals for Surface Water and Sediment at 488-D Pooled Basin, 488-D Drainage, and Dead and Stressed Vegetation Area

Refined COC	488-D Pooled Basin Refined COC Type	488-D Drainage Refined COC Type	Dead and Stressed Vegetation Area Refined COC Type	Proposed RG	Units
Surface Water					
Aluminum	ARAR, ECO	ARAR, ECO	ARAR, ECO	8.70E-02[1]	mg/L
Arsenic	ARAR, HH-res	ARAR, HH-res		1.50E-01[1]	mg/L
Beryllium	ARAR, ECO	ARAR, ECO	ECO	5.30E-04[1]	mg/L
Cobalt		ECO			
Copper	ARAR, ECO	ARAR		1.69E-02[1]	mg/L
Iron	ARAR, ECO	ARAR, ECO		9.80E-01[1]	mg/L
Thallium	ARAR	ARAR		2.00E-03[2]	mg/L
pH	ECO	ECO	ECO	5.8[3]	Units
Sediment					
Arsenic		HH-res, ECO	HH-res	3.30E+00[4]	mg/kg
Actinium-228		HH-res		Visual Extent[5]	--
Potassium-40		HH-res	HH-res	Visual Extent[5]	--
Radium-226		HH-res		Visual Extent[5]	--
Radium-228			HH-res	Visual Extent[5]	--
pH			ECO	NA[6]	Units

1. RG based on Ambient Water Quality Criteria (AWQC).
2. RG based on the MCL.
3. RG based on the unit-specific average.
4. RG based on the HH-future industrial worker soil (1.0E-06), as the end-state of the DSVA will be soil, not sediment.
5. Coal-related radionuclides will be addressed through removal of coal rejects (Visual Extent) and verified in the 0-1 foot interval by the arsenic RG.
6. The DSVA will not be restored as a wetland; therefore, the pH RG is not applicable (NA).

HH-res – Human Health residential only,

ECO – Ecological,

ARAR – Applicable or Relevant and Appropriate Requirements

DRP Remedial Action Objectives

- Prevent exposure of industrial workers to surface soils containing unacceptable levels of arsenic and aroclor-1254.

- Prevent exposure of ecological receptors to elevated levels of metals and PCBs in soils.

- Prevent generation of low pH leachate and beryllium from leaching to groundwater above MCL.

The RG for aroclor-1254 (a PCB) is based on the chemical-specific ARAR of 1 mg/kg for high occupancy use established in the Toxic Substances Control Act (TSCA), 40 CFR 761.

There are several compelling factors that make selection of a model-derived remedial goal (RG) for beryllium inappropriate. Beryllium is not co-located with known coal/waste deposited at the DRP in the main portion of the unit. Rather, beryllium was only detected in a small area of the northern portion of the unit (10% of total samples) and appears to be associated with naturally occurring iron nodules and not waste coal rejects. Since the modeling predicts beryllium to leach fairly quickly to the subsurface, it is likely that beryllium has already leached to groundwater due to the presence of low pH leachate in the main portion of the DRP. The monitoring well data show increasing pH and decreasing beryllium concentrations which suggests that beryllium is not a future threat to groundwater without a significant source of low pH leachate to mobilize this constituent in the subsurface at DRP. Therefore, the RG for beryllium should not be based on a numerical value but rather the remediation of coal reject material, which will prevent the generation of low pH leachate needed to leach beryllium. Thus, the RG will be established as excavation to the visual extent of coal rejects and waste.

RGOs for ecological protection were established for arsenic, zinc, antimony, selenium, aroclor-1254, and aroclor-1260. The RG for arsenic is based on industrial worker protection, as it is lower than the ecological RGO. The zinc RG is based on the ecological RGO. The distribution of antimony and selenium was consistent with the distribution of arsenic and the waste/coal rejects. Therefore, the RG for these two metals are also established based on the visual extent of the waste/coal rejects. The RG for the PCBs is based on the human health ARAR, which was determined to be protective for ecological receptors since the area impacted by PCBs is small.

488-DAB Remedial Action Objectives

- Prevent or minimize contaminants leaching to groundwater above MCLs/preliminary remedial goals (PRGs).
- Prevent exposure of industrial workers to waste materials, surface soils, and sediments containing unacceptable levels of arsenic and coal-related radionuclides.
- Prevent exposure of ecological receptors to arsenic, selenium, and vanadium present in the basin.
- Prevent or minimize the acidic runoff that results in pooled water at the west end of the basin.
- Prevent exposure of ecological receptors to metals in surface water in the 488-D Pooled Basin, the 488-D Drainage, and the DSVA above ambient water quality criteria.
- Protect ecological receptors from elevated arsenic in sediment in the 488-D Drainage ditch.
- Prevent exposure of ecological receptors to unacceptable risk due to low pH (due to the presence of coal fines) in the sediment in the DSVA.

The 1 x 10^{-6} risk and contaminant migration values for the radionuclides (except for uranium-238) are below naturally occurring background levels; thus RGOs based on unit-specific background are included in Table 29 and Table 30. Since arsenic is the best indicator of coal-related contamination, and surface soils will be verified to the industrial worker 1 × 10^{-6} cancer risk RG, visual observation of waste (coal rejects) will be used as the RG for coal-related radionuclides.

The RFI/RI/BRA established RGOs in the DSVA based on residential exposure to sediments, since this area is a wetland. However, the DSVA will not be restored as a wetland, it will be replaced elsewhere or wetland bank credits will be used. After removal of coal rejects and fines, this area will be backfilled and vegetated with grass. Thus, an industrial worker scenario is more applicable and the 1 x 10^{-6} industrial worker RG value of 3.3 mg/kg for arsenic will be used as the surface soil cleanup level.

To address surface water contamination in the 488-D Pooled Basin, 488-D Drainage, and the DSVA, the Clean Water Act (ambient water quality criteria) would be used to establish the RGs. Since the actions will prevent further generation of contaminated surface water, the existing surface water will be treated based on the relevant action-specific ARAR value.

IX. DESCRIPTION OF ALTERNATIVES

A detailed analysis of the alternatives was conducted in the CMS/FS (WSRC 2003b) to determine the best set of remedial alternatives for the DEXOU. Four alternatives for DRP and three alternatives for 488-DAB were retained for detailed evaluation. Remedial alternatives that contain institutional controls as part of the remedy are expected to continue for greater than 30 years so for comparative purposes, a 500-year present worth (PW) cost estimate was used. For remedies that include land use and institutional controls a LUCIP will be developed providing implementation, monitoring, and reporting details. These alternatives are briefly discussed below:

Remedy Components, Common Elements, and Distinguishing Features of Each Alternatives for DRP

Alternative DRP-1 – No Action

The No Action Alternative is required by the National Contingency Plan (NCP) in order to provide a baseline for comparison against remedial action. It involves no activity to monitor, remove, treat, or otherwise mitigate the contamination. The alternative provides no long-term effectiveness and does not reduce the toxicity, mobility or volume of contaminants. This alternative is readily implementable.

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

- Estimated Capital Cost: $0
- Estimated Annual Operations and Maintenance (O&M) Cost (excludes five-year remedy reviews): $0
- Estimated Present Worth (3.9% Discount Rate): $0
- Estimated Construction Time Frame: None
- Estimated Time to Achieve RAOs: Not Applicable

Description of Remedy Components

Alternative DRP-1 does not include treatment components or engineering controls. Alternative DRP-1 requires no administrative or monitoring controls. This alternative requires no operations and maintenance (O&M).

Common Elements and Distinguishing Features

Alternative DRP-1 (No Action) has no common features with the other three alternatives. This alternative does not meet Toxic Substances Control Act (TSCA) action level (40 CFR 761) for PCBs of 1 mg/kg. Alternative DRP-1 does not protect human health and the environment or achieve RAOs for DRP.

Alternative DRP-2 – Consolidation to 1.8 hectare (4.5 acre) Footprint, Low Permeability Geosynthetic Cover System, Institutional Controls, and Monitoring

This alternative is a containment option. Figure 17 illustrates this alternative. Perimeter soils containing coal rejects (approximately 8,410 m^3 [11,000 yd^3]) would be excavated to visual extent of coal rejects (a minimum of 0.3 m [1 ft]) and would be re-positioned within a 1.8 ha (4.5 acre) footprint at DRP. An aroclor-1254 hot spot (approximately 57 m^3 [2,000 ft^3]) would be removed and transported to an approved off-SRS disposal facility. A low permeability geosynthetic cover system would be installed over the 1.8 ha (4.5 acre) footprint to limit infiltration for protection of groundwater. The excavated areas would be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion and infiltration.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to prevent exposure to contamination left in place. Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action. Site maintenance (site inspections, mowing, general housekeeping, repair of erosion damage, and other routine maintenance as needed) would be required to maintain the cover.

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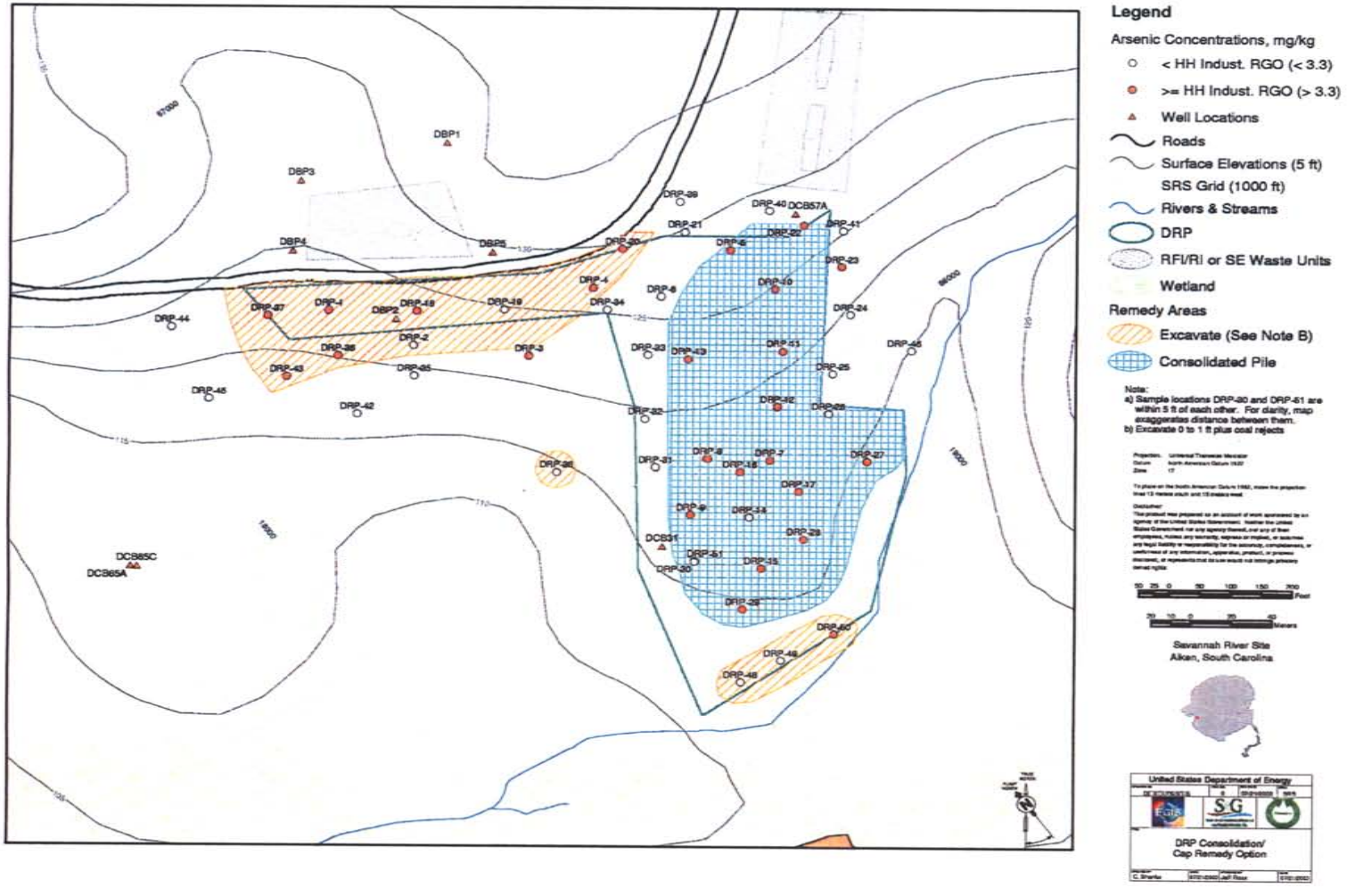

