007091

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G) (U)

WSRC-RP-98-4105
Revision 1
September 1999

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

SAFETY · RESPONSIBILITY · SECURITY
SRS
SAVANNAH RIVER SITE

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

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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)

WSRC-RP-98-4105
Rev.1 September, 1999

Savannah River Site
Aiken, South Carolina

Prepared by:

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

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DECLARATION FOR THE RECORD OF DECISION

Unit Names and Locations

L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)
Savannah River Site
US EPA ID #SC1890008989
Aiken, South Carolina

Statement of Basis and Purpose

This decision document presents the selected remedial alternatives for the L- and P-Area Bingham Pump Outage Pits (L and P BPOPs) located at the Savannah River Site (SRS) south of Aiken, South Carolina. The selected alternatives were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Act and Reauthorization Amendments (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). These decisions are based on the Administrative Record File for these specific units. The United States Environmental Protection Agency (US EPA) and the State of South Carolina concur with the selected remedy.

Assessment of the Sites

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

Description of the Selected Remedy

The selected remedy for the L and P BPOPs is as follows:

L BPOPs

- Land Use Controls (access and deed restrictions/notifications) for soil
- No action for groundwater

P BPOP

- Land Use Controls (access and deed restrictions/notifications) for soil
- No action for groundwater

These alternatives will meet Remedial Action Objectives (RAOs) by reducing the potential for exposure to buried waste at each unit and polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in subsurface soil at the P BPOP. Because of the absence of free liquids or mobile or highly toxic material, the primary source material (the buried waste) is categorized as Low Level Threat Waste. Therefore, the preferred alternative is consistent with US EPA guidance that preference be given to remedial alternatives that center around containment rather than treatment.

The L and P BPOPs are located in a potential residential zone close to but outside of industrial zone boundaries as identified on the Proposed SRS Future Land Use Map of the SRS FFA Implementation Plan. The location of the L and P BPOPs adjacent to the Heavy Industrial (Nuclear) Zones, and the presence of buried debris, make the units unsuitable for residential use. Although the units are located outside of the defined industrial use zones, it is anticipated that the units will be limited use areas with restrictions similar to an industrial use zone. Land Use Controls (LUCs) will restrict the L and P BPOPs to future industrial use and will prohibit residential use of the areas. Unauthorized excavation will also be prohibited and the waste units will remain undisturbed. LUCs will be maintained until such time that they are deemed unnecessary.

Statutory Determination

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. However, because treatment of the principle threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

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

Per the US EPA-Region 4 LUC Policy, a LUC Assurance Plan (LUCAP) for SRS has been developed and submitted to the regulators for their approval. In addition, a LUC Implementation Plan (LUCIP) for the L- and P- BPOPs will be developed and submitted to the regulators for their approval with the post-ROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the LUC elements of the L- and P-BPOPs preferred alternative to ensure that the remedy remains protective of human health and the environment.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste.

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

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

Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Constituents of concern (COCs) and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for COCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD
- Land and groundwater use that will be available at the site as a result of the Selected Remedy
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
- Decisive factor(s) that led to selecting the remedy

11/1/99
Date

Thomas F. Heenan
Assistant Manager for Environmental Programs
U. S. Department of Energy, Savannah River Operations Office

[illegible]
Date

Richard D. Green
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Waste Management Division
U. S. Environmental Protection Agency

8/31/00
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South Carolina Department of Health and Environmental Control

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)

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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ASCAD™	Approved Standardized Corrective Action Design
bls	below land surface
BPOP	Bingham Pump Outage Pit
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM COC	Contaminant Migration Constituent of Concern
CMS	Corrective Measures Study
COC	Constituent of Concern
CSM	Conceptual Site Model
EAV	E-Area Vaults
ELCR	Estimated Lifetime Cancer Risk
ER/WM	Environmental Restoration/Waste Management
ERHQ	Exposure Route Hazard Quotient
ERR	Exposure Route Risk
FFA	Federal Facility Agreement
FRR	Final Remediation Report
FS	Feasibility Study
HI	Hazard Index
HQs	Hazard Quotients
K BPOP	K-Area Bingham Pump Outage Pit
L BPOPs	L-Area Bingham Pump Outage Pits
LUC	Land Use Control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
mR/hr	milliRoentgen per hour
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OUs	Operable Units
P BPOP	P-Area Bingham Pump Outage Pit
PAHs	polyaromatic hydrocarbons
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
PP	Proposed Plan
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	Remedial Goal
RGO	Remedial Goal Option
RI	Remedial Investigation

RME	Reasonable Maximum Exposure
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site
SB	Statement of Basis
SVOCs	Semivolatile Organic Compounds
TRV	Toxicity Reference Value
USCs	Unit-Specific Constituents
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
UTRA	Upper Three Runs Aquifer
VOCs	volatile organic compounds
WSRC	Westinghouse Savannah River Company

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

Savannah River Site Location, Description, and Process History

Savannah River Site, Aiken, SC

US EPA ID #SC1890008989

United States Department of Energy

The Savannah River Site (SRS) occupies approximately 800 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents, and is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia and 32 kilometers (20 miles) south of Aiken, South Carolina (Figure 1).

SRS is owned by the United States Department of Energy (US DOE). Management and operating services are currently provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) for the SRS lists the L-Area Bingham Pump Outage Pits (L BPOPs) (643-2G and 643-3G) and the P-Area Bingham Pump Outage Pit (P BPOP) (643-4G) as CERCLA operable units (OUs) requiring further evaluation using an investigation/assessment process that includes a

CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment.

The L and P BPOPs are burial pits containing waste debris that was generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958 including the primary system Bingham Pumps. The units were formed by excavating trenches to an average depth of 4.0 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the unit to grade by covering the debris with 1.2 m (4 ft) of backfill. The waste consists of miscellaneous construction materials such as pipes, cables, ladders, and concrete. No known pumps or liquid wastes were buried in the L and P BPOPs. The radioactive contamination was less than 25 milliRoentgen per hour (mR/hr) with no detected alpha activity. The buried waste is categorized as Low Level Threat Waste (US EPA, 1991) because of the absence of free liquids or mobile or highly toxic material.

The L and P BPOPs are located near the L and P Reactor Areas at the SRS (Figures 1, 2, and 3). They are located in a potential residential zone close to but outside of industrial zone boundaries as identified on the Proposed SRS Future Land Use Map of the SRS FFA Implementation Plan (WSRC, 1997a). The location of the L and P BPOPs adjacent to the Heavy Industrial (Nuclear) Zones, and the presence of buried debris, make the units unsuitable for residential use (US DOE, 1996). Although the units are located outside of the defined industrial use zones, they will not be developed for residential purposes. Rather, industrial zone-type use limitations will be imposed through the Land Use Controls.

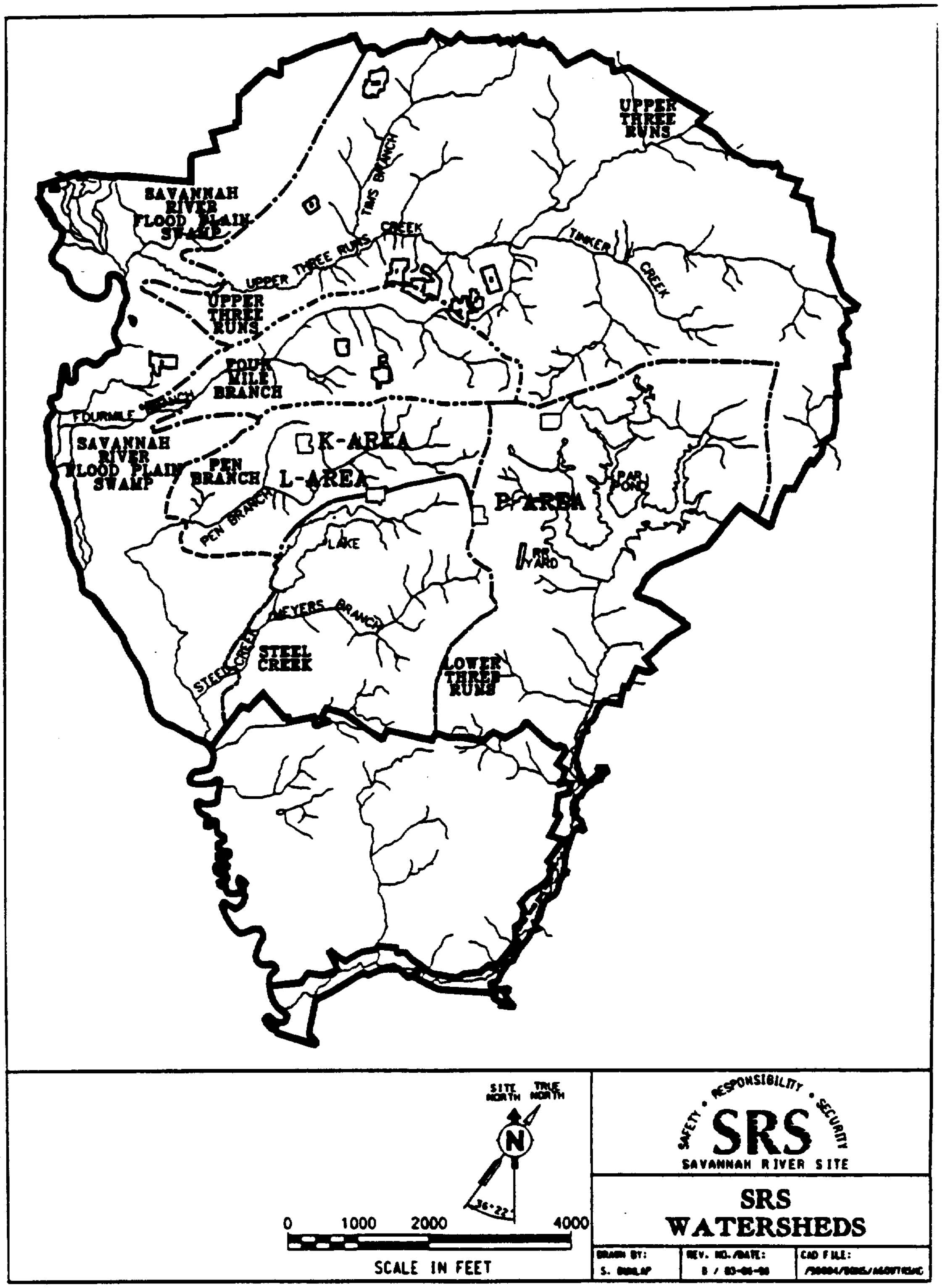

FIGURE 1. LOCATION OF THE K, L, AND P REACTOR AREAS AND SRS WATERSHEDS

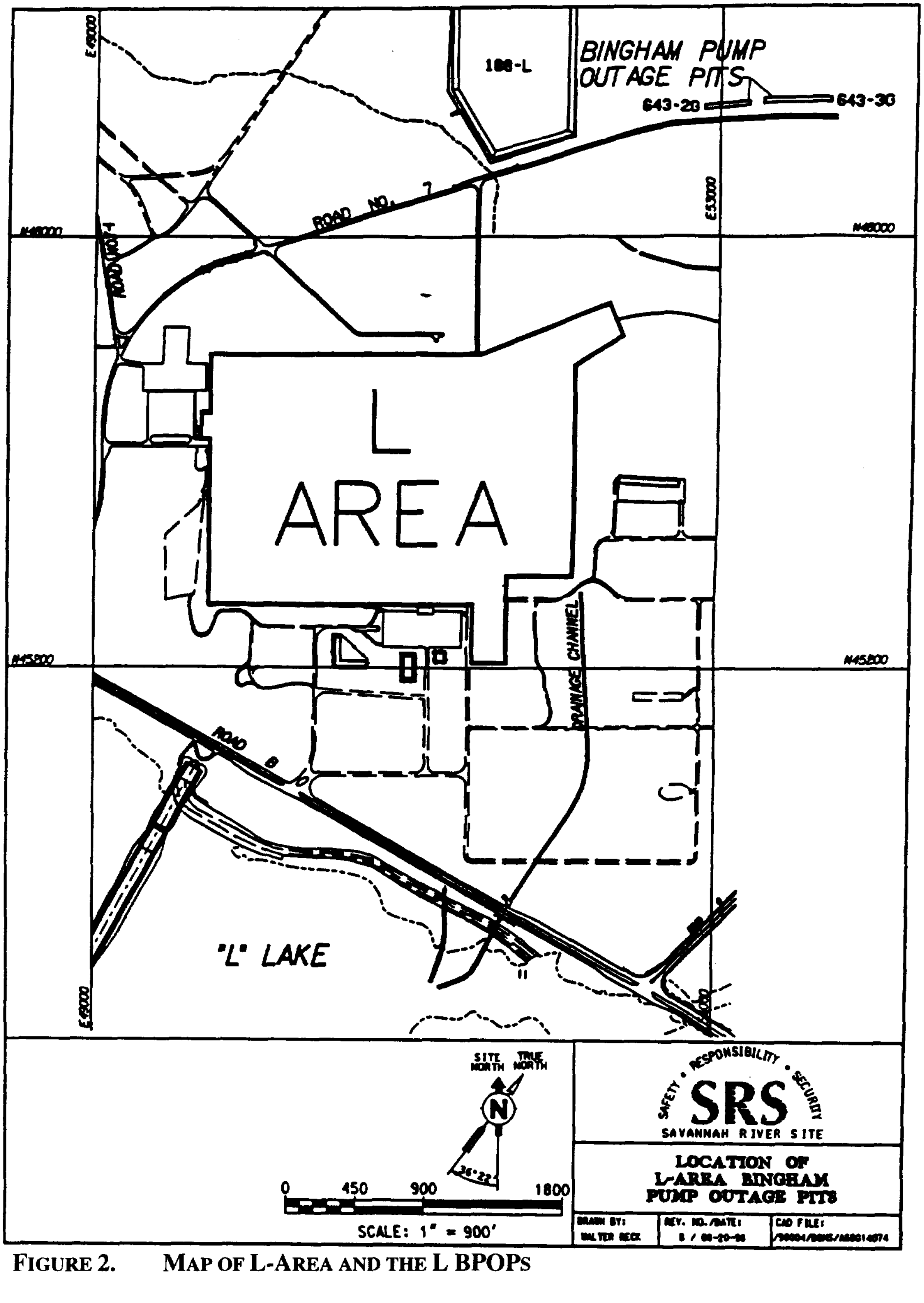

FIGURE 2. MAP OF L-AREA AND THE L BPOPS

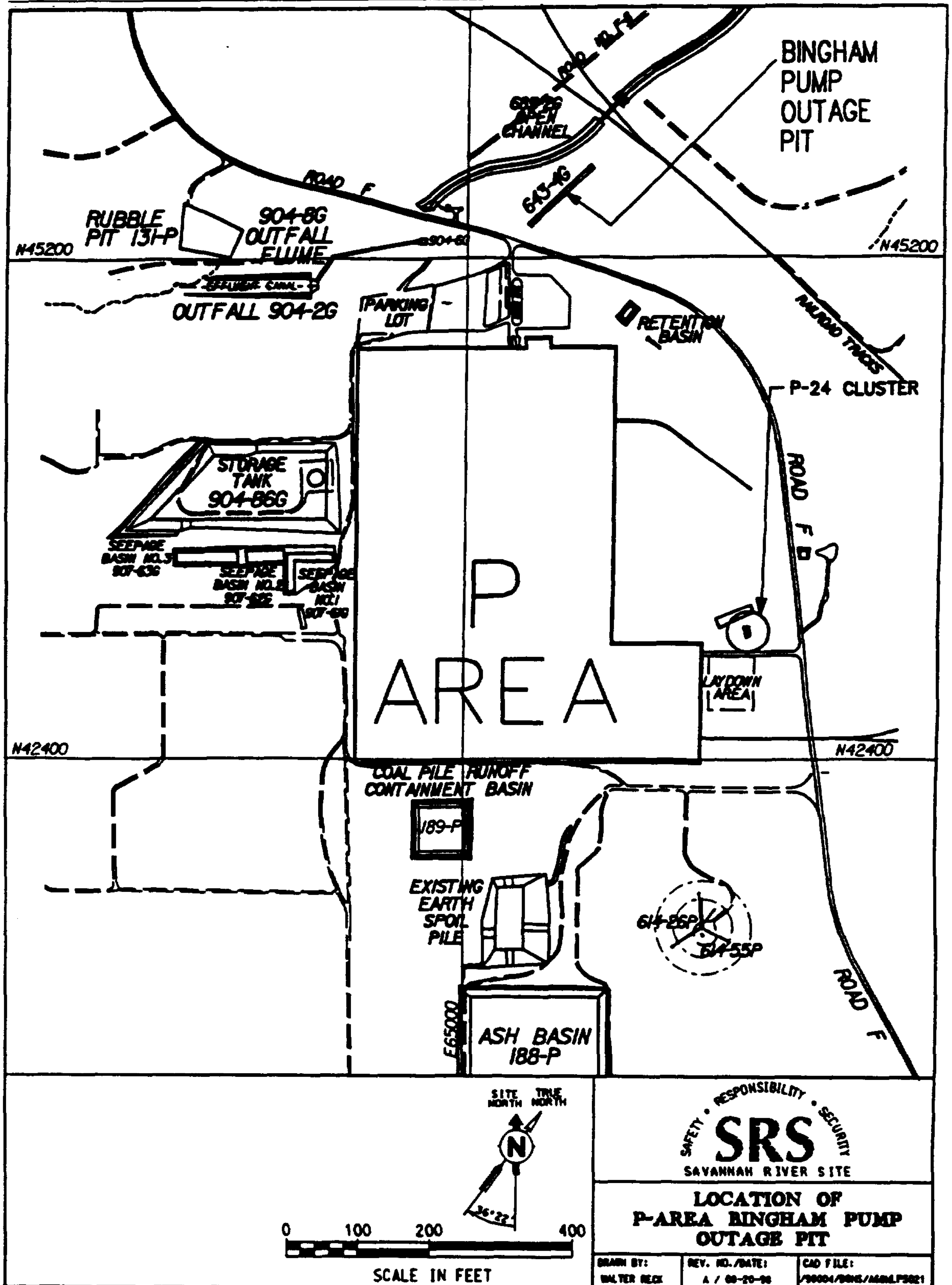

FIGURE 3. MAP OF P-AREA AND THE P BPOP

The L BPOPs consist of two pits (643-2G and 643-3G) aligned end-to-end with approximately 38 m (125 ft) between them; one pit is 83.8 x 6.7 m (275 x 22 ft) and the other is 114.9 x 6.1 m (377 x 20 ft). The P BPOP consists of one pit (643-4G) having dimensions of 143.9 x 7.9 m (472 x 26 ft). The mean depth of each pit is approximately 4.0 m (13 ft). Maps of the units are presented as Figures 4 and 5.

The units are not fenced, but are marked with orange marker balls and signs identifying them as CERCLA waste units. SRS employees can access the L and P BPOPs via dirt roads. General public access to SRS is prohibited, with access limited by guards and security fences.

The local topography around the L and P BPOPs is level to gently sloping. The units are grass covered and surrounded mostly by trees. The habitats in the vicinity generally do not meet the needs of most listed SRS threatened and endangered plant and animal species. Ecological field surveys have found little in the way of unique, specialized, or sensitive habitats around the units. There are no ditches, drainage areas, or surface waters associated with either unit. Photographs of the units are provided as Figures 6 and 7.