Figure 17. Alternative DRP-2 Consolidation and Cover System

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

- Estimated Capital Cost: $2,460,730
- Estimated Annual O&M Cost (includes five-year remedy review): $185,870
- Estimated Present Worth (3.9% Discount Rate): $2,646,600
- Estimated Construction Time Frame: 1 to 2 years
- Estimated Time to Achieve RAOs: 1 to 2 years

Description of Remedy Components

Alternative DRP-2 does not include treatment components. It includes engineering controls in the form of a geosynthetic cover system. It includes land use controls to prevent residential use and disturbance of the cover system. Groundwater monitoring is required to help evaluate the cover systems effectiveness. Alternative DRP-2 requires maintenance for the low permeability cover system.

Common Elements and Distinguishing Features

Alternative DRP-2 is similar to alternatives DRP-3 and DRP-4 in that they all meet ARARs (TSCA action level for PCBs of 1 mg/kg), protect human health and the environment, and are reliable. Although DRP-2 includes institutional controls and groundwater monitoring (as does DRP-3 and DRP-4), the land use controls are more stringent and the time for groundwater monitoring is longer since waste (60,000 yd^3 of contaminated soil, coal rejects and debris) is left in place. The key distinguishing feature is that DRP-2 is a containment alternative utilizing a geosynthetic cover, whereas DRP-3 and DRP-4 are both removal alternatives.

Alternative DRP-3 – Excavation and consolidation of waste into the 488-DAB, Institutional Controls, and Monitoring

This alternative is a removal option. Figure 18 illustrates this alternative. Waste material and soils containing coal rejects (approximately 45,870 m^3 [60,000 yd^3]) would be excavated to visual extent (a minimum of 0.3 m [1 ft]) of waste and coal rejects and would be transported to the 488-DAB for consolidation under a geosynthetic cover. An aroclor-1254 hot spot (approximately 57 m^3 [2,000 ft^3]) would be removed and transported to an approved off-SRS disposal facility. The excavated areas would be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to prevent exposure to residual contamination. Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action.

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

- Estimated Capital Cost: $2,257,166
- Estimated Annual O&M Cost (includes five-year remedy review): $101,255
- Estimated Present Worth (3.9% Discount Rate): $2,358,421
- Estimated Construction Time Frame: 1 to 2 years
- Estimated Time to Achieve RAOs: 1 to 2 years

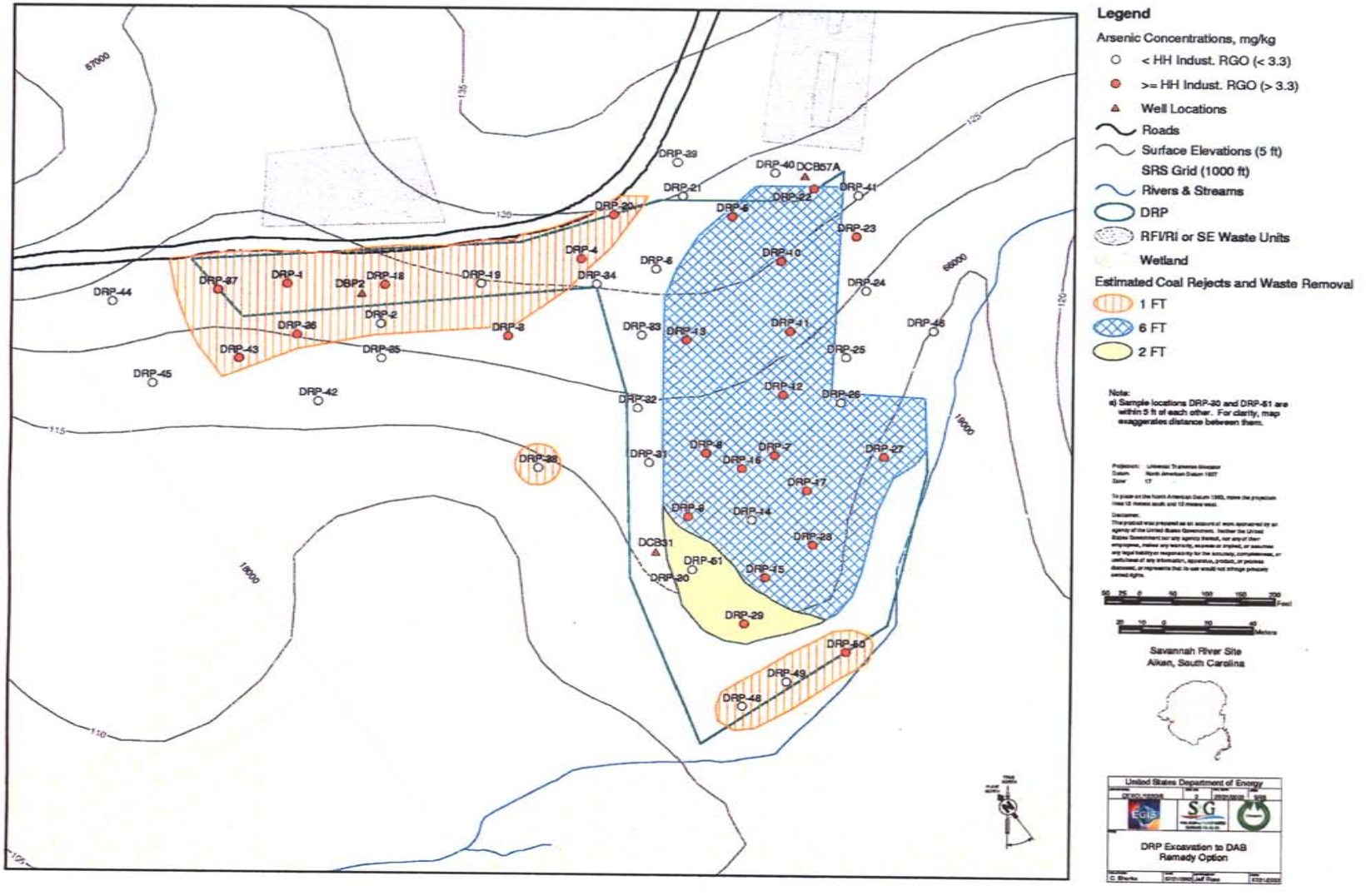

Figure 18. Alternatives DRP-3 and DRP-4 Excavation Extent

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Description of Remedy Components

Alternative DRP-3 does not include treatment components. The excavated soils, coal rejects, and debris will be managed at 488-DAB. This alternative does not require engineering controls or maintenance. Groundwater monitoring is needed to verify that the removal was effective in preventing groundwater impact. This alternative includes land use controls to prevent residential use. This alternative requires administrative and institutional controls.

Common Elements and Distinguishing Features

Alternative DRP-3 is similar to alternatives DRP-2 and DRP-4 in that they all meet ARARs (TSCA action level for PCBs of 1 mg/kg), protect human health and the environment, and are reliable. The key distinguishing feature is that DRP-3, like DRP-4, is a removal alternative, however, the destination of the 60,000 yd^3 of contaminated soil, coal rejects and debris is the 488-DAB.

Alternative DRP-4 – Excavation and consolidation of all waste material, off-SRS disposal, Institutional Controls, and Monitoring

This alternative is a removal option. Alternative DRP-4 is the same as Alternative DRP-3 except that Alternative DRP-4 includes off-SRS disposal instead of consolidation at 488-DAB. Waste material and soils containing coal rejects approximately 45,870 m^3 (60,000 yd^3) would be excavated to visual extent (a minimum of 0.3 m [1 ft]) of coal and an aroclor-1254 hot spot (approximately 57 m^3 [2,000 ft^3]) would be removed and transported to an approved off-SRS disposal facility. The area would be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to prevent exposure to residual contamination.

Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action.

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

- Estimated Capital Cost: $4,592,546
- Estimated Annual O&M Cost (includes five-year remedy review): $101,255
- Estimated Present Worth (3.9% Discount Rate): $4,693,801
- Estimated Construction Time Frame: 1 to 2 years
- Estimated Time to Achieve RAOs: 1 to 2 years

Description of Remedy Components

Alternative DRP-4 does not include treatment components. The excavated soils, coal rejects, and debris will be managed off the SRS. This alternative does not require engineering controls or maintenance. Groundwater monitoring is needed to verify that the removal was effective in preventing groundwater impact. This alternative includes land use controls to prevent residential use. This alternative requires administrative and institutional controls.

Common Elements and Distinguishing Features

Alternative DRP-4 is similar to alternatives DRP-2 and DRP-3 in that they all meet ARARs (TSCA action level for PCBs of 1 mg/kg), protect human health and the environment, and are reliable. The key distinguishing feature is that DRP-4 is a removal alternative, like DRP-3; however, the destination of the 60,000 yd^3 of contaminated soil, coal rejects and debris is off-site (Off-SRS).

Alternatives for 488-DAB

Alternative 488-DAB-1 – No Action

The No Action Alternative is required by the NCP in order to provide a baseline for comparison against remedial action. It involves no activity to monitor, remove, treat, or otherwise mitigate the contamination. The alternative provides no long-term effectiveness and does not reduce the toxicity, mobility or volume of contaminants through treatment. This alternative is readily implementable.

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

- Estimated Capital Cost: $0
- Estimated Annual Operations and Maintenance (O&M) Cost (excludes five-year remedy reviews): $0
- Estimated Present Worth (3.9% Discount Rate): $0
- Estimated Construction Time Frame: None
- Estimated Time to Achieve RAOs: Not Applicable

Description of Remedy Components

Alternative 488-DAB-1 does not include treatment components or engineering controls. Alternative 488-DAB-1 requires no administrative or monitoring controls. This alternative requires no operations and maintenance (O&M).

Common Elements and Distinguishing Features

Alternative 488-DAB-1 (No Action) has no common features with the other alternatives. This alternative does not protect human health and the environment or achieve RAOs for the 488-DAB.

Alternative 488-DAB-2 – Consolidation of Exposure Areas (DSVA, Basin Exterior, 488-DAB Drainage), Low Permeability Geosynthetic Cover System, Institutional Controls, Monitoring

This alternative is a containment option (Figure 19). This alternative addresses PTSM present at 488-DAB (the ash and coal within the basin) and prevents groundwater impact by limiting infiltration through the waste. Coal rejects and impacted soils (approximately 38,200 m^3 [50,000 yd^3]) outside of the 488-DAB (from the DSVA, Basin Exterior, and 488-DAB Drainage) would be excavated to visual extent (a minimum of 0.3 m [1 ft]) and consolidated in the 488-DAB. The portion of the DSVA delineated as a wetland (approximately 0.4 ha [1 acre]) would be replaced either through the site wetland bank or by reconstructing a wetland at another location. The existing standpipe in the west end of 488-DAB would be covered, plugged or removed to prevent further impact to the drainage ditch. Water pooled in the west end of the 488-DAB (approximately 3.8 million liters [1 million gallons]) would be treated based on the relevant action-specific ARAR value for land application or discharge to surface water. Treatment options include treatment at a permitted onsite treatment facility, treatment and discharge adjacent to the basin, treatment and reuse in cap construction activities, or treatment and land application within the area of contamination (AOC).

A low permeability geosynthetic cover system would be installed over the 488-DAB. At a minimum, the cover system would include an infiltration layer, an erosion layer of earthen material capable of sustaining native plant growth, and have a minimum hydraulic conductivity of 1 x 10^{-8} cm/s. The excavated

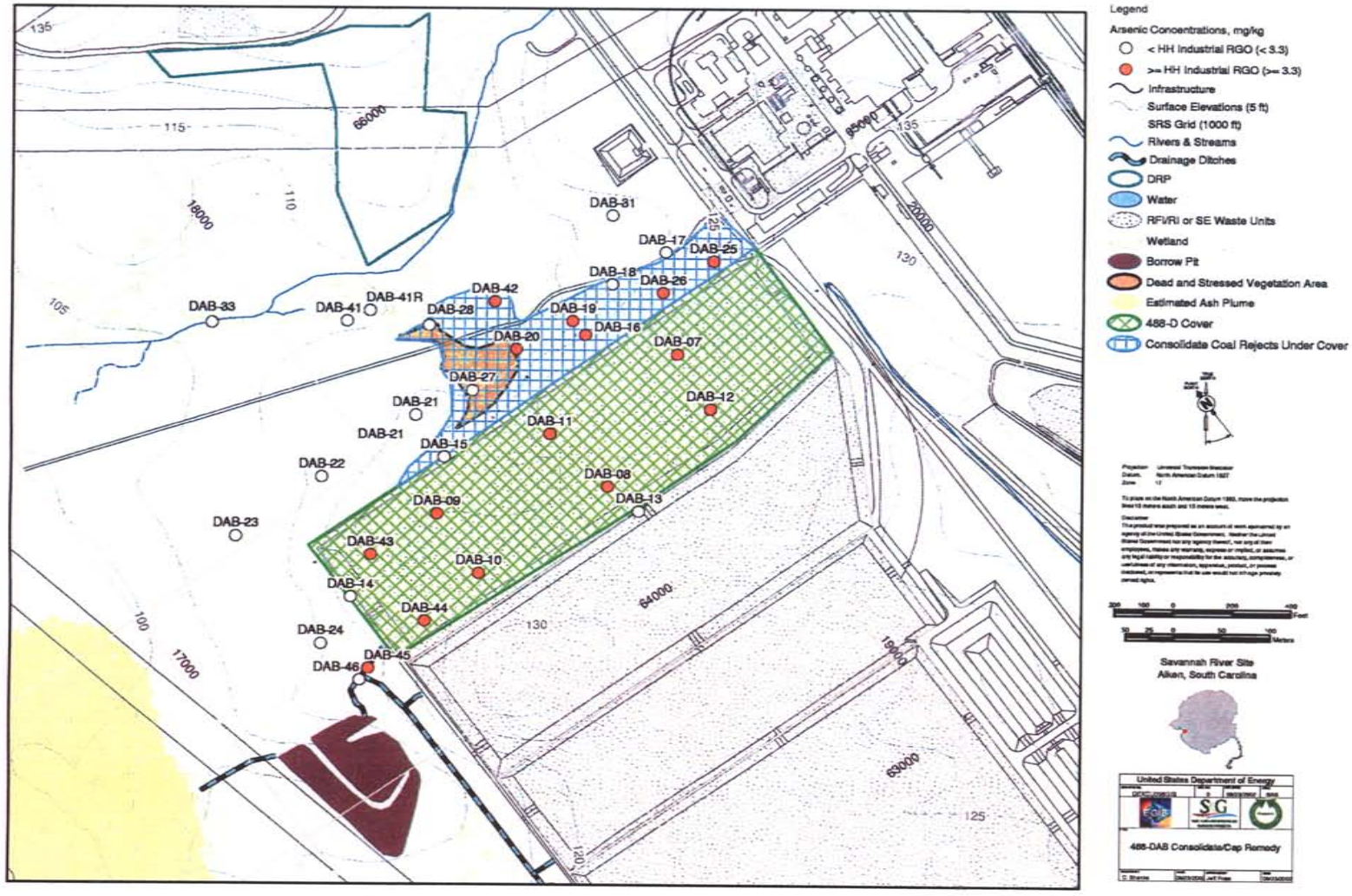

Figure 19. Alternative 488-DAB-2 Consolidation and Low Permeability Cover System

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areas would be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion and infiltration.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to prevent exposure to contamination left in place. Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action. Site maintenance (site inspections, mowing, general housekeeping, repair of erosion damage, and other routine maintenance as needed) would be required to maintain the cover.

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

- Estimated Capital Cost: $12,788,050
- Estimated Annual O&M Cost (includes five-year remedy review): $298,691
- Estimated Present Worth (3.9% Discount Rate): $13,086,741
- Estimated Construction Time Frame: 1 to 2 years
- Estimated Time to Achieve RAOs: 1 to 2 years

Description of Remedy Components

Although alternative 488-DAB-2 does not include treatment as a principal component of the remedy, it includes treatment for any water present in the Pooled Basin and the DSVA. Treatment options include treatment at a permitted onsite treatment facility, treatment and discharge adjacent to the basin, treatment and reuse in cap construction activities, or treatment and land application within the area of contamination (AOC). Alternative 488-DAB-2 includes engineering controls in the form of a low permeability cover system to isolate waste and prevent impact to the environment. Long-term

maintenance of cover system will be required. There will be footprint reduction through consolidation into the basin.

Common Elements and Distinguishing Features

Alternative 488-DAB-2 is similar to 488-DAB-3 in that it involves the excavation of 50,000 yd3 of material outside the basin, and treatment of any surface water in the pooled basin and DSVA. Both Alternatives 488-DAB-2 and 488-DAB-3 meet ARARs, protect human health and the environment, and are reliable. The key distinguishing feature is that this alternative is a containment alternative using a geosynthetic cover system to prevent exposure and minimize infiltration. Long-term maintenance is needed to maintain the cover system and groundwater monitoring is needed to measure the effectiveness of the cover system. Land use controls will be required to prevent residential use and cover disturbance.

Alternative 488-DAB-3 - Excavation of Waste Material and Offsite Disposal (Non-SRS), Institutional Controls

This alternative is a removal option. Coal rejects and impacted soils (approximately 38,200 m^3 [50,000 yd^3]) outside of 488-DAB (from the DSVA, Basin Exterior, and 488-DAB Drainage) would be excavated to visual extent (a minimum of 0.3 m [1 ft]) and disposed of off-SRS. The ash and coal rejects within the 488-DAB (approximately 550,500 m^3 [720,000 yd^3]) would be excavated and disposed of off-SRS. The portion of the DSVA delineated as a wetland (approximately 0.4 ha [1 acre]) would be replaced either through the site wetland bank or by reconstructing a wetland at another location. The existing standpipe in the west end of 488-DAB would be removed to prevent further impact to the drainage ditch. Water pooled in the west end of the 488-DAB (up to 3.8 million liters [1 million gallons]) would be treated based on the relevant action-specific ARAR value. Treatment options include treatment at a permitted onsite treatment facility, treatment and discharge adjacent to the basin, or treatment and land

application within the AOC. The disturbed areas would be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion.

This alternative addresses PTSM present at 488-DAB (the ash and coal within the basin) and prevents groundwater impact by removing the PTSM.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to prevent exposure to residual contamination. Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action.

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

- Estimated Capital Cost: $38,126,826
- Estimated Annual O&M Cost (includes five-year remedy review): $101,255
- Estimated Present Worth (3.9% Discount Rate): $38,228,081
- Estimated Construction Time Frame: 2 to 3 years
- Estimated Time to Achieve RAOs: 2 to 3 years

Description of Remedy Components

Although alternative 488-DAB-3 does not include treatment as a principal component of the remedy, it includes treatment for any water present in the Pooled Basin and the DSVA. Treatment options include treatment at a permitted onsite treatment facility, treatment and discharge adjacent to the basin, or treatment and land application within the area of contamination (AOC). Alternative 488-DAB-3 requires no engineering controls or monitoring controls. Administrative controls would be required to restrict residential use. Operations and maintenance, including inspections and sign maintenance, is a part of this alternative.

Common Elements and Distinguishing Features

Alternative 488-DAB-2 is similar to 488-DAB-3 in that it involves the excavation of 50,000 yd^3 of material outside the basin, and treatment of any surface water in the pooled basin and DSVA. Both Alternatives 488-DAB-2 and 488-DAB-3 meet ARARs, protect human health and the environment, and are reliable. The key distinguishing feature is that this alternative is a removal alternative (800,000 yd^3 of waste) for off-site disposal.

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

All the remedial alternatives identified for the DEXOU have been evaluated against the nine CERCLA criteria that provide the basis for selecting the best remedial alternatives. The nine CERCLA criteria are divided into three groups: the Threshold Criteria, the Balancing Criteria, and the Modifying Criteria. These are discussed in Table 31.

Table 31. CERCLA Criteria for Selecting Remedial Alternatives

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

A detailed evaluation of each remedial alternative is documented in the CMS/FS (WSRC 2003b). A summary of the overall conclusions resulting from the detailed CERCLA nine-criteria evaluation for each of DEXOU units is provided in Table 32 (DRP) and Table 33 (488-DAB). A relative comparison of the alternatives for each unit is included. In these tables, the CERCLA Criteria are evaluated based on whether the alternative does or does not meet the requirement.