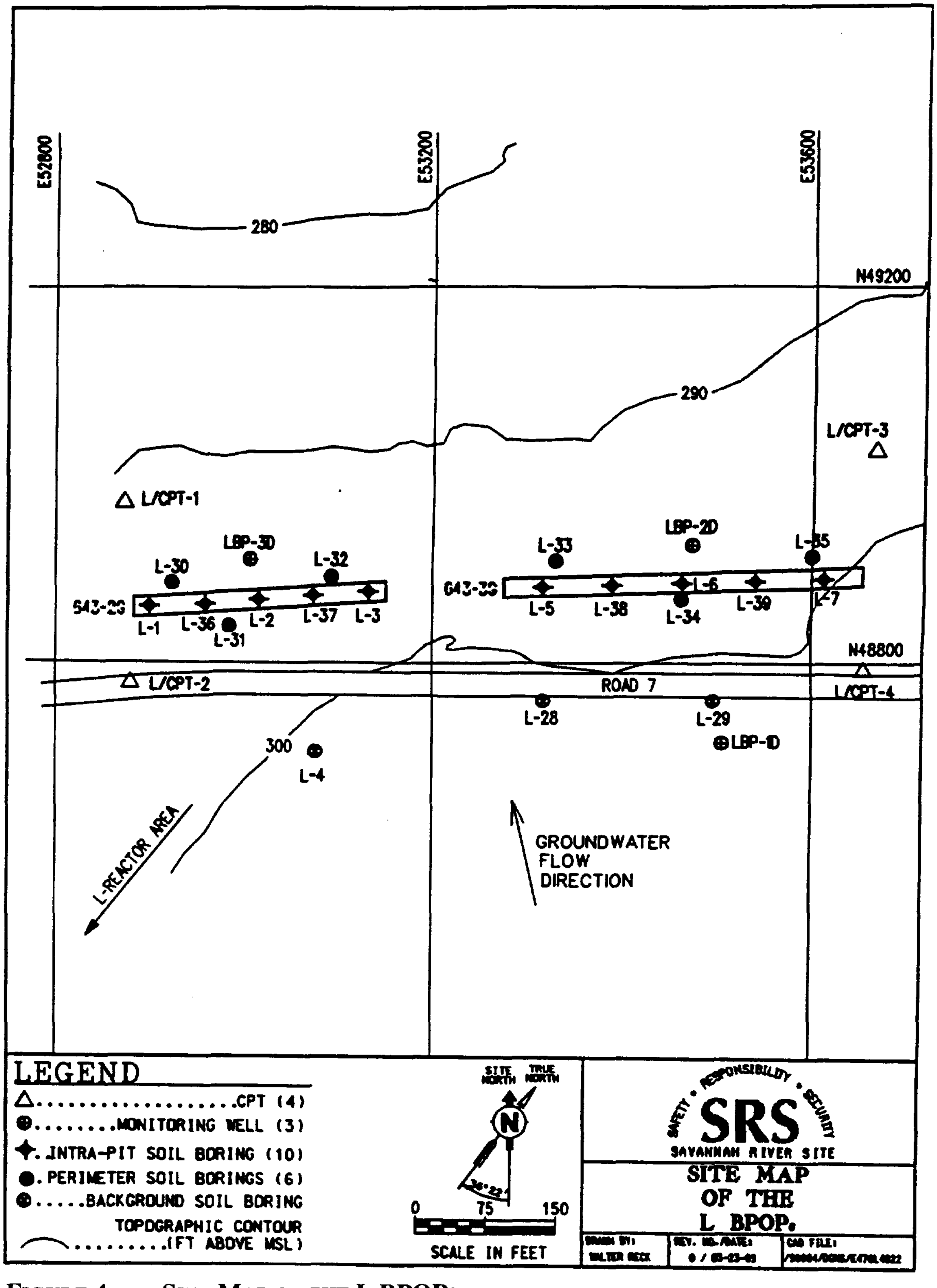

FIGURE 4. SITE MAP OF THE L BPOPS

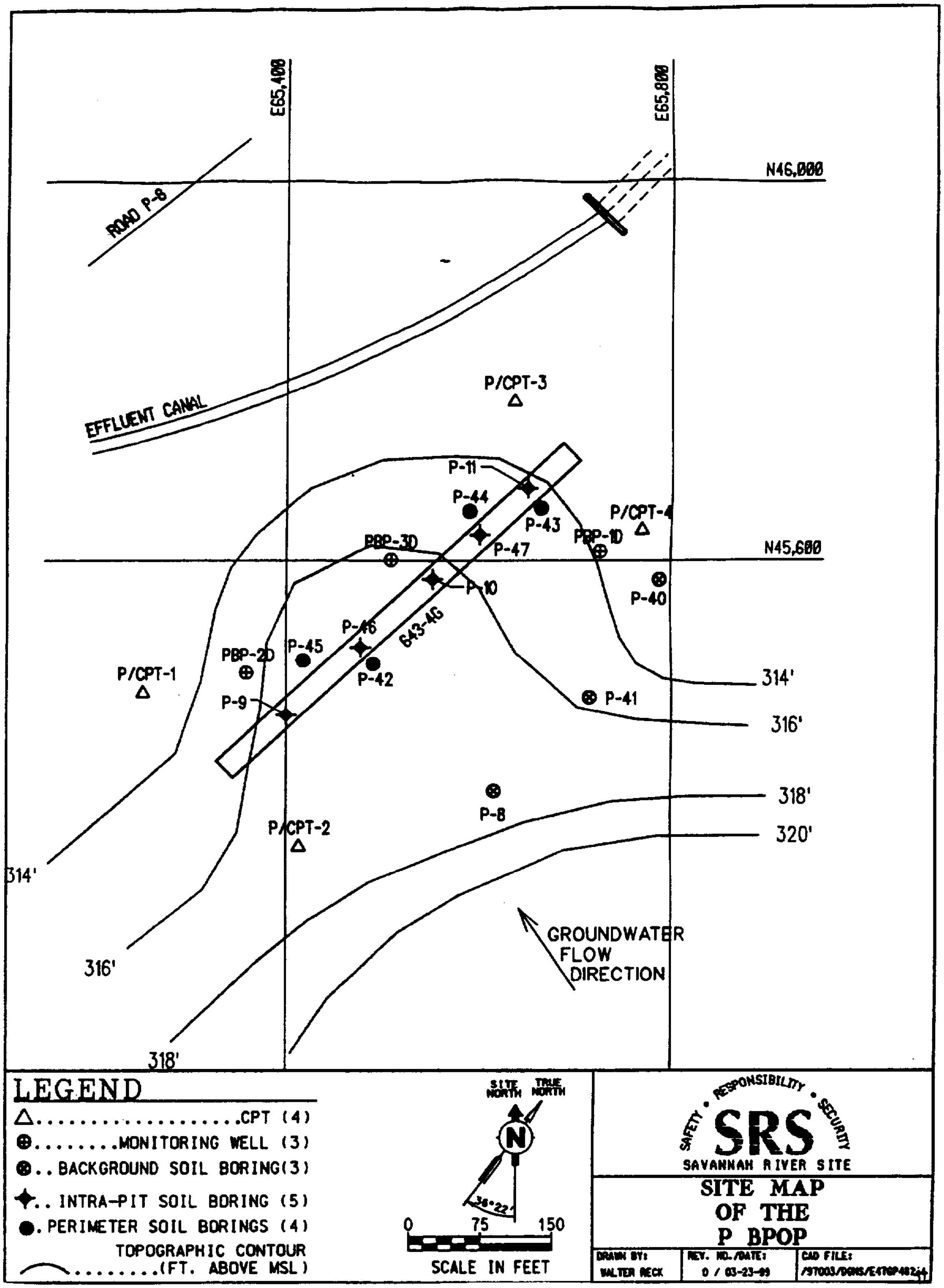

FIGURE 5. SITE MAP OF THE P BPOP

Figure 6. Photograph of the L BPOPs
The OU is subject only to the provisions of CERCLA; the RCRA/CERCLA designation on the sign is standard on SRS waste unit postings.

Figure 7. Photograph of the P BPOP

The OU is subject only to the provisions of CERCLA; the RCRA/CERCLA designation on the sign is standard on SRS waste unit postings.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS was to produce tritium, plutonium-239, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

SRS Compliance History

On December 21, 1989, SRS was included on the National Priorities List. The inclusion created a need to integrate the established Resource Conservation and Recovery Act Facility Investigation (RFI) Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, US DOE has negotiated a FFA (FFA, 1993) with the United States Environmental Protection Agency (US EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements. US DOE functions as the lead agency for remedial actions at SRS with concurrence by US EPA-Region IV and the SCDHEC.

Operable Unit Compliance History

As previously stated, the L and P BPOPs are listed in the FFA as CERCLA units requiring further evaluation to determine the actual or potential impact to human health and the environment. A RI characterization, Baseline Risk Assessment (BRA), and focused Feasibility Study (FS) were conducted for the units between 1996 and 1998. Pre-Work Plan data were collected from June 26 to August 19, 1996. The Revision 0 RI Work Plan (WSRC, 1997b) was submitted on July 24, 1996, and the Field Start date was March 3, 1997. The results of the RI/BRA and focused FS were presented in *Approved Standardized Corrective Action Design (ASCAD™) Combined Document for the L- and P-Area Bingham Pump Outage Pits (U)* (WSRC, 1999a). This report was submitted in accordance with the FFA and the approved implementation schedule, and was approved by US EPA and SCDHEC in June 1999. The Proposed Plan (PP) for the L and P BPOPs (WSRC, 1999b) was submitted in accordance with the FFA and the approved implementation schedule, and was approved by US EPA and SCDHEC in June 1999.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the L and P BPOPs' soil and groundwater. The Administrative Record File must be established at or near the facility at issue. The *SRS Public Involvement Plan* (US DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. Section 117(a) of CERCLA, as amended, requires notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action. The *Proposed Plan for the L- and P-Area Bingham Pump Outage Pits* (WSRC, 1999b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the L and P BPOPs.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the US EPA office and 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 public was notified of the public comment period through mailing of the *SRS Environmental Bulletin*, a newsletter sent to approximately 3,500 citizens in South Carolina and Georgia, and through the *Aiken Standard,* the *Allendale Citizen Leader*, the *Barnwell People-Sentinel, The State,* and the *Augusta Chronicle* newspapers. The public comment period was also announced on local radio stations.

The 30-day public comment period began on June 10, 1999 and ended on July 9, 1999. The Proposed Plan was also presented in an open public meeting to the SRS Citizens Advisory Board (CAB ER/WM Subcommittee) on June 22, 1999 and to the full CAB on July 27, 1999.. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this ROD.

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

RCRA/CERCLA Programs at SRS

RCRA/CERCLA units at SRS are subject to a multi-stage remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the FFA (FFA, 1993). The RCRA/CERCLA processes are illustrated on Figure 8 and summarized below.

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

The steps of this process are iterative in nature, and include decision points which involve concurrence between the US DOE (as owner/manager), the US EPA and SCDHEC (as regulatory oversight), and the public.