DRP Alternatives

Overall Protection of Human Health and the Environment

Alternatives DRP-2, DRP-3 and DRP-4 would be protective of human health and the environment. Soils would either be contained (capping) or removed to the extent practicable. The PCB hot spot would be removed. Each alternative includes mechanisms to (1) protect groundwater quality, and (2) prevent human and ecological access to contaminated media. Alternative DRP-2 provides a geosynthetic cover system to prevent infiltration to groundwater. Alternatives DRP-3 and DRP-4 provide a greater level of overall protection because the contamination would be removed from the waste sub-unit rather than managed in place.

Alternative DRP-1 (No Action) would not be protective of human health and the environment. The resulting conditions would be the same as current conditions, which pose unacceptable risks to current and future industrial workers.

Compliance with ARARs

Alternatives DRP-2, DRP-3, and DRP-4 comply with the chemical, action, and location-specific ARARs specified in Appendix B, Table B-1. Alternative DRP-1 does not comply with the ARARs as PCBs are present above the TSCA limits for high occupancy use.

Table 32. Alternative Evaluation Summary for the DRP

Criterion	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	No Action	Consolidation to 4.5 acre footprint, Low Permeability Geosynthetic Cover System, Institutional Controls, Monitoring	Excavation and consolidation of waste into the 488-DAB, Institutional Controls, Monitoring	Excavation of all waste material and Off-SRS Disposal, Institutional Controls, Monitoring
Overall Protection of Human Health and the Environment				
Protection of Human Health	Not Protective	Protective	Protective	Protective
Protection of the Environment	Not Protective	Protective	Protective	Protective
Compliance with ARARs				
Chemical-Specific	Not Applicable	Achieves Chemical-Specific ARARs	Achieves Chemical-Specific ARARs	Achieves Chemical-Specific ARARs
Location-Specific	Not Applicable	Achieves Location-Specific ARARs	Achieves Location-Specific ARARs	Achieves Location-Specific ARARs
Action-Specific	Not Applicable	Achieves Action-Specific ARARs	Achieves Action-Specific ARARs	Achieves Action-Specific ARARs
Long-Term Effectiveness and Permanence				
Magnitude of Residual Risks	Risks remain unchanged, not protective	Risks are reduced to acceptable levels by controlling exposure pathway	Risk would be eliminated at the unit. Risk greater than alternative 2 and equal to alternative 4.	Industrial risk would be eliminated at the unit. Residential risk remain.
Adequacy of Controls	Not Adequate	Adequate	Adequate	Adequate
Permanence	Not Permanent	Permanent	Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment				
Treatment Process	None	None	None	None
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	No reduction through treatment	No reduction through treatment	No reduction through treatment
Short-Term Effectiveness				
Risk to Remedial Workers	Not applicable; no remedial action involved.	Controlled through Work Plan involving erosion and runoff control	Controlled through Work Plan involving erosion and runoff control and through transport safety requirements.	Controlled through Work Plan involving erosion and runoff control and through transport safety requirements.
Risk to Community	Not applicable; no remedial action involved.	None	None	Greater risk to community over other alternatives; however, controlled through transport safety requirements.
Risks to Environment	Not applicable; no remedial action involved.	Moderate. ~8 acres cleared and 3 acres consolidated, erosion controls protect surface water	Moderate. ~ 8 acres cleared, erosion controls protect surface water	Moderate. ~ 8 acres cleared, erosion controls protect surface water
Estimated Time Frame to Achieve RAOs or concentration-based RGs	Does not achieve RAOs/RGs	1 - 2 years	1 - 2 years	1 - 2 years
Implementability				
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward, specialized materials, equipment and labor not required to complete remediation	Straightforward, specialized materials, equipment and labor not required to complete remediation	Straightforward, specialized materials, equipment and labor not required to complete remediation
Ability to Construct and Operate the Remedial Technology	Not Applicable	Readily Implemented	Readily Implemented; some risks with excavation of asbestos	Readily Implemented; some risks with excavation of asbestos
Ability to Obtain Permits/Approvals from Agencies	Not Applicable	Readily implemented	Readily implemented	Readily implemented, offsite WAC verification required
Ease of Undertaking Additional Actions	Compatible	Compatible	Compatible	Compatible
Time to Implement	Readily implementable	1 - 2 years	1 - 2 years	1 - 2 years
Cost				
Capital Costs	$0	$2,460,730	$2,257,166	$4,592,546
O&M Costs	$0	$185,870	$101,255	$101,255
Total Present-Worth Costs	$0	$2,646,600	$2,358,421	$4,693,801

Table 33. Alternative Evaluation Summary for the 488-DAB

Criterion	Alternative 1	Alternative 2	Alternative 3
	No Action	Consolidation of Exposure areas (DSVA, basin exterior, DAB drainage), Low Permeability Geosynthetic Cover System, Institutional Controls, Monitoring	Excavation of all waste material for Off-SRS Disposal, Institutional Controls
Overall Protection of Human Health and the Environment			
Protection of Human Health	Not Protective	Protective	Protective
Protection of the Environment	Not Protective	Protective	Protective
Compliance with ARARs			
Chemical-Specific	Does not meet AWQC in CWA	Achieves Chemical-Specific ARARs	Achieves Chemical-Specific ARARs
Location-Specific	Not Applicable	Achieves Location-Specific ARARs	Achieves Location-Specific ARARs
Action-Specific	Not Applicable	Achieves Action-Specific ARARs	Achieves Action-Specific ARARs
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risks	Risks remain unchanged, not protective	Risks are reduced to acceptable levels by controlling exposure pathway and preventing impact to surface water & groundwater	Industrial risk would be eliminated at the unit. Residential risk remain. Less residual risk than alternative 2.
Adequacy of Controls	Not Adequate	Adequate	Adequate
Permanence	Not Permanent	Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process	None	None	None
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	No reduction through treatment	No reduction through treatment
Short-Term Effectiveness			
Risk to Remedial Workers	Not applicable; no remedial action involved.	Controlled through Work Plan involving erosion and runoff control	Controlled through Work Plan involving erosion and runoff control and through transport safety requirements. Shoring requirements signaficant due to excavation.
Risk to Community	Not applicable; no remedial action involved.	None	Greater risk to community over other alternatives; however, controlled through transport safety requirements.
Risks to Environment	Not applicable; no remedial action involved.	Minimal, some clearing outside of basin, erosion controls protect surface water (SW)	Minimal, some clearing outside of basin, erosion controls protect surface water (SW)
Estimated Time Frame to Achieve RAOs or concentration-based RGs	Does not achieve RAOs/RGs	1 - 2 years	2 - 3 years
Implementability			
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward, specialized materials, equipment and labor not required to complete remediation	Straightforward, specialized materials, equipment and labor not required to complete remediation
Ability to Construct and Operate the Remedial Technology	Not Applicable	Straightforward	More difficult than 2, will have to dewater entire basin, stability of ash slurry, sheet piling for a large portion of basin.
Ability to Obtain Permits/Approvals from Agencies	Not Applicable	Readily implemented	Readily implemented
Ease of Undertaking Additional Actions	Compatible	Compatible	Compatible
Time to Implement	Readily implementable	1 - 2 years	2 - 3 years
Cost			
Capital Costs	$0	$12,788,050	$38,126,826
O&M Costs	$0	$298,691	$101,255
Total Present-Worth Costs	$0	$13,086,741	$38,228,081

Long-Term Effectiveness and Permanence

Alternatives DRP-3 and DRP-4 would reduce residual risk to 1E-06 for the industrial worker. Alternative DRP-2 would isolate contamination under the engineered cover and minimize impact to groundwater. Placement of clean backfill over the excavated areas would prevent exposure to residual risk at depth for Alternatives DRP-2, DRP-3 and DRP-4. Alternatives DRP-3 and DRP-4 would remove contaminated soil, waste and coal rejects from the DRP, thereby providing a greater level of permanence than Alternative DRP-2. Alternative DRP-2 (including an engineered cover) would be subject to erosion and would require more long-term maintenance. Alternative DRP-1 (No Action) would be neither effective in the long-term nor permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives DRP-1, DRP-2, DRP-3 and DRP-4 would not involve treatment to reduce toxicity, mobility, or volume.

Short-Term Effectiveness

This criteria is not applicable to Alternative DRP-1 (No Action) since no remedial action is being conducted.

Risk to Remedial Workers

The short-term risks to remedial workers would increase with the volume of contaminated media directly handled or processed and with project duration. In addition, remedial workers would be exposed to potential construction-related risks, which would increase with project duration and depth of excavation. Using established health and safety procedures, potential short-term risks to remedial workers should be manageable for all alternatives under consideration.

Alternative DRP-2 would offer minimal risk by excavation a portion of the contaminated soils and installing the engineered cover system. Alternative DRP-3 would offer a slightly greater risk by excavating and handling a larger volume of contaminated soils. Alternative DRP-4 would offer an additional risk because it requires the soils to be packaged, sampled, and shipped/transported, which results in greater handling and exposure time.

Risk to Community

Alternatives DRP-2 and DRP-3 present minimal risk to the community because the contaminated soils would remain within SRS boundaries. There would be little to no exposure concerns to the public because the DEXOU is located several miles from the nearest SRS boundary. Alternative DRP-4 would present the greatest risk to the public because contaminated soils would be transferred over public railways and roadways to an off-SRS disposal facility. However, any increase in off-SRS traffic would be negligible and controlled through transport safety requirements.

Risk to Environment

Alternatives DRP-2, DRP-3 and DRP-4 would have a moderate impact to the environment since clearing and/or excavation is required over about 8 acres. For each of these alternatives, erosion control measures would be performed in order to protect surface water adjacent to DRP.

Estimated Time Frame to Achieve RAOs or Concentration-Based RGs

Given that SRS has controls in place to prevent unacceptable exposure to current workers, the time to construct the remedy is not identified as a key consideration in the remedy selection process. Regardless, the amount of time needed to achieve protectiveness after remedial action would be equal for Alternative DRP-2, DRP-3, and DRP-4 at 1 to 2 years. Alternative DRP-1 would not achieve protectiveness.

Implementability

Alternative DRP-1 (No Action) does not involve any action; therefore, implementability is not applicable. The remaining three alternatives are easily implementable. The applied technologies (i.e. excavation, consolidation, placement of a cover system, disposal) are common for the disposition of waste units. However, design and placement of a cover system (DRP-2) is generally more complicated than excavation and may require specialized equipment and permanent relocation of drainage adjacent to DRP due to the proximity to the cover. Also, if asbestos is encountered in significant quantities, worker protection controls will also complicate the excavation for Alternatives DRP-2, DRP-3, and DRP-4. Alternatives DRP-3 and DRP-4 require additional material to be excavated. Alternative DRP-4 is the most difficult to implement since it involves off-SRS transportation and disposal, although standard earth-moving equipment is readily available. Moreover, Alternative DRP-4 also requires the waste meet off-SRS disposal facility waste acceptance criteria. Design efforts for Alternative DRP-2 are more complicated than Alternatives DRP-3 and DRP-4 due to the cover system

Cost

The costs for long term maintenance and institutional controls are calculated for 500 years. Beyond this time period, the present worth of those future costs are essentially zero, therefore the alternatives are comparable regardless of how much longer maintenance or institutional controls are required. The costs of each DRP alternative are provided in Table 32.

State Acceptance

SCHDEC prefers Alternative DRP-3, Excavation and consolidation of waste into the 488-DAB, Institutional Controls, Monitoring.

Community Acceptance

The SB/PP public comment period began on Feb 11, 2004, and ended on March 26, 2004. No public comments were received; therefore, community acceptance of the alternative has been granted.

488-DAB Alternatives

Overall Protection of Human Health and the Environment

All alternatives, except Alternative 488-DAB-1 (No Action), would be protective of human health and the environment. For Alternatives 488-DAB-2 and 488-DAB-3, soils and ash material containing refined COCs and PTSM would either be contained (under a cover system) or removed. Alternatives 488-DAB-2 and 488-DAB-3 include mechanisms to (1) protect groundwater quality and (2) prevent human access to contaminated media. Alternative 488-DAB-3 provides a greater level of overall protection because the contamination would be removed from the waste subunit rather than managed in place.

Compliance with ARARs

Alternatives 488-DAB-2 and 488-DAB-3 would comply with the ARARs identified in Appendix B Table B-1. Alternative 488-DAB-1 (No Action) would not meet the AWQC for water present in the 488-D Pooled Basin, 488-D Drainage, or DSVA.

Long-Term Effectiveness and Permanence

All alternatives except Alternative 488-DAB-1 (No Action) effectively eliminate exposure pathways so that there would be no unacceptable risk to a future industrial worker.

Alternative 488-DAB-2 would isolate contamination under the engineered cover and minimize impact to groundwater. Placement of clean backfill over the excavated areas

would prevent exposure to residual risk at depth for Alternatives 488-DAB-2 and 488-DAB-3. Alternative 488-DAB-3 would reduce the long-term residual risk better than Alternative 488-DAB-2 because contaminants would be removed from the subunit rather than managed in place.

Although the residual risk for each alternative is generally similar, the alternatives have different degrees of permanence. Alternative 488-DAB-3 would remove soil containing refined COCs and PTSM from the unit, thereby providing a greater level of permanence than the other alternatives. Alternative 488-DAB-3 would be more permanent than Alternative 488-DAB-2 because an engineered cover (Alternative 488-DAB-2) would be subject to erosion and would require more long-term maintenance.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 488-DAB-1 would not involve treatment to reduce toxicity, mobility, or volume. Treatment is not a principal component of either 488-DAB-2 or 488-DAB-3. However, treatment of any pooled basin water for Alternatives 488-DAB-2 and 488-DAB-3 would reduce the toxicity associated with the dissolved metals prior to discharge or release.

Short-Term Effectiveness

This criteria is not applicable to Alternative DRP-1 (No Action) since no remedial action is being conducted.

Risk to Remedial Workers

The short-term risks to remedial workers would increase with the volume of contaminated media directly handled or processed and with project duration. In addition, remedial workers would be exposed to potential construction-related risks, which would increase with project duration and depth of excavation. Using established health and

safety procedures, potential short-term risks to remedial workers should be manageable for all alternatives under consideration.

Alternative 488-DAB-3 would offer a greater risk than 488-DAB-2 because it involves excavating the largest volume of soil, and the soils must be packaged, sampled, and shipped/transported, which results in greater handling and exposure time. Alternative 488-DAB-3 would also offer additional construction risks due to the deeper excavations required for removal.

Risk to Community

Alternative 488-DAB-2 presents minimal risk to the community because the contaminated soils would remain within SRS boundaries. There would be little to no exposure concerns to the public because the DEXOU is located several miles from the nearest SRS boundary. Alternative 488-DAB-3 would present the greatest risk to the public because contaminated soils may be transferred over public railways, waterways, and roadways to an off-SRS disposal facility; however, the risks from off-SRS traffic would be controlled through transport safety requirements.

Risk to Environment

Alternatives 488-DAB-2 and 488-DAB-3 would have a minimal impact to the environment since some clearing would be required. For both of these alternatives, erosion control measures would be performed in order to protect surface water.

Estimated Time Frame to Achieve RAOs or Concentration-Based RGs

Given that SRS has controls in place to prevent unacceptable exposure to current workers, the time to construct the remedy is not identified as a key consideration in the remedy selection process. Regardless, the amount of time needed to achieve protectiveness after remedial action would be greater for Alternative 488-DAB-3 (2 to 3

years) compared to Alternative 488-DAB-2 (1 to 2 years). Alternative 488-DAB-1 would not achieve protectiveness.

Implementability

Alternative 488-DAB-1 (No Action) does not involve any action; therefore, implementability is not applicable. The applied technologies (i.e., excavation, consolidation, placement of a cover system, disposal) are common for the disposition of waste units. Design and placement of a geosynthetic cover system (Alternative 488-DAB-2) is generally more complicated than excavation and may require specialized equipment. However, Alternative 488-DAB-3 is considerably more difficult to implement than Alternative 488-DAB-2 due to the large volume of material to be excavated, significant shoring, and the potential dewatering of a large volume of pooled water in the basin. In addition, 488-DAB-3 involves off-SRS transportation and disposal of a very large volume (~800,000 cubic yards) of waste.

Cost

The costs for long term maintenance and institutional controls are calculated for 500 years. Beyond this time period, the present worth of those future costs are essentially zero, therefore the alternatives are comparable regardless of how much longer maintenance or institutional controls are required. The costs of each 488-DAB alternatives are provided in Table 33.

State Acceptance

SCHDEC prefers Alternative 488-DAB-2, Consolidation of Exposure areas (DSVA, Basin Exterior, 488-D Drainage), Low Permeability Geosynthetic Cover System, Institutional Controls, and Monitoring.

Community Acceptance

The SB/PP public comment period began on February 11, 2004, and ended on March 26, 2004. No public comments were received; therefore, community acceptance of the alternative has been granted.

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

The selected remedy for the DEXOU is excavation of waste material from DRP (Alternative DRP-3) and consolidation with the 488-DAB in conjunction with consolidation of the 488-DAB exposure areas (DSVA, basin exterior, DAB drainage), and application of a low permeability geosynthetic cover system, institutional controls, and monitoring (Alternative 488-DAB-2). See Figure 20 for the illustration of the combined units into a single remedy.

The rationale for proposing this remedy over the other alternatives includes the following:

- The proposed remedy satisfies the preference to remove RCOCs at DRP to the extent practicable versus Alternative DRP-2, which leaves material in place.

- The proposed 488-DAB remedy satisfies the preference to remove refined COCs to the extent practicable (at the 488-DAB Drainage, DSVA and Basin Exterior). Consolidation of material onto the basin (Alternative 488-DAB-2) is less expensive than disposal at an off-SRS facility (Alternative 488-DAB-3). Alternative 488-DAB-2 does not involve transportation of wastes on off-SRS public right-of-ways as Alternative 488-DAB-3 does. Removal of refined COCs at the 488-DAB Interior is cost prohibitive and results in more short-term risk to the community than the proposed alternative.

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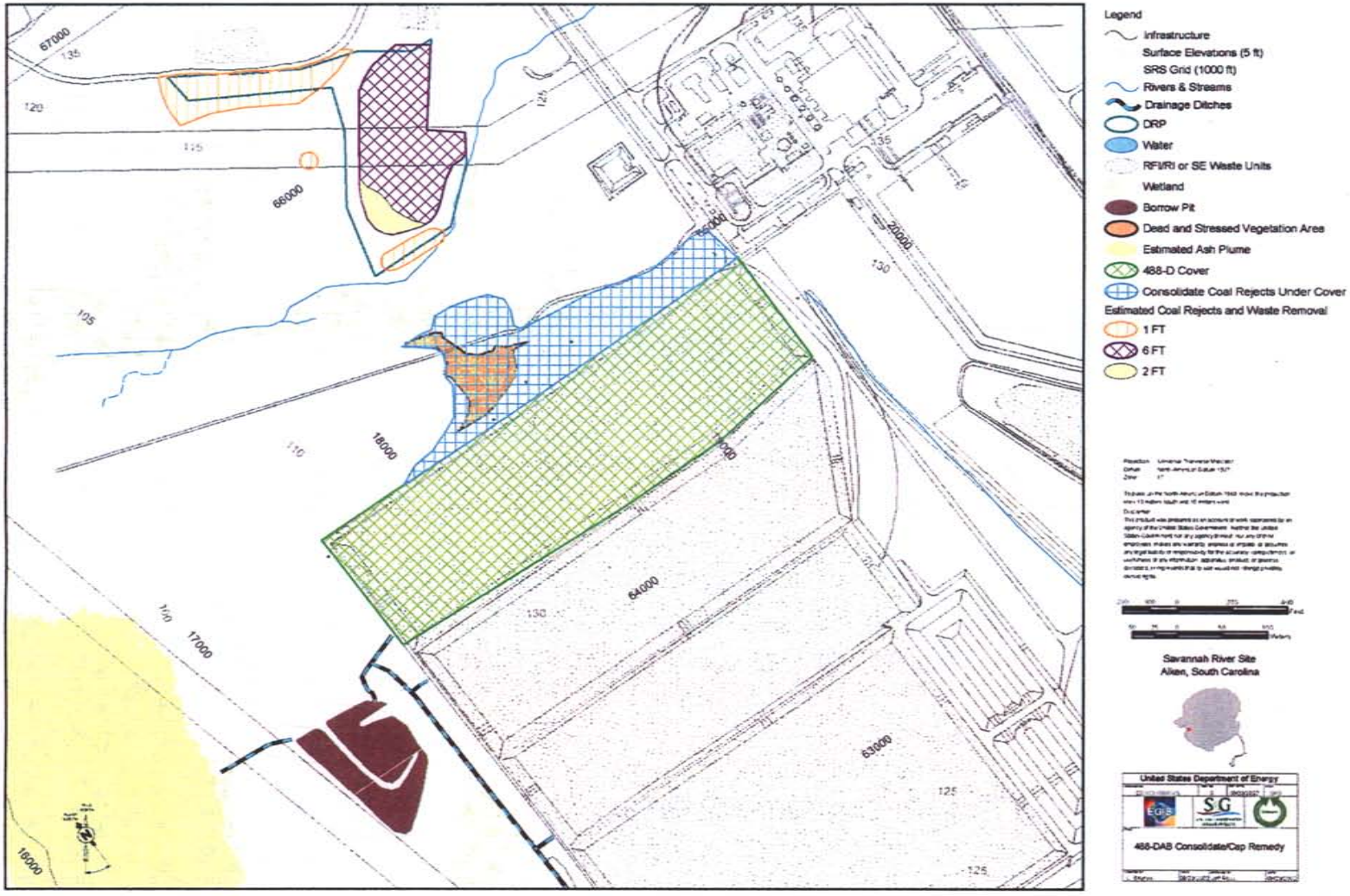

Figure 20. Combined DRP and DAB Alternatives into the DEXOU Preferred Remedy

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The preferred remedy at DRP includes the following activities:

Excavate soil and coal reject materials containing unacceptable levels of arsenic, approximately 45,870 m^3 (60,000 yd^3), to visual extent of coal within the DRP and along the adjacent road. The lateral extent of surface soil removal will be confirmed based on the zinc and arsenic RGs. The excavated material will include approximately 57 m^3 (2,000 ft^3) of soil contaminated with PCBs at a concentration greater than 1 mg/kg. The area of the PCB hotspot will be sampled for confirmation that PCBs were removed to the RG. All excavated material will be transported to the 488-DAB for consolidation under a geosynthetic cover. Both the DRP and 488-DAB contain coal rejects and are in close proximity with areas that can be considered contiguously contaminated. Therefore, the DRP and 488-DAB will be considered an AOC, and the excavated material will be moved within this AOC to achieve comprehensive cleanup for this OU.