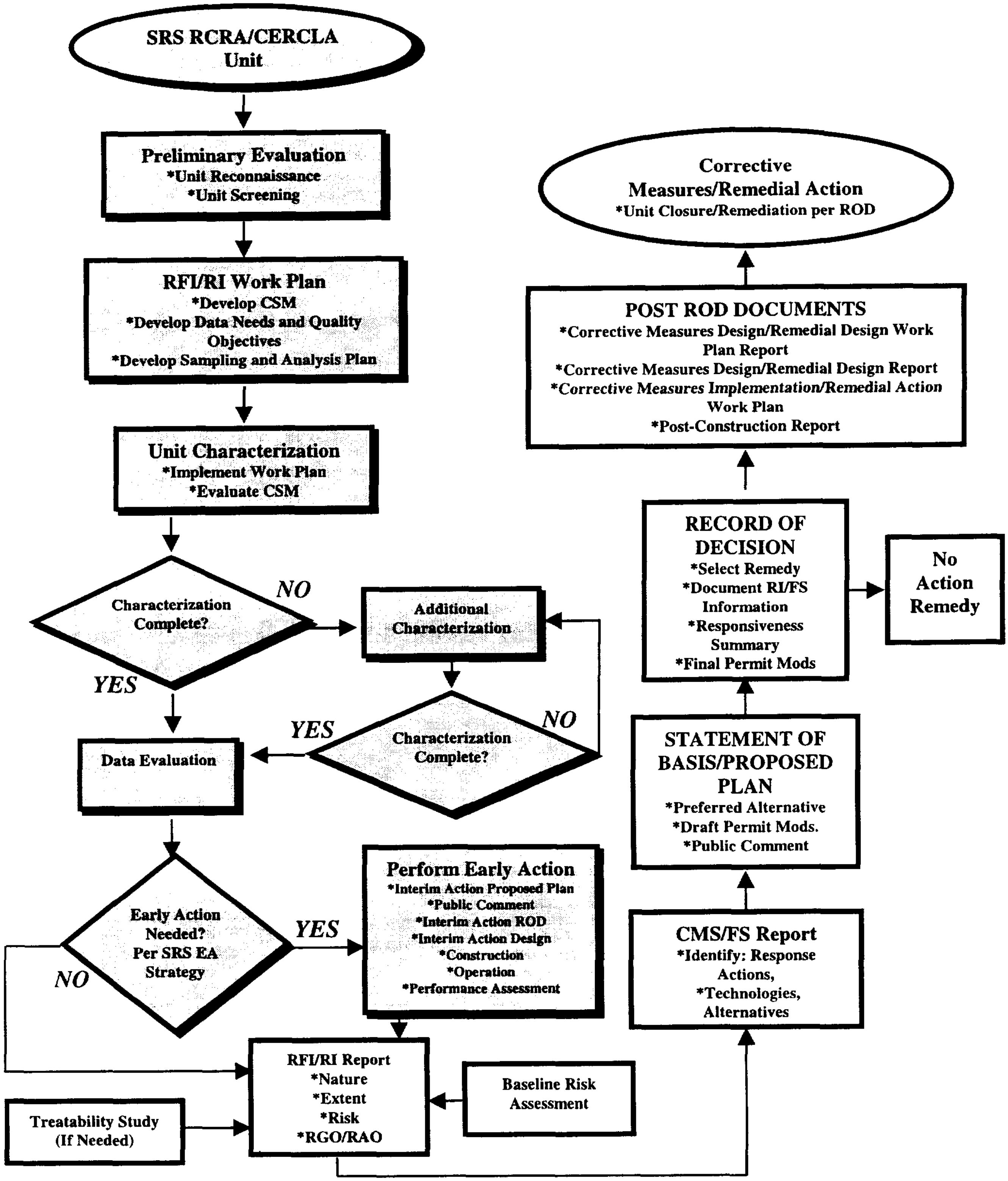

FIGURE 8. RCRA/CERCLA LOGIC AND DOCUMENTATION

By agreement between US EPA, SCDHEC, and US DOE, the BPOP waste unit group was evaluated using the Approved Standardized Corrective Action Design (ASCAD™) approach. Under ASCAD™, a representative "lead" unit is subjected to a comprehensive investigation that includes characterization, technology development, and remedial design. Where there are significant similarities between the lead and secondary units, ASCAD™ is utilized to streamline the documentation, remedial design, and remedial action for the secondary units.

The lead unit for the BPOP waste group is the K-Area BPOP (643-1G) (K BPOP). A RI/BRA (WSRC, 1997c), Feasibility Study (FS) (WSRC, 1997d), PP (WSRC, 1997e), and ROD (WSRC, 1997f) for the K BPOP were submitted to and approved by SCDHEC and US EPA.

The results of the RI/BRA for the L and P BPOPs indicated that these units are similar to the lead unit, and that subsequent documentation may be streamlined in accordance with the ASCAD™ approach.

ASCAD™ was applied to the L and P BPOPs by (1) combining the RI/BRA for each OU into a single report, (2) developing a focused FS using the remedial alternatives developed in the K BPOP FS, (3) combining the PP for each OU into a single document, and (4) combining the ROD for each OU into a single document.

L and P BPOPs Remedial Strategy

The RI process provides a method of managing the steps that lead to the ultimate remediation of a specific waste unit. An OU usually consists of the contaminated media (sources, soil, groundwater, sediments, surface water, and air) specific to a waste unit and the proposed actions related to their characterization and ultimate remediation and/or the timing of those actions. The overall strategy for addressing the L and P BPOPs was to: (1) characterize the waste unit by delineating the nature and extent of contamination and identifying the media of concern (perform the RI); (2) perform a BRA to evaluate media of concern, Constituents 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 L BPOPs is an OU within the Pen Branch watershed; the P BPOP is an OU within the Lower Three Runs watershed (Figure 1). Several OUs within these watersheds will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all OUs to minimize impact to these watersheds. Based on characterization and BRA information, the L and P BPOPs do not significantly impact their respective watersheds.

At the L BPOPs, no human health or ecological final COCs were identified for any land use/receptor scenario, indicating that surface soil and subsurface soil and groundwater do not pose unacceptable risks to human or environmental receptors under current or future conditions. Furthermore, no final Contaminant Migration Constituents of Concern (CM COCs) were identified; therefore, leaching does not pose a threat to groundwater. Land Use Controls will provide adequate protection against exposure to waste left in place by prohibiting unauthorized excavation through access controls and deed restrictions.

At the P BPOP, no ecological final COCs or final CM COCs were identified; therefore, the unit does not pose unacceptable risks to ecological receptors and does not pose a future threat to groundwater. For the hypothetical on-unit resident and the future industrial worker scenarios, human health final COCs in the subsurface soil included polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). No human health final COCs were identified for the current land use scenario. Land Use Controls will provide adequate protection against exposure to waste left in place by prohibiting unauthorized excavation through access controls and deed restrictions.

The proposed actions for the L and P BPOPs OUs are final actions.

V. OPERABLE UNIT CHARACTERISTICS

A Conceptual Site Model (CSM) was developed for the L and P BPOPs to identify the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors (Figure 9). The CSM is based on the data that are presented in the CERCLA documentation for these units and is described in the *Approved Standardized Corrective Action Design (ASCAD™) Combined Document for the L- and P-Area Bingham Pump Outage Pits (U)* (WSRC, 1999a), available in the Administrative Record File (See Section III). The CSM and the results of the RI are summarized in the following sections.

Media Assessment

The potentially contaminated media at the L and P BPOPs was assessed using soil and groundwater samples. The L BPOPs consist of two pits (643-2G and 643-3G) aligned end-to-end with approximately 38 m (125 ft.) between them; one pit is 83.3 x 6.7 m (275 x 22 ft.) and the other is 114.9 x 6.1 m (377 x 20 ft.). The P BPOP consists of one pit (643-4G) having dimensions of 143.9 x 7.9 (472 x 26 ft.). The mean depth of each pit is approximately 4.0 m (13 ft.), with the top 1.2 m (4 ft) being clean fill.

The media assessment was performed in two phases. Phase I consisted of soil borings inside the pits and at background locations. At the L BPOPs, 57 intra-pit soil intervals from 6 borings were sampled. Samples were collected from the backfill material, from the waste debris, and from below the base of the pits to a depth of approximately 3.0 to 4.6 m (10 to 15 ft.) above the water table. At the P BPOP, 27 intra-pit soil intervals from 3 borings were sampled. Samples were collected from the backfill material, from waste debris, and from below the base of the pit to a depth of approximately 3.0 m (10 ft.) above the water table.

Phase II sampling was performed to augment the Phase I data set with sufficient data to develop a BRA. This included installation and sampling of monitoring wells, collection of soil samples around the perimeters of the pits, and collection of additional intra-pit and background samples. At the L BPOPs, the following samples were taken: 24 background (all depths), 24 perimeter (all depths), 20 intra-pit (0 to 1.2 m [0 to 4 ft.]), and 75 intra-pit (all depths). At the P BPOP, the following samples were taken: 26 background (all depths); 16 perimeter (all depths), 9 intra-pit (0 to 1.2 m [0 to 4 ft.]), and 36 intra-pit (all depths).

An assessment of the P BPOP produced six final COCs for the soils. These constituents and their maximum observed concentrations are as follows: Aroclor 1254 (1.99 mg/kg), Aroclor 1260 (0.524 mg/kg), benzo(a)anthracene (1560 ug/kg), benzo(a)pyrene (1430 ug/kg), benzo(b)fluoranthene (2580 ug/kg), and dibenzo(a,h)anthracene (214 ug/kg). There were no final COCs retained for the L BPOPs. The investigation revealed miscellaneous construction materials such as pipes, cables, ladders, and concrete buried in the soil. The waste volumes for the L and P BPOPs are 3408 m^3 (122,310 ft^3) and 3069 m^3 (110,448 ft^3), respectively. This waste is characterized as Low Level Threat Waste because of the absence of free liquids or mobile or highly toxic material. There are no RCRA hazardous wastes located at the site. No other site-specific factors exist that may affect the response action.

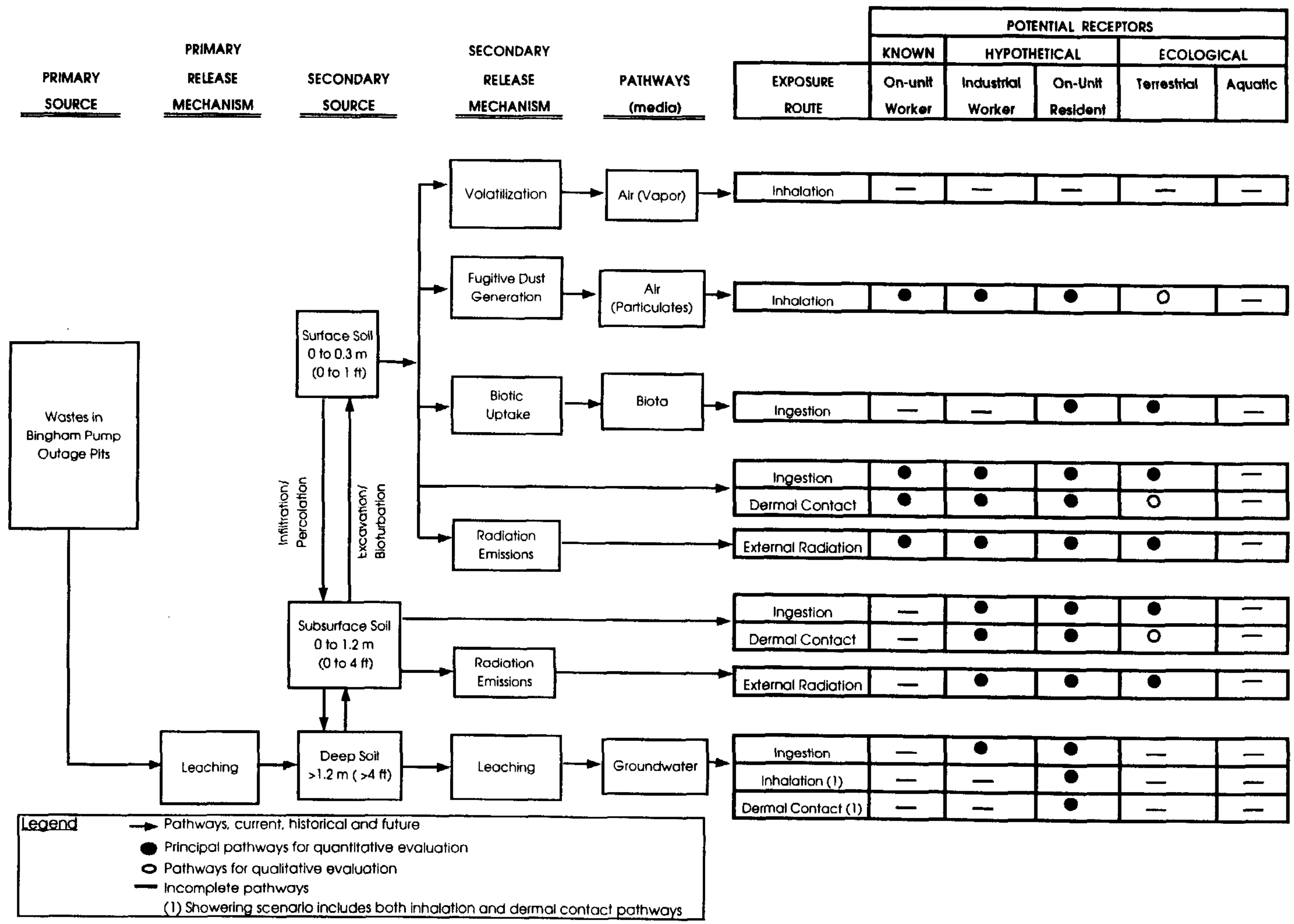

FIGURE 9. CSM FOR THE L AND P BPOPs

Primary Sources and Release Mechanisms

The lateral extent of the pits at each BPOP was delineated by ground penetrating radar surveys and magnetic surveys. The vertical extent of primary source material was established during soil boring activities by identifying the deepest occurrences of debris. Soil descriptions recorded during drilling and sampling activities indicate the nature of the debris in the pits. Items encountered in the borings and brought to the surface included metal, wood, plastic items, and other miscellaneous construction materials. The boring descriptions are consistent with historical records of the waste debris.

The primary source material was placed directly into the pits at depths greater than 1.2 m (4 ft) and then covered by 1.2 m (4 ft) of backfill. Contaminants associated with the waste debris may have been released into soils greater than 1.2 m (4 ft) deep by leaching. Contaminants were not released by the primary source mechanism into soils less than 1.2 m (4 ft) deep because the backfill was not in direct contact with the waste debris. Upward migration of contaminants through the soil profile is a result of secondary release mechanisms.

Secondary Sources and Release Mechanisms

Secondary sources of contamination at the L and P BPOPs are identified as surface soil (0 to 0.3 m [0 to 1 ft] below land surface [bls]), subsurface soil (0 to 1.2 m [0 to 4 ft] bls), and deep soil (>1.2 m [>4 ft] bls).

Environmental media serve both as a reservoir via chemical bonding and biotic uptake, and as a secondary release mechanism of contaminants. Secondary environmental release mechanisms may include the following:

- Generation of contaminated fugitive dust by wind or other surface soil disturbance
- Biotic uptake
- Direct contact with surface and subsurface soils
- Leaching

Two phases of soil sampling were performed to characterize the secondary sources. Soil samples were advanced into and below the pits (intra-pit borings), adjacent to the pits (perimeter borings), and at unit-specific background locations.

All intra-pit analytical results were screened against two times average background concentrations for all-depths to determine unit-specific constituents (USCs). At the L BPOPs, the list of USCs for soil included 20 inorganics, 23 semivolatile organic compounds (SVOCs), 10 volatile organic compounds (VOCs), 10 pesticides, 2 PCBs, and 10 radionuclides. The list of USCs for groundwater included 9 inorganics, 1 SVOC, 1 pesticide, and 2 radionuclides. At the P BPOP, the list of USCs for soil included 24 inorganics, 21 SVOCs, 7 VOCs, 12 pesticides, 2 PCBs, and 4 radionuclides. The list of USCs for groundwater included 7 inorganics, 1 SVOC, 1 pesticide, and 4 radionuclides (WSRC, 1999a).

Contaminant Transport Analysis

The potential for contaminant transport begins with precipitation. The degree to which the processes of infiltration and runoff occur depends primarily upon the type and density of vegetation. The area surrounding the L and P BPOPs is vegetated; thus, infiltration is expected to be high. The average annual percolation to the water table is expected to be 37 cm (15 in). The primary release mechanism at the L and P BPOPs is infiltration with leaching to the groundwater.

At the L BPOPs, the vadose zone is approximately 11.9 m (39 ft) thick and is composed primarily of Upland Unit clay and silt with lesser sand. The water table aquifer represents the "upper" aquifer zone of the Upper Three Runs Aquifer (UTRA) and is composed of silt and clay. The aquifer is approximately 23.5 m (77 ft) thick; it extends from the water table to a locally continuous clay layer at a depth of approximately 35.4 m (116 ft) below land surface (bls). Groundwater flow direction at the L BPOPs is to the northwest. No groundwater constituents of concern were identified for the L BPOPs.

At the P BPOP, the vadose zone is approximately 10.7 m (35 ft) thick and is composed of clay interbedded with lesser sand and silt of the Upland Unit and Tobacco Road sand. The water table aquifer represents the "upper" aquifer zone of the UTRA and is composed of discontinuous layers of clay, silt, and sand. The aquifer is approximately 20.1 m (66 ft) thick; it extends from the water table to the local confining unit at a depth approximately 30.8 m (101 ft) bls. The groundwater flow direction at the P BPOP is generally to the west. No groundwater constituents of concern were identified for P BPOP.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessment process for the L and P BPOPs, a BRA was performed using data generated during the assessment phase. The BRA consisted of human health and ecological risk assessments. Detailed information regarding the risk assessments can be found in *Approved Standardized Corrective Action Design (ASCAD™) Combined Document for the L- and P-Area Bingham Pump Outage Pits (U)* (WSRC, 1999a).

Summary of Human Health Risk Assessment

Identification of Constituents of Concern

A human health risk assessment was conducted in order to evaluate the significance of contamination in soil and groundwater. As a result of the human health risk assessment, six final COCs were identified for the P BPOP: Aroclor 1254, Aroclor 1260, benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene. No final COCs were identified for the L BPOPs. Human health preliminary COCs are designated as constituents with individual cancer risks greater than or equal to 1×10^{-6} (or exposure route hazard quotients [ERHQs] greater than or equal to 0.1 for noncancer constituents) that are associated with a total media risk greater than or equal to 1×10^{-6} (or a target organ hazard index greater than or equal to 1). Preliminary COCs are subjected to an uncertainty analysis to identify those constituents for which remediation may be warranted (final COCs).

Exposure Assessment

The exposure assessment resulted in the identification of applicable land use scenarios, pathways, and concentrations that were used to derive risk estimates for the unit. The receptors were based on current and future land uses as determined in the CAB Recommendation No. 2, dated January 24, 1995 and included in Figure 3.3 of the FFA Implementation Plan. The current land use is an inactive industrial site. The current receptor is identified as the known on-unit worker. The only current exposure scenario identified was for on-unit workers who may perform periodic maintenance or environmental research such as groundwater sampling. The current worker is evaluated for the surface soil (0 to 0.3 m [0 to 1 ft]) interval. Conservative future exposure scenarios included future on-unit industrial workers and future on-unit resident adults and children. The future residential scenario includes homegrown produce as an exposure point, which is not considered under the current on-unit worker or future industrial worker scenarios. Future receptors are evaluated for surface soil (0 to 0.3 m [0 to 1 ft]), subsurface soil (0 to 1.2 m [0 to 4 ft]), and groundwater. Summary statistics, including an estimate of the exposure point concentration based on the Reasonable Maximum Exposure (RME) were prepared for each soil and groundwater exposure group. The RME is intended to provide a conservative, yet realistic, estimate of exposure to receptors.

Toxicity Assessment

All final COCs are considered Class B2 carcinogens. Class A carcinogens represent the highest weight of evidence as known human carcinogens, reflecting a high confidence that exposure could result in carcinogenesis. Class B1 and B2 carcinogens represent a somewhat lower weight of evidence, but they are still considered probable human carcinogens.

Risk Characterization

Tables 1, 2, and 3 summarize the results of the human health risk assessment for the L BPOPs. No final COCs were identified for the L BPOPs. Tables 4, 5, and 6 summarize the results of the human health risk assessment for the P BPOP. Results of Risk Characterization indicate that only one final COC (benzo(a)pyrene) was identified for the industrial worker. All six COCs are applicable for the future on-unit resident scenario. The risks associated with the final COCs at the P BPOP are summarized in the following paragraphs.