Excavated areas within the DRP will be backfilled a minimum of 0.3 m (1 ft), graded and vegetated to minimize erosion.

The surface water drainage adjacent to DRP will be protected during construction activities by placement of erosion control measures.

Institutional controls will be implemented at DRP in perpetuity, and will be described in detail after the 488-DAB remedy components are described. To evaluate the long-term effectiveness of the action, groundwater monitoring will be performed until contaminants present in the groundwater downgradient of DRP are below MCLs (beryllium) and PRGs (manganese). Provisions for groundwater monitoring will be provided as part of the Monitoring Work Plan for the D-Area Groundwater Operable Unit (U) (WSRC 2003d).

The preferred remedy at 488-DAB includes the following activities:

Approximately 50,000 yd^3 of material containing coal rejects will be covered or excavated from outside the 488-DAB (488-D Drainage, DSVA, and Basin Exterior). A

minimum depth of 1 foot will be removed with the extent of removal being the visual extent of coal. Excavated material shall be placed under the 488-DAB cover. All excavated areas will be backfilled and regraded as required and seeded. The portion of the DSVA delineated as a wetland (approximately 0.4 ha [1 acre]) would be replaced either through the site wetland bank or by reconstructing a wetland at another location.

Approximately 1 ft of soil from the bottom and sides of the drainage ditch will be excavated at the west end of the 488-DAB. The drainpipe will be sealed, covered, or removed, to eliminate leakage of water/ash into the drainage ditch. Excavated material will be placed in the main basin. The excavated areas will be backfilled and regraded as required followed by seeding.

If present, water pooled in the west end of the 488-DAB (up to 1 million gallons) would be treated based on the relevant action-specific ARAR value for land application or discharge to surface water. Pooled water in the western end of the 488-DAB will be managed in accordance with the Waste Management Plan and will comply with all applicable State and Federal requirements. Treatment options include treatment at a permitted onsite treatment facility, treatment and discharge adjacent to the basin, treatment and reuse in cap construction activities, or treatment and land application within the area of contamination (AOC). Specifically, treatment may include pH adjustment or evaporation with disposal of any residual sludge. Upon removal of the pooled water within the basin, surface water will be managed by placement of erosion control measures.

An engineered cover system will be placed on the entire 488-DAB and consolidated areas (approximately 25 acres). At a minimum, the cover system will include an erosion layer, a protection layer, a drainage layer, and an infiltration layer. The cover system's expected life is a minimum 100 years and will be designed for a 25 year, 24 hour storm event. The maximum hydraulic conductivity of the cover system will be 1×10^{-8} cm/s. The cover will be designed to 1) require minimal maintenance for the life of the system,

2) promote drainage and minimize erosion or abrasion of the cover, and 3) accommodate settling and subsidence so that the integrity of the cover is maintained.

Institutional controls consisting of access controls (warning signs and land use restrictions) would be implemented to maintain the cover system. Groundwater monitoring would be performed to evaluate the long-term effectiveness of the action. Institutional controls are needed in perpetuity to prevent exposure to potential future residents to elevated levels of arsenic at DRP and 488-DAB. Land use controls will also be used to prevent disturbance of the cover system or waste at 488-DAB. See Table 34 for a list of land use controls.

Institutional controls will be implemented by:

- Access controls to prevent exposure to onsite workers via the Site Use Program, Site Clearance Program, work control, worker training, worker briefing of health and safety requirements and identification signs located at the waste unit boundaries.

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

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken at 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 to manage and dispose 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 unit.

Table 34. Land Use Controls for the D-Area Expanded Operable Unit (DEXOU)

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas[a]
1. Property Record Notices[b]	Provide notice to anyone searching records about the existence and location of contaminated areas.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by DOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use (DRP and 488-DAB).
2. Property record restrictions[c]: Land Use	Restrict use of property by imposing limitations.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Drafted and implemented by DOE upon transfer of affected areas. Recorded by DOE in accordance with state law at County Register of Deeds office.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use (DRP and 488-DAB).
3. 3. Other Notices[d]	Provide notice to county/city about the existence and location of waste disposal and residual contamination areas for zoning/planning purposes.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by DOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use (DRP and 488-DAB).
4. Site Use Program[e]	Provide notice to worker/developer (i.e., permit requestor) on extent of contamination and prohibit or limit excavation/penetration activity.	As long as property remains under DOE control.	Implemented by DOE Initiated by permit request	Cover system and associated structures at 488-DAB.
5. Physical Access Controls[f] (e.g., fences, gates, portals)	Control and restrict access to workers and the public to prevent unauthorized use.	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Controls maintained by DOE	At select locations throughout SRS. Not required for DEXOU
6. Warning Signs[g]	Provide notice or warning to prevent unauthorized uses	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Signage maintained by DOE	At select locations throughout SRS Spaced at regular intervals along boundaries at DRP and 488-DAB.
7. Security Surveillance Measures	Control and monitor access by workers/public	Until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Established and maintained by DOE Necessity of patrols evaluated upon completion of remedial actions.	Patrol of selected area throughout SRS, as necessary.

[a] Affected areas – Specific locations identified in the SRS LUCIP or subsequent post-ROD documents.
[b] Property Record Notices – Refers to any non-enforceable, purely informational document recorded along with the original property acquisition records of DOE and its predecessor agencies that alerts anyone searching property records to important information about residual contamination; waste disposal areas in the property.
[c] Property Record Restrictions – Includes conditions and/or covenants that restrict or prohibit certain uses of real property and are recoded along with original property acquisition records of Doe and its predecessor agencies.
[d] Other Notices – Includes information on the location of waste disposal areas and residual contamination depicted on as survey plat, which is provided to a zoning authority (i.e., city planning commission) for consideration in appropriate zoning decisions for non-DOE property.
[e] Site Use Program – Refers to the internal DOE/DOE contractor administrative program(s) that requires the permit requestor to obtain authorization, usually in the form of a permit, before beginning any excavation/penetration activity (e.g., well drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities/structures, or in the case contaminated soil or groundwater, will not disturb the affected areas without the appropriate precautions and safeguards.
[f] Physical Access Controls – Physical barriers or restrictions to entry.
[g] Signs – Posted command, warning or direction.

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

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

The selected remedy for the DEXOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control and Assurance Plan (LUCAP) to ensure that the Land Use Controls (LUCs) required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Control Implementation Plan (LUCIP) incorporated by reference into this ROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy. USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the Corrective Measures Investigation (CMI)/Remedial Action Implementation Plan (RAIP), as required in the FFA for review and approval by USEPA and SCDHEC. The LUCIP will be a stand-alone document. Upon final approval, the LUCIP will be appended to the LUCAP and considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the SRS Federal Facilities Agreement. After completion of construction, the survey plat will be developed with the as-built data for the OU and submitted concurrently with the

Post-Construction Report (PCR) for review and approval by USEPA and SCDHEC. Upon approval of the survey plat, it will be inserted in the approved LUCIP. No further review or approval of the LUCIP will be required. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will be referenced in all subsequent post-ROD documents (i.e., PCR and Final Remediation Report (FRR)). The LUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The deed shall contain appropriate provisions to ensure that the restrictions continue to run with the land. The LUCs shall be maintained until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. Approval by USEPA and SCDHEC is required for any modification or termination of the institutional controls (ICs). LUCIP modification will only occur through another CERCLA document.

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

The LUC objectives necessary to ensure the protectiveness of the preferred alternative are as follows:

- prevent contact, removal, or excavation of buried waste [debris, coal, and coal rejects]
- preclude residential use of the area

Based on the characterization data and risk assessment, the uncertainty associated with the extent of contamination at the DRP and 488-DAB is minimal.

After the Preferred Alternative is implemented the expected condition is that residual levels of metals in the subsurface soils will not pose an exposure risk to industrial workers or ecological receptors and that no contaminants at DEXOU will pose a leachability risk to groundwater.

The selected remedy, comprising one selected alternative for each DEXOU unit, will be the final action for the DEXOU; however, the remedy may change as a result of remedial design or construction processes. Any changes to the remedy described in the ROD will be documented in the Administrative Record by a memo, an Explanation of Significant Difference (ESD), or a ROD amendment.

The selected alternative provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria, and it is protective of human health and the environment. It is a cost-effective long-term solution that achieves RAOs.

Cost Estimate for the Selected Remedy

Estimated costs associated with the selected remedy on the 3.9% discount rate over a 500-year period are summarized below:

488-DAB

- Total Capital Costs: $12,788,050
- Total O&M Costs: $298,691
- Total Present Worth Cost $13,086,741

DRP

• Total Capital Costs:	$2,257,166
• Total O&M Costs:	$101,255
• Total Present Worth Cost	$2,358,421
Total Cost	**$15,445,162**

Detailed cost estimates for each of the two areas are presented in Appendix C of this document.

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

Estimated Outcomes of Selected Remedy

The excavation and removal of both the soil and coal reject material and the aroclor-1254 hot spot and the backfilling of excavated areas along with institutional controls will meet the RAOs for DRP by:

1) Preventing exposure of industrial workers to soils containing unacceptable levels of arsenic and PCBs.

2) Preventing exposure of ecological receptors to elevated levels of metals and PCBs in soils.

3) Preventing generation of low pH leachate and beryllium from leaching to groundwater above MCLs.

4) Prevent unrestricted (residential and/or agricultural) land use.

DRP should be available for industrial use 3 years after remedial action start. The soils cleanup level for arsenic is 3.3 mg/kg which is based on a 1×10^{-6} excess cancer risk to a future industrial worker.

Additionally, the preferred alternative is a cost-effective long-term solution for the 488-DAB that achieves the following RAOs by:

1) Preventing or minimizing contaminants leaching to groundwater above MCLs/PRGs.

2) Preventing exposure of industrial workers to waste materials, surface soils, and sediments containing unacceptable levels of arsenic and coal-related radionuclides.