Benzo(a)anthracene is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (Exposure Route Risk

[ERR]=2 x 10^{-6}), dermal contact (1 x 10^{-6}), and ingestion of tuberous vegetables (2 x 10^{-5}).

Benzo(a)pyrene is identified as a final COC for the future industrial worker exposed to subsurface soil via ingestion (2 x 10^{-6}) and dermal contact (4 x 10^{-6}). It is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (2 x 10^{-5}), dermal contact (1 x 10^{-5}), and ingestion of tuberous vegetables (1 x 10^{-4}).

Benzo(a)fluoranthene is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (3 x 10^{-6}), dermal contact (2 x 10^{-6}), and ingestion of tuberous vegetables (1 x 10^{-5}).

Dibenzo(a,h)anthracene is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (2 x 10^{-6}), dermal contact (2 x 10^{-6}), and ingestion of tuberous vegetables (1 x 10^{-4}).

Aroclor 1254 is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (2 x 10^{-6}) and ingestion of tuberous vegetables (5 x 10^{-5}). Aroclor 1254 is also a COC for ocular effects by ingestion of tuberous produce by children (ERHQ = 4) and adults (ERHQ = 3)

Aroclor 1260 is identified as a final COC for the hypothetical residential adult/child exposed to subsurface soil via ingestion (1 x 10^{-6}) and ingestion of tuberous vegetables (3 x 10^{-5}).

TABLE 1 RISK CHARACTERIZATION SUMMARY FOR THE L BPOPS: CURRENT LAND USE SCENARIO - SURFACE SOIL

Medium	Exposure Route	Chemicals: Noncancer HI On-Unit Worker		Chemicals: Cancer Risk On-Unit Worker		Radionuclides: Cancer Risk On-Unit Worker
Soil	Ingestion	1E-03	B	4E-09	B	2E-11
	Dermal/Extern	1E-03	B	6E-10	B	1E-08
	Inhalation	U	B	6E-11	B	1E-15
	Subtotal	2E-03	B	5E-09	B	1E-08
Groundwater	Ingestion	NA		NA		NA
	Showering	NA		NA		NA
	Subtotal	NA		NA		NA
Leafy Vegetables	Ingestion	NA		NA		NA
Tuberous Vegetables	Ingestion	NA		NA		NA
Fruits	Ingestion	NA		NA		NA
	Subtotal	NA		NA		NA
Chemical Exposures						
Combined Hazard Index:		2E-03	B			
Combined Cancer Risk:				5E-09	B	
Radiological Exposures						
Combined Cancer Risk						1E-08

NA - pathway not evaluated
U - Unknown - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals
ELCR = Estimated Lifetime Cancer Risk
HI = Hazard Index

TABLE 2 RISK CHARACTERIZATION SUMMARY FOR THE L BPOPS: FUTURE LAND USE SCENARIOS - SURFACE SOIL AND GROUNDWATER

Medium	Exposure Route	Chemicals										Radionuclides	
		Noncancer HI						Cancer Risk				Cancer Risk	
		Resident				Industrial				Industrial			Industrial
		Child		Adult		Worker		Resident		Worker		Resident	Worker
Soil	Ingestion	1E+00	B	1E-01	B	4E-02	B	8E-06	E	9E-07	B	2E-08	5E-09
	Dermal/Exter	2E-01	B	9E-02	B	4E-02	B	4E-07	B	1E-07	B	1E-05	4E-06
	Inhalation	U	B	U	B	U	B	3E-08	B	1E-08	B	4E-13	3E-13
	Subtotal	1E+00	B	2E-01	B	9E-02	B	8E-06	E	1E-06	B	1E-05	4E-06
Groundwater	Ingestion	8E-01	B	4E-01	B	1E-01	B	2E-05	E	4E-06	E	2E-06	6E-07
	Showering	NA		NA		NA		NA		NA		NA	NA
	Subtotal	8E-01	B	4E-01	B	1E-01	B	2E-05	E	4E-06	E	2E-06	6E-07
Leafy Vegetables	Ingestion	8E-02	B	5E-02	B	NA		6E-06	E	NA		7E-07	NA
Tuberous Vegetabl	Ingestion	9E-02	B	5E-02	B	NA		5E-06	E	NA		2E-06	NA
Fruits	Ingestion	2E-01	B	1E-01	B	NA		1E-05	E	NA		5E-06	NA
	Subtotal	4E-01	B	2E-01	B	NA		2E-05	E	NA		8E-06	NA
Chemical Exposures													
Combined Hazard Index:		3E+00	E	8E-01	B	2E-01	B						
Combined Cancer Risk:								5E-05	E	5E-06	E		
Radiological Exposures													
Combined Cancer Risk												2E-05	4E-06

NA - pathway not evaluated
U - Unknown -pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals

TABLE 3 RISK CHARACTERIZATION SUMMARY FOR THE L BPOPS: FUTURE LAND USE SCENARIOS - SUBSURFACE SOIL AND GROUNDWATER

Medium	Exposure Route	Chemicals												Radionuclides	
		Noncancer HI						Cancer Risk						Cancer Risk	
		Resident				Industrial Worker		Resident		Industrial Worker				Resident	Industrial Worker
		Child		Adult											
Soil	Ingestion	9E-01	B	9E-02	B	3E-02	B	6E-06	E	7E-07	B			1E-07	3E-08
	Dermal/Exter	1E-01	B	7E-02	B	3E-02	B	3E-07	B	1E-07	B			2E-05	6E-06
	Inhalation	U	B	U	B	U	B	3E-08	B	1E-08	B			5E-10	3E-10
	Subtotal	1E+00	B	2E-01	B	7E-02	B	6E-06	E	8E-07	B			2E-05	6E-06
Groundwater	Ingestion	8E-01	B	4E-01	B	1E-01	B	2E-05	E	4E-06	E			2E-06	6E-07
	Showering	NA		NA		NA		NA		NA				NA	NA
	Subtotal	8E-01	B	4E-01	B	1E-01	B	2E-05	E	4E-06	E			2E-06	6E-07
Leafy Vegetables	Ingestion	6E-02	B	4E-02	B	NA		5E-06	E	NA				7E-07	NA
Tuberous Vegetabl	Ingestion	7E-02	B	4E-02	B	NA		4E-06	E	NA				2E-06	NA
Fruits	Ingestion	2E-01	B	1E-01	B	NA		9E-06	E	NA				5E-06	NA
	Subtotal	3E-01	B	2E-01	B	NA		2E-05	E	NA				8E-06	NA
Chemical Exposures															
Combined Hazard Index:		2E+00	E	7E-01	B	2E-01	B								
Combined Cancer Risk:								4E-05	E	5E-06	E				
Radiological Exposures															
Combined Cancer Risk														3E-05	7E-06

NA - pathway not evaluated
U - Unknown - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals

TABLE 4 RISK CHARACTERIZATION SUMMARY FOR THE P BPOP: CURRENT LAND USE SCENARIO - SURFACE SOIL

Medium	Exposure Route	Chemicals: Noncancer HI On-Unit Worker	Chemicals: Cancer Risk On-Unit Worker	Radionuclides: Cancer Risk On-Unit Worker
Soil	Ingestion	1E-03 B	6E-09 B	U
	Dermal/Exter	6E-04 B	9E-10 B	U
	Inhalation	U B	5E-12 B	U
	Subtotal	2E-03 B	7E-09 B	U
Groundwater	Ingestion	NA	NA	NA
	Showering	NA	NA	NA
	Subtotal	NA	NA	NA
Leafy Vegetables	Ingestion	NA	NA	NA
Tuberous Vegetable	Ingestion	NA	NA	NA
Fruits	Ingestion	NA	NA	NA
	Subtotal	NA	NA	NA
Chemical Exposures				
Combined Hazard Index:		2E-03 B		
Combined Cancer Risk:			7E-09 B	
Radiological Exposures				
Combined Cancer Risk				0E+00 B

NA - pathway not evaluated
U - Unknown - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals

TABLE 5 RISK CHARACTERIZATION SUMMARY FOR THE P BPOP: FUTURE LAND USE SCENARIOS - SURFACE SOIL AND GROUNDWATER

Medium	Exposure Route	Chemicals										Radionuclides	
		Noncancer HI						Cancer Risk				Cancer Risk	
		Resident				Industrial Worker		Resident		Industrial Worker		Resident	Industrial Worker
		Child		Adult									
Soil	Ingestion	1E+00	B	2E-01	B	6E-02	B	1E-05	E	1E-06	B	U	U
	Dermal/Exter	9E-02	B	5E-02	B	2E-02	B	6E-07	B	2E-07	B	U	U
	Inhalation	U	B	U	B	U	B	3E-09	B	1E-09	B	U	U
	Subtotal	2E+00	E	2E-01	B	8E-02	B	1E-05	E	1E-06	B	U	U
Groundwater	Ingestion	3E-01	B	1E-01	B	5E-02	B	4E-05	E	9E-06	E	4E-06	1E-06
	Showering	NA		NA		NA		NA		NA		NA	NA
	Subtotal	3E-01	B	1E-01	B	5E-02	B	4E-05	E	9E-06	E	4E-06	1E-06
Leafy Vegetables	Ingestion	1E-01	B	6E-02	B	NA		9E-06	E	NA		U	NA
Tuberous Vegetable	Ingestion	1E-01	B	8E-02	B	NA		7E-06	E	NA		U	NA
Fruits	Ingestion	4E-01	B	2E-01	B	NA		2E-05	E	NA		U	NA
	Subtotal	6E-01	B	4E-01	B	NA		3E-05	E	NA		U	NA
Chemical Exposures													
Combined Hazard Index:		2E+00	E	7E-01	B	1E-01	B						
Combined Cancer Risk:								8E-05	E	1E-05	E		
Radiological Exposures													
Combined Cancer Risk												4E-06	1E-06

NA - pathway not evaluated
U - Unknown - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals

TABLE 6 RISK CHARACTERIZATION SUMMARY FOR THE P BPOP: FUTURE LAND USE SCENARIOS - SUBSURFACE SOIL AND GROUNDWATER

Medium	Exposure Route	Chemicals												Radionuclides	
		Noncancer HI						Cancer Risk						Cancer Risk	
		Resident				Industrial				Industrial					Industrial
		Child		Adult		Worker		Resident		Worker				Resident	Worker
Soil	Ingestion	2E+00	E	2E-01	B	9E-02	B	4E-05	E	4E-06	E			5E-08	1E-08
	Dermal/Exter	2E-01	B	1E-01	B	7E-02	B	2E-05	E	7E-06	E			3E-05	1E-05
	Inhalation	U	B	U	B	U	B	2E-09	B	1E-09	B			1E-12	7E-13
	Subtotal	2E+00	E	4E-01	B	2E-01	B	6E-05	E	1E-05	E			3E-05	1E-05
Groundwater	Ingestion	3E-01	B	1E-01	B	5E-02	B	4E-05	E	9E-06	E			4E-06	1E-06
	Showering	NA		NA		NA		NA		NA				NA	NA
	Subtotal	3E-01	B	1E-01	B	5E-02	B	4E-05	E	9E-06	E			4E-06	1E-06
Leafy Vegetables	Ingestion	1E-01	B	7E-02	B	NA		8E-06	E	NA				2E-06	NA
Tuberous Vegetable	Ingestion	5E+00	E	3E+00	E	NA		4E-04	E	NA				5E-06	NA
Fruits	Ingestion	4E-01	B	2E-01	B	NA		1E-05	E	NA				1E-05	NA
	Subtotal	5E+00	E	3E+00	E	NA		4E-04	E	NA				2E-05	NA
Chemical Exposures Combined Hazard Index:		8E+00	E	3E+00	E	2E-01	B								
Combined Cancer Risk:								5E-04	E	2E-05	E				
Radiological Exposures Combined Cancer Risk														5E-05	1E-05

NA - pathway not evaluated
U-Unknown - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI <= 1 or ELCR <= 10^{-6} for chemical risks
E - HI > 1 or ELCR > 10^{-6} for chemicals

Summary of Ecological Risk Assessment

The ecological risk assessment evaluated the likelihood of occurrence for adverse ecological effects from exposure to chemicals associated with the L and P BPOPs. The ecological settings of the units are not unique. There are no known endangered, threatened, or special concern species at either unit, nor are the species that inhabit the unit rare in the region or considered to be of special societal value. The area of each unit is small and the habitat is low in diversity and productivity. No ecological final COCs were retained at either unit; therefore, the units do not pose unacceptable risk to ecological receptors.

Uncertainty Analysis and Final COCs

An uncertainty analysis was performed on preliminary COCs. The uncertainty analysis allows for professional judgment to be used to exclude constituents that may not be clearly unit-related and for which risks may be overstated. Uncertainty for each preliminary COC was evaluated on a case-by-case basis, and is discussed in detail in Chapter 7 of *Approved Standardized Corrective Action Design (ASCAD™) Combined Document for the L- and P-Area Bingham Pump Outage Pits (U)* (WSRC, 1999a).

Preliminary Remediation Goals

Remedial Goal Options (RGOs) are concentration goals for individual chemicals for specific medium and land use combinations. They are designed to provide conservative, long-term targets for the selection and analysis of remedial alternatives. Final remedial levels for the COCs, which are selected by risk managers, are to be protective of both human health and ecological receptors, as well as comply with Federal and State Applicable or Relevant and Appropriate Requirements (ARARs). Because no final CM COCs or ecological final COCs were identified at the L and P BPOPs, no contaminant migration RGOs or ecological RGOs were developed.

For each land use/receptor scenario (current on-unit worker, future industrial worker, and hypothetical on-unit resident), a range of potential human health RGOs is provided, corresponding to target HQs of 0.1, 1, and 3 as well as target cancer risks of 1×10^{-6}, 1×10^{-5}, and 1×10^{-4} (Table 7). However, because the anticipated land use is industrial and exposure will be limited to surface soil, and because there were no final COCs in surface soil, no RGOs were selected (Table 7).

Conclusions and Site-Specific Considerations

The response action selected in this Record of Decision is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment. Site-specific considerations for the development of remedial alternatives, based on the conclusions of the RI/BRA for the L and P BPOPs, include:

- Buried waste remains in place at the L and P BPOPs below 1.2 m (4 ft) of backfill. The waste is categorized as Low Level Threat Waste (US EPA, 1991) because of the absence of free liquids or mobile or highly toxic material. The waste consists primarily of miscellaneous construction debris (pipes, cables, ladders, concrete, and miscellaneous construction hardware) which may have low-level fixed contamination such as cesium-137, strontium-90, and cobalt-60.

- No human health final COCs were identified in groundwater for any land use/receptor scenario at either unit, indicating that groundwater does not pose unacceptable risks.

TABLE 7 PRELIMINARY RGOs FOR HUMAN HEALTH COCs IN SOIL AT THE P BPOP

			Noncarcinogenic Effects				Carcinogenic Effects			2X Average Backgroun			
				Future				Future		P BPOP		Conc.	
Constituent	Target Hazard Quotient	Target Cancer Risk	Current Worker	Resident Child	Resident Adult	Industrial Worker	Current Worker	Resident	Industrial Worker	(Surface)	(All Depths)	Based ARAR	RGO
PCBs (mg/kg)													
Aroclor 1254	0.1	1E-06	100	0.14	0.94	2.4	350	0.26	1.7	ND	ND	10	*
Aroclor 1260	0.1	1E-06	No RfD	No RfD	No RfD	No RfD	350	0.26	1.7	ND	ND	10	*
SVOCs (ug/kg)													
Benzo(a)anthracene	0.1	1E-06	8.34E+07	1.82E+05	8.38E+05	2.00E+06	5.33E+05	519	2.56E+03	ND	ND	none	*
Benzo(a)pyrene	0.1	1E-06	8.34E+07	1.82E+05	8.38E+05	2.00E+06	5.33E+04	52	256	ND	10.9	none	*
Benzo(b)fluoranthene	0.1	1E-06	8.34E+07	1.82E+05	8.38E+05	2.00E+06	5.33E+05	519	2.56E+03	9.98	11.1	none	*
Dibenzo(a,h)anthracene	0.1	1E-06	8.34E+07	1.82E+05	8.38E+05	2.00E+06	5.33E+04	52	256	ND	7.02	none	*
PCBs (mg/kg)													
Aroclor 1254	1	1E-05	995	1.4	9.4	24	3,499	2.6	17	ND	ND	10	*
Aroclor 1260	1	1E-05	No RfD	No RfD	No RfD	No RfD	3,499	2.6	17	ND	ND	10	*
SVOCs (ug/kg)													
Benzo(a)anthracene	1	1E-05	8.34E+08	1.82E+06	8.38E+06	2.00E+07	5.33E+06	5.19E+03	2.56E+04	ND	ND	none	*
Benzo(a)pyrene	1	1E-05	8.34E+08	1.82E+06	8.38E+06	2.00E+07	5.33E+05	519	2.56E+03	ND	10.9	none	*
Benzo(b)fluoranthene	1	1E-05	8.34E+08	1.82E+06	8.38E+06	2.00E+07	5.33E+06	5.19E+03	2.56E+04	9.98	11.1	none	*
Dibenzo(a,h)anthracene	1	1E-05	8.34E+08	1.82E+06	8.38E+06	2.00E+07	5.33E+05	519	2.56E+03	ND	7.02	none	*
PCBs (mg/kg)													
Aroclor 1254	3	1E-04	2,986	4.3	28	72	34,986	26	168	ND	ND	10	*
Aroclor 1260	3	1E-04	No RfD	No RfD	No RfD	No RfD	34,986	26	168	ND	ND	10	*
SVOCs (ug/kg)													
Benzo(a)anthracene	3	1E-04	2.50E+09	5.46E+06	2.51E+07	6.00E+07	5.33E+07	5.19E+04	2.56E+05	ND	ND	none	*
Benzo(a)pyrene	3	1E-04	2.50E+09	5.46E+06	2.51E+07	6.00E+07	5.33E+06	5.19E+03	2.56E+04	ND	10.9	none	*
Benzo(b)fluoranthene	3	1E-04	2.50E+09	5.46E+06	2.51E+07	6.00E+07	5.33E+07	5.19E+04	2.56E+05	9.98	11.1	none	*
Dibenzo(a,h)anthracene	3	1E-04	2.50E+09	5.46E+06	2.51E+07	6.00E+07	5.33E+06	5.19E+03	2.56E+04	ND	7.02	none	*

ND = Not Detected
RfD = Reference Dose
No final COCs were identified at the L BPOPs; therefore, no table of preliminary RGOs for Human Health COCs in soil was developed.
Concentration-based ARARs for PCBs in soil based on US EPA guidance for sites in industrial areas (US EPA, 1990); the guidance states that action levels should be established in the range of 10 to 25 mg/kg, based on site-specific conditions.
* RGOs are selected based on the anticipated future land use of the unit (limited use with restrictions similar to an industrial use zone) with exposure to surface soil. Because there were no final COCs for surface soil, no RGOs are listed.

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- Fate and transport modeling found that leaching of the constituents present in soils at the L or P BPOPs does not present an unacceptable future risk to groundwater at either unit, and no CM COCs are retained.
- At the L BPOPs, no human health final COCs were identified in soil for any land use/receptor scenario, indicating that surface and subsurface soils do not pose unacceptable risks to human health under current or future conditions.
- At the P BPOP, PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[a]fluoranthene, and dibenzo[a,h]anthracene) and PCBs (Aroclor 1254 and Aroclor 1260) were retained as human health final COCs in soil. Each of the final COCs is identified as a COC in subsurface soil for the hypothetical on-unit resident scenario; benzo(a)pyrene is also identified as a COC in subsurface soil for the future industrial worker scenario. Potential RGOs were developed for these final COCs for three target risk levels under current and hypothetical future land use scenarios (Table 7).
- The future land use for the L and P BPOPs is anticipated to be limited with restrictions similar to an industrial use zone.
- The one constituent that is identified as a COC for the future industrial scenario (benzo[a]pyrene at the P BPOP) exceeds target risk levels in a small, isolated location in the pit subsurface soils (Figure 10).
- No ecological final COCs were retained at either unit, therefore, the units do not pose unacceptable risks to ecological receptors.

Remedial strategies for the units must focus on the buried waste that remains in place below 1.2 m (4 ft) of backfill at each unit.