3) Preventing exposure of ecological receptors to arsenic, selenium, and vanadium present in the basin.

4) Preventing or minimizing the acidic runoff that results in pooled water at the west end of the basin.

5) Preventing exposure of ecological receptors to metals in surface water in the 488-D Pooled Basin, the 488-D Drainage, and the DSVA above ambient water quality criteria.

6) Protecting ecological receptors from elevated arsenic in sediment in the 488-D Drainage ditch.

7) Preventing exposure of ecological receptors to unacceptable risk due to low pH (due to the presence of coal fines) in the sediment in the DSVA.

8) Prevent unrestricted (residential and/or agricultural) land use.

Except for the basin interior, the 488-DAB should be available for industrial use about 3 years after the remedial action start. The area under the cover system will require additional controls to prevent damage to the cover and disturbance of the waste. The soils cleanup level for arsenic is 3.3 mg/kg which is based on a 1×10^{-6} excess cancer risk to a future industrial worker.

Waste Disposal and Transport

All unused environmental samples may be returned to the waste site within the AOC. This only includes samples to which no preservatives have been added.

Decontamination solutions and rinsates from cleaning items intended for reuse or recycle (e.g., field sampling tools, equipment, or personal protection equipment) may be discharged to the ground surface in areas in which neither runoff nor erosion can occur. An engineering evaluation is not required to determine a waste disposal strategy for this method of handling decontamination solutions. Decontamination wash and rinse solutions typically include laboratory grade soap and deionized water, and laboratory grade isopropyl alcohol for residual organic compound stripping and tool drying. To avoid discharging an ignitable hazardous solution, any residual isopropyl alcohol must be containerized and combined with the soapy wash water before the solution is discharged to the ground surface.

When environmental sampling boreholes are abandoned, they will be grouted to the surface per SCDHEC regulations. The soil cuttings will be placed in the 488-DAB as this area will be covered.

XII. STATUTORY DETERMINATIONS

Based on the RFI/RI/BRA (WSRC 2003a), the DEXOU poses a threat to human health and the environment. Alternatives 488-DAB-2 and DRP-3 have been selected as the

remedies for the DEXOU. The selected remedies are protective of human health and the environment under the industrial land use scenario, comply with federal and state requirements that are applicable or relevant and appropriate to the remedial actions, are cost-effective, and utilize permanent solutions to the maximum extent practicable. While the selected remedies do not satisfy the statutory preference for treatment as a principal element, the removal of waste material from DRP and installation of a low permeability cover system at 488-DAB provide a high level of protection. The selected remedies comply with key ARARs by meeting applicable standards for surface water and preventing groundwater impact for exceeding MCLs. The selected remedy satisfies the requirements of Section 121 of CERCLA.

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

XIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy selected at DRP will include placement of PCBs (<100 mg/kg) under the 488-DAB geosynthetic cover rather than off-site disposal, as described in the Description of Alternatives and in the SB/PP. Since the PCB contaminated waste was disposed of prior to April 18, 1978 it is not PCB remediation waste per TSCA. Regardless, the cover meets all engineering requirements for disposal of PCBs up to 100 mg/kg. Institutional controls, maintenance, and deed restrictions will also be applied, conforming to TSCA relevant and appropriate requirements. Removal and placement under the 488-DAB cover will take place within the DEXOU AOC.

No comments were received during the public comment period.

XIV. RESPONSIVENESS SUMMARY

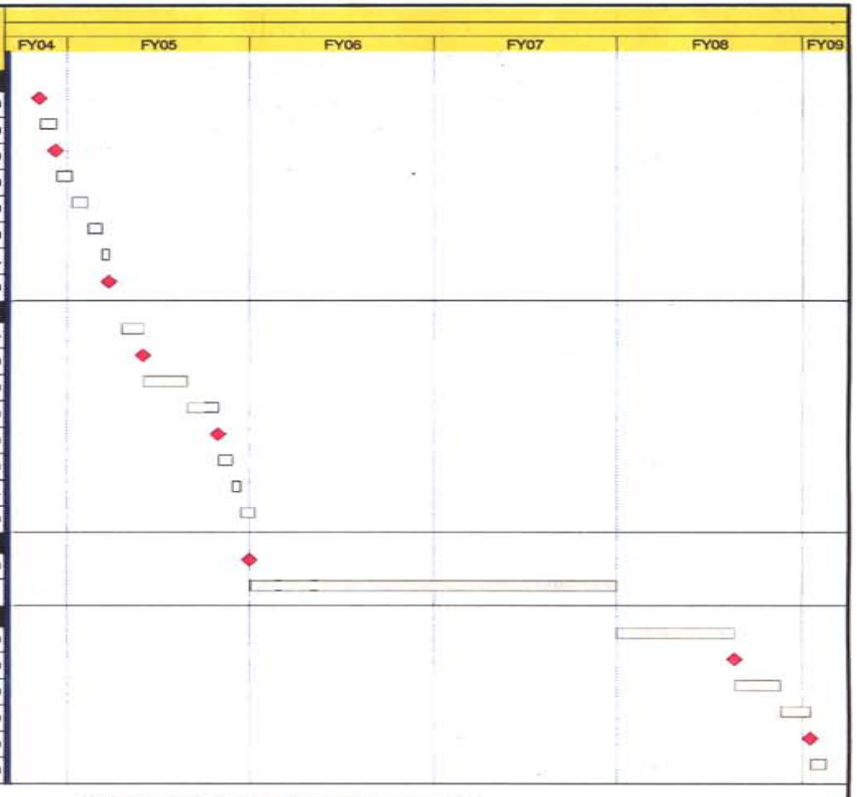
XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

A detailed schedule for the ROD and post-ROD activities is shown in Figure 21.

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

- CMI/RAIP Rev. 0 for the DEXOU will be developed and submitted for regulatory review after the ROD issuance.
- USEPA/SCDHEC will receive 90 days for review of Rev. 0 CMI/RAIP.
- The SRS revision of the CMI/RAIP will be completed 60 calendar days after receipt of all regulatory comments.
- USEPA/SCDHEC will receive 30 days for their final review and approval of CMI/RAIP.
- Proposed Remedial Action start date of September 30, 2005
- The combined PCR/FRR Rev. 0 will be submitted to USEPA/SCDHEC after completion of the remedial action in accordance with the implementation schedule in the approved DEXOU CMI/RAIP.

Activity ID	Activity Description	Early Start	Early Finish	Orig Dur
CA1116 D-Area Expanded Operable Unit				
LCS:14 STATEMENT OF BASIS/PROPOSED PLAN & ROD				
AMP0101026	SRS Submit Rev. 1 ROD		09AUG04	0
AMP0101028	USEPA/SCDHEC Final Review & Approval	10AUG04	08SEP04	30
AMP0101040	Receipt of ROD Approval		08SEP04	0
AMP0114045	USDOE obtain signature on ROD	09SEP04	08OCT04	30
AMP0114046	USEPA obtain signature on ROD	11OCT04	09NOV04	30
AMP0114047	SCDHEC obtain signature on ROD	10NOV04	09DEC04	30
AMP0114048	Prepare for Public Notice	10DEC04	23DEC04	14
AMP0114049	Issue ROD		23DEC04	0
LCS:15 DETAILED ENG & PRECONST ACTIVITIES				
AMP0101703	SRS Develop Rev. 0 CMI/RAIP & LUCIP	17JAN05	01MAR05	44
AMP0101704	SRS Submit Rev. 0 CMI/RAIP & LUCIP		01MAR05	0
AMP0101705	USEPA/SCDHEC review Rev. 0 CMI/RAIP & LUCIP	02MAR05	30MAY05	90
AMP0101707	SRS incorporates USEPA/SCDHEC comments	31MAY05	29JUL05	60
AMP0101708	SRS Submit Rev. 1 CMI/RAIP & LUCIP		29JUL05	0
AMP0101709	USEPA/SCDHEC Final Review & Approval	30JUL05	28AUG05	30
AMP0101798	Notification of Pre-Con Briefing Fact Sheet	29AUG05	11SEP05	14
AMP0101799	Pre-Con Briefing Fact Sheet Public Review Period	12SEP05	11OCT05	30
LCS:16 REMEDIAL ACTION IMPLEMENTATION				
AMP0116905	Remedial Action Start	30SEP05		0
AMP0116910	Construction Activities	30SEP05	28SEP07	501
LCS:17 POST CONSTRUCTION ACTIVITIES				
AMP010750	SRS Develop Rev. 0 PCR/CMIR/FRR	01OCT07	20MAY08	160
AMP010755	SRS Submit Rev. 0 PCR/CMIR/FRR		20MAY08	0
AMP010760	USEPA/SCDHEC review Rev. 0 PCR/CMIR/FRR	21MAY08	18AUG08	90
AMP010765	SRS incorporates USEPA/SCDHEC comments	19AUG08	17OCT08	60
AMP010770	SRS Submit Rev. 1 PCR/CMIR/FRR		17OCT08	0
AMP010775	USEPA/SCDHEC Final Review & Approval	18OCT08	16NOV08	30



Note: This schedule is for planning purposes only and is subject to change. Construction complete is dependant upon the remediation subcontractor's implementation schedule and contract award.

Start Date 01OCT92
Finish Date 16NOV08
Data Date 08JUN04
Run Date 05AUG04 13:35

Primavera Systems, Inc.

S&G
SOIL AND GROUNDWATER CLOSURE PROJECTS

Soil & Groundwater Closure Projects
CA 1116 D-Area Expanded Operable Unit
Implementation Schedule

Date	Revision	Checked	Approved

Figure 21. DEXOU Post-ROD Schedule

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XVI. REFERENCES

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

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USEPA, 1995. *Supplemental Guidance to RAGS Region IV Bulletins (Human Health Risk Assessment)*, Interim Draft, Office of Technical Services, United States Environmental Protection Agency, Region IV, Atlanta, Georgia

WSRC, 1996. *Federal Facility Agreement Implementation Plan,* Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *RCRA Facility Investigation/Remedial Investigation Work Plan Addendum for the D-Area Expanded Operable Unit*, WSRC-RP-99-4067, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003a. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the D-Area Expanded Operable Unit (DEXOU) (U)*, WSRC-RP-2001-4162, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation Work Plan for the 488-D Ash Basin and D-Area Coal Pile Runoff Basin Operable Unit*, WSRC-RP-97-440, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina

WSRC, 2003b. *Corrective Measures Study/Feasibility Study Report for the D-Area Expanded Operable Unit (U)*, WSRC-RP-2003-4143, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003c. *Statement of Basis/Proposed Plan for the D-Area Expanded Operable Unit (U)*, WSRC-RP-2003-4165, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC 2003d. Monitoring Work Plan for the D-Area Groundwater Operable Unit (U), WSRC-RP-2003-4150, Rev. 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

XVII. APPENDICES

Appendix A	Responsiveness Summary
Appendix B	Applicable or Relevant and Appropriate Requirements
Appendix C	Cost Estimate for the Selected Remedy

APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for D-Area Expanded Operable Unit (DEXOU) began on February 11, 2004, and ended on March 26, 2004.

Public Comments

No public comments were received.

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APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Table B-1. DEXOU Chemical, Action, Location-specific ARARs

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Chemical				
NPDES 40 CFR 122 SC R.61-9 NPDES Permits	Applicable	Regulates discharges of pollutants from any point source into waters of the U.S.	Applicable if water from the site will be discharged to land or streams, rivers or lakes	488-DAB-2, 488-DAB-3
40 CFR 268	Applicable	Identifies land disposal restrictions	Applicable if water is discharged to land	488-DAB-2, 488-DAB-3
40 CFR 761.61 Toxic Substances Control Act (TSCA)	Applicable	Identifies risk-based disposal requirements for cleaning, decontaminating, or removing PCB remediation waste	Low concentrations of PCBs have been identified at the surface at DRP above the high occupancy use cleanup level of 1 ppm. Disposal requirements for remediation waste.	DRP-2, DRP-3, DRP-4
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 $\mu g/m^3$ (annual arithmetic mean) or 150 $\mu g/m^3$ (24-hour average concentration)	Dust suppression will likely be required to minimize dust emissions during construction/remedial action.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
SC R.61-62.6 Fugitive Dust	Applicable	Fugitive particulate material shall be controlled.	Dust suppression will likely be required to minimize dust emissions during construction/remedial action.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
SC R.61-9 NPDES Permits	Applicable	Requires notification of intent to discharge stormwater from construction associated with industrial activity that will result in a land disturbance of 1 acre or more and industrial activities and sets the requirements for the control of stormwater discharges	Potentially applicable if stormwater is discharged during construction activities. Greater than 1 acre of land will be disturbed during the action for both DRP and 488-DAB.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
SC R 61-71 Well Construction Standards	Applicable	Prescribes minimum standards for the construction of groundwater wells	Standards for installation and abandonment of groundwater. Wells at 488-DAB may be abandoned or installed.	488-DAB-2, 488-DAB-3

Table B-1. DEXOU Chemical, Action, Location-specific ARARs (Continued)

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Action				
SC R 72-300 Standards for Stormwater Management and Sediment Reduction	Applicable	Stormwater management and sediment control plan for land disturbances.	Greater tan 2 acres of land will be disturbed during the action for both DRP and 488-DAB.	488-DAB-2, 488-DAB-3, DRP-2, DRP-3, DRP-4
SC R.61-107.16.60, Subpart F Industrial Solid Waste Landfill Closure and Post Closure	Specific portions are relevant and appropriate	The final cover system must be designed and constructed to (1) have a permeability of less than or equal to the permeability of any bottom liner system or natural subsurface soils present; (2) minimize infiltration through the closed Industrial Solid Waste Landfill (ISWLF) by the use of an infiltration layer or flexible membrane liner; and (3) minimize erosion of the final cover by the use of an erosion layer that is capable of sustaining native plant growth. Following closure of each ISWLF, the owner or operator must conduct post-closure care. Post-closure care must be conducted for a minimum 30 years, except as provided under paragraph b. of this section, and consist of at least the following: Maintaining the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and runoff from eroding or otherwise damaging the final cover.	Closure of this facility is analogous to closure of an ISWLF	DRP-2, 488-DAB-2

Table B-1. DEXOU Chemical, Action, Location-specific ARARs (Continued)

Citation(s)	Status	Requirement Summary	Reason for Inclusion	Alternative
Action				
40 CFR 260.261 and 268 SC R.679.260, 261 and 268 Federal and State Hazardous Waste Regulations	Potentially Applicable	Defines criteria for determining whether a waste is RCRA hazardous waste and provides treatment, storage, and disposal requirements.	Would be applicable if hazardous waste are found to be present at the DRP and 488-DAB and removed from area of contamination.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
Location				
Endangered Species Act of 1973; 50 CRF 17, 50 CFR 450, 451 and 452	Applicable	The remedial action must be conducted in a manner to conserve threatened, endangered and sensitive (TES) species.	There are TES in the surrounding wetlands.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
Fish and Wildlife Conservation Action 16 USC 2901 to 2911	Applicable	The remedial action must be conducted in a manner to protect fish or wildlife.	This remedial action has the potential to affect fish and wildlife in the vicinity of the 488-DAB and DRP.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
Migratory Bird Treaty Act 16 USC 703-712	Applicable	The remedial action must be conducted in a manner that minimizes impacts to migratory birds and their habitats.	Migratory bird populations may be present in the vicinity of the 488-DAB and DRP.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
Wetlands Protection 40 CFR 230 to 232, 33 CFR 320, 321, 322, 323, 325, 328 and 330	Applicable	The remedial action must minimize the destruction, loss, or degradation of wetlands.	Wetlands are located in the vicinity of DRP and 488-DAB.	DRP-2, DRP-3, DRP-4, 488-DAB-2, 488-DAB-3
Executive Order 11990	TBC	Protection against destruction, loss or degradation of wetlands		

APPENDIX C

COST ESTIMATE FOR THE SELECTED REMEDY

Alternative DRP-3, Excavation and Consolidation of Waste into the 488-DAB, Institutional Controls, Monitoring

Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
CAPITAL COSTS				
Direct Capital Costs				
Submittals	1	ls		$25,000
Mobilization	1	ls		$15,000
Site Preparation	1	ls		$35,000
Construction				
Removal of Debris from DRP and its perimeter and stockpile onto DAB	60,000	cy	$12	$720,000
Excavate, load, and haul clean soil from SRS borrow pit to backfill excavated areas of DRP; spread and compact	30,000	cy	$14	$420,000
Testing of clean fill	21	sample	$1,750	$36,750
Haul and spread 6 inch top soil for vegetative layer	4,000	cy	$25	$100,000
Application of grass seed	24,000	sy	$1	$24,000
Confirmation Sampling	60	sample	$500	$30,000
Erosion Control Measures	1	ls		$45,000
Final Submittals	1	ls		$10,000
Demobilization	1	ls		$15,000
Institutional Controls				
Land Use Control Implementation Plan	1	ea	$15,000	$15,000
Deed Restrictions	1	ea	$30,000	$30,000
Access Controls (Signs)	30	ea	$50	$1,500
Subcontractor Management (10% Construction Cost)				$149,725
Total Direct Capital Cost				**$1,671,975**
Other Capital Costs				
Engineering, Design and Construction	20%	of direct capital		$334,395
Project Management	10%	of direct capital		$167,198
Health & Safety	5%	of direct capital		$83,599
Total Other Capital Cost				**$585,191**
Subtotal Estimated Capital Cost				**$2,257,166**
Total Estimated Capital Cost				**$2,257,166**
OPERATION & MAINTENANCE (O&M) COSTS				
Direct O&M Costs	3.9%	discount rate		
Annual Costs	500	year O&M period		
Operations and Maintenance	1	yr	$1,000	$1,000
Subtotal - Annual Cost				$1,000
Present Worth Annual Costs				$25,641
Five Year Costs				
Remedy Review	100	ea	$14,000	$14,000
Subtotal - Five Year O&M Costs				$14,000
Present Worth Five Year Costs				$66,409
Total Present Worth Direct O&M Cost				**$92,050**
Other O&M Costs				
Project/Admin Management	10%	of direct O&M		$9,205
Total Present Worth Other O&M Cost				**$9,205**
Total Present Worth O&M Cost				**$101,255**
TOTAL ESTIMATED COST				**$2,358,421**

Alternative 488-DAB-2, Consolidation of Exposure areas (DSVA, basin exterior, DAB drainage), Low Permeability Geosynthetic Cover System, Institutional Controls, Monitoring

Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
CAPITAL COSTS				
Direct Capital Costs				
Submittals	1	ls		$25,000
Mobilization	1	ls		$15,000
Site Preparation	1	ls		$35,000
Construction				
Consolidate ash and coal rejects from DAB perimeter, berm, and DSVA and stockpile onto the basin	50,000	cy	$15	$750,000
Excavate, load, and haul clean soil from SRS borrow pit to backfill an fill void of excavated areas, spread, grade, and compact	60,000	cy	$14	$840,000
Cover standpipe	1	ls		$30,000
Dewatering of pooled basin and waste acceptance testing	1	ls		$60,000
Regrade ash basin for soil base prep	1	ls		$50,000
Miscellaneous tasks, i.e. extend wells, raise/improve road, clean ditches, vegetation removal	1	ls		$200,000
Geosynthetic Cover System (Includes material and labor for flexible membrane liner, drainage layer, rip rap drainage)	138,000	sy	$31	$4,308,360
Excavate, load, and haul clean soil from SRS borrow pit to provide 1' base layer and 2' soil cover; spread and compact	138,000	cy	$14	$1,932,000
Clean fill testing	88	sample	$1,750	$154,000
Haul and spread 6 inch top soil for vegetative layer	20,000	cy	$25	$500,000
Application of grass seed	138,000	sy	$1	$138,000
Confirmation Sampling	50	sample	$500	$25,000
Erosion Control Measures	1	ls		$75,000
Final Submittals	1	ls		$30,000
Demobilization	1	ls		$15,000
Institutional Controls				
Land Use Control Implementation Plan	1	ea	$15,000	$15,000
Deed Restrictions	1	ea	$30,000	$30,000
Access Controls (Signs)	30	ea	$50	$1,500
Subcontractor Management (10% Construction Cost)				$920,386
Total Direct Capital Cost				**$10,149,246**
Other Capital Costs				
Engineering, Design, and Construction	15%	of direct capital		$1,522,387
Project Management	7%	of direct capital		$710,447
Health & Safety	4%	of direct capital		$405,970
Total Other Capital Cost				**$2,638,804**
Subtotal Estimated Capital Cost				**$12,788,050**
Total Estimated Capital Cost				**$12,788,050**
OPERATION & MAINTENANCE (O&M) COSTS				
Direct O&M Costs	3.9%	discount rate		
Annual Costs	500	year O&M period		
Inspections/Maintenance	1	yr	$8,000	$8,000
				$0
				$0
Subtotal - Annual Costs				$8,000
Present Worth Annual Costs				$205,128
Five Year Costs				
Remedy Review	100	ea	$14,000	$14,000
Subtotal - Five Year O&M Costs				$14,000
Present Worth Five Year Costs				$66,409
Total Present Worth Direct O&M Cost				**$271,537**
Other O&M Costs				
Project/Admin Management	10%	of direct O&M		$27,154
Total Present Worth Other O&M Cost				**$27,154**
Subtotal Present Worth O&M Cost				**$298,691**
Total Present Worth O&M Cost				**$298,691**
TOTAL ESTIMATED COST				**$13,086,741**

DRP

• Total Capital Costs:	$2,257,166
• Total O & M Costs:	$101,255
• Total Present Worth Cost	$2,358,421

488-DAB

• Total Capital Costs:	$12,788,050
• Total O & M Costs:	$298,691
• Total Present Worth Cost	$13,086,741

Total Cost for Selected Remedy $15,445,162