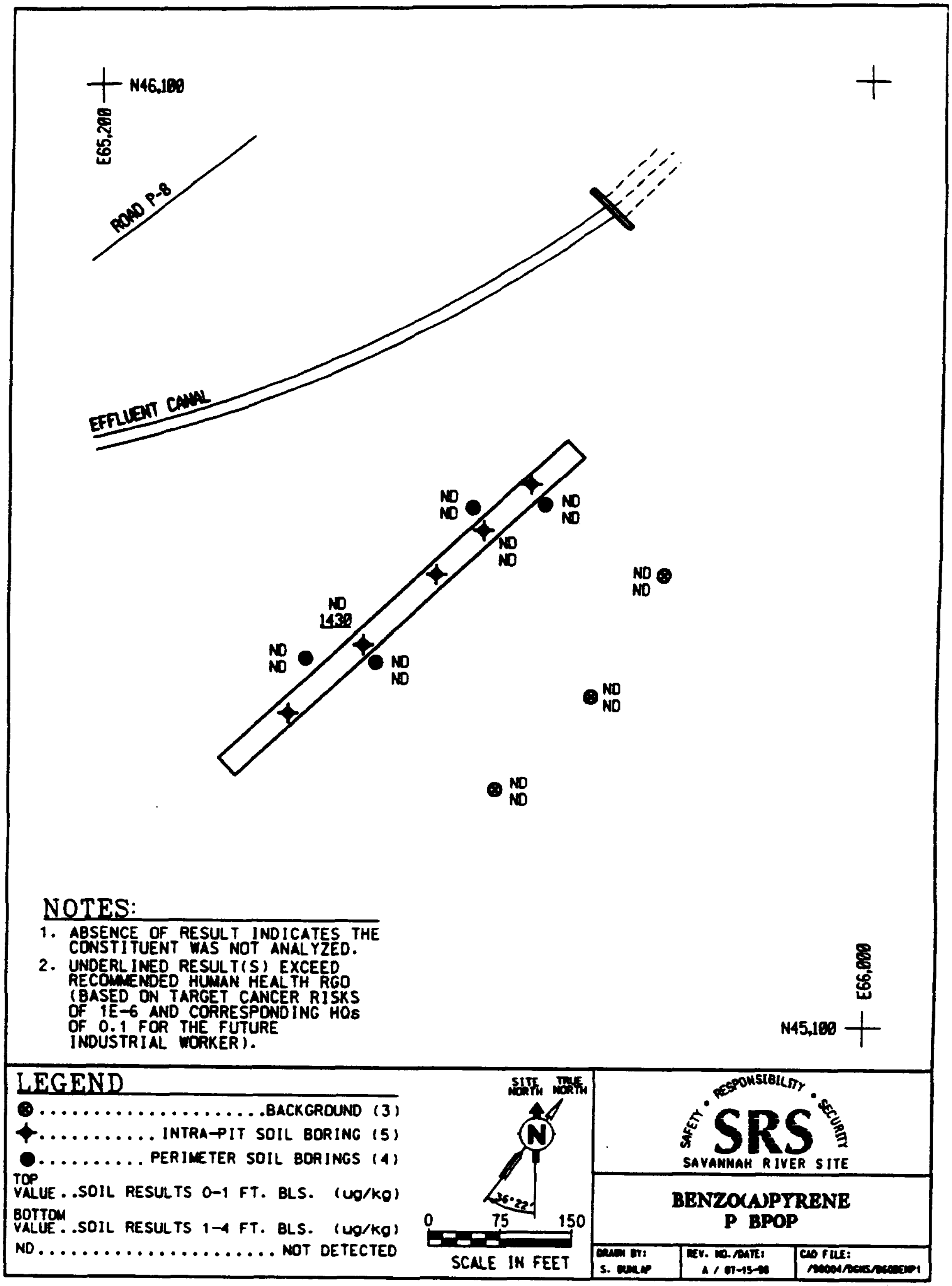

Figure 10. Distribution of Benzo(a)pyrene in Surface and Subsurface Soils at the P BPOP

VII. REMEDIAL ACTION OBJECTIVES AND DESCRIPTION OF CONSIDERED ALTERNATIVES

Remedial Action Objectives

Remedial Action Objectives (RAOs) specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs, information to-be-considered, or other information from the RI/BRA. These goals should be modified, as necessary, as more information and potential remedial technologies become available. Final remediation goals are determined when the remedy is selected. Then, acceptable exposure levels that are protective of human health and the environment shall be established.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal, State, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs (action-, chemical-, and location-specific) have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific and health-based concentration limits developed for site-specific levels of constituents in specific media. Location-specific ARARs must consider Federal, State, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area. There were no action-specific, location-specific, or chemical-specific ARARs relevant to establishing RAOs for the L and P BPOPs. Action-specific ARARs have been identified while investigating remedial alternatives

Remedial Alternatives for Soil

Six alternatives for soil remediation were developed in the K BPOP FS. These alternatives address a wide range of technologies and general response actions with baseline, containment, treatment, and excavation/removal features. The alternatives were designed to be applicable to each of the units in the BPOP waste unit group, and address both primary sources and secondary sources of contamination.

In the focused FS for the L and P BPOPs, each of the six alternatives was reviewed and then assessed individually for the L and P BPOPs. Table 8 provides a listing of the alternatives and the estimated costs associated with their implementation. The following sections provide a description of each alternative.

Alternative 1 - No Action

Under this alternative, no actions would be conducted and no limitations would be placed on future uses of the site. US EPA policy and regulations require the consideration of No Action to serve as a baseline against which the other alternatives can be compared. Because no action would be taken at the unit, the unit would remain in its present condition and there would be no reduction of risk.

TABLE 8 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL AT THE L AND P BPOPs

CERCLA CRITERIA	Alternative 1. No Action	Alternative 2. Land Use Controls	Alternative 3. Placement of Soil Cover	Alternative 4. In-situ solidification of soil and debris; soil cover	Alternative 5. Excavate debris; solidify/stabilize soil; backfill treated soil and debris; soil cover	Alternative 6. Excavate debris and soil, disposal in EAV
Overall Protection of Human Health and the Environment						
Human Health (evaluation focuses on the the primary source material at each unit and the human health final COCs in subsurface soil at the P BPOP)	No long term protection. In the absence of periodic maintenance and access/deed restrictions, erosion of existing backfill or development could increase exposure to primary source material and the final COCs in subsurface soil at P BPOP.	Protective. Access and deed restrictions would greatly reduce the risk of exposure to primary source material at each unit and the final COCs in subsurface soil at P BPOP by prohibiting unauthorized excavation and land use.	Protective. Soil cover would further isolate the primary source material at each unit and the final COCs in subsurface soil at P BPOP. The Land Use Controls would provide the necessary reduction in exposure.	Protective.In-situ grouting would reduce exposure potential by immobilizing COCs and preventing direct contact. The Land Use Controls would provide the necessary reduction in exposure.	Protective. Ex-situ grouting would reduce exposure potential by immobilizing COCs and preventing direct contact. The Land Use Controls would provide the necessary reduction in exposure.	Protective. Risk reduced to background levels through complete source term removal.
Environment (evaluation focuses on the the primary source material at each unit – no ecological final COCs were identified at either unit)	No long term protection. Erosion of existing backfill or development could increase exposure to primary source material.	Protective. Maintenance, inspections, and land use restrictions would prevent exhumation of primary source material.	Protective. Soil cover would further isolate the primary source material at each unit. The Land Use Controls would provide the necessary reduction in exposure.	Protective. In-situ grouting would reduce exposure potential by preventing direct contact. The Land Use Controls would provide the necessary reduction in exposure.	Protective. Ex-situ grouting would reduce exposure potential by preventing direct contact. The Land Use Controls would provide the necessary reduction in exposure.	Protective. Risk reduced to background levels through complete source term removal.
Control of Source Release (neither unit poses a risk to groundwater - no final CM COCs were identified)	Does not reduce leaching. No actions would be taken to reduce infiltration and percolation, therefore, leaching would continue under current conditions.	Does not reduce leaching. No actions would be taken to reduce infiltration and percolation, therefore, leaching would continue under current conditions.	Provides moderate reduction in infiltration and leaching.	Provides significant reduction in infiltration and leaching.	Provides greater reduction in infiltration and leaching.	Provides the greatest reduction in infiltration and leaching through source term removal.

TABLE 8 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL AT THE L AND P BPOPS (CONT'D.)

CERCLA CRITERIA	Alternative 1. No Action	Alternative 2. Land Use Controls	Alternative 3. Placement of Soil Cover	Alternative 4. In-situ solidification of soil and debris; soil cover	Alternative 5. Excavate debris; solidify/stabilize soil; backfill treated soil and debris; soil cover	Alternative 6. Excavate debris and soil, disposal in EAV
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)						
Chemical-Specific	None.	None.	None.	None.	None.	None.
Location-Specific	None.	None.	None.	None.	None.	None.
Action-Specific	None.	None.	Complies with the appropriate ARARs if erosion control and dust emission standards (SC R61-62.6) are instated for any onsite remediation. OSHA (29 CFR 1910), NESHAPs, and Occupational Radiation Protection regulations also apply.	Complies with the appropriate ARARs if erosion control and dust emission standards (SC R61-62.6) are instated for any onsite remediation. OSHA (29 CFR 1910), NESHAPs, Occupational Radiation Protection regulations, and 40 CFR 264.114 also apply.	Complies with the appropriate ARARs if erosion control and dust emission standards (SC R61-62.6) are instated for any onsite remediation. OSHA (29 CFR 1910), NESHAPs, Occupational Radiation Protection regulations, 40 CFR 264.114, 40 CFR 264.251, and 40 CFR 264.258(a) also apply.	Complies with the appropriate ARARs if erosion control and dust emission standards (SC R61-62.6) are instated for any onsite remediation. OSHA (29 CFR 1910), NESHAPs, Occupational Radiation Protection regulations. RCRA regulations for hazardous waste (SC R61-79.261 through 79.268) generation, transport, characterization, treatment, storage, and disposal, 40 CFR 264.114, and 49 CFR 107, also apply.

TABLE 8 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL AT THE L AND P BPOPS (CONT'D.)

CERCLA CRITERIA	Alternative 1. No Action	Alternative 2. Land Use Controls	Alternative 3. Placement of Soil Cover	Alternative 4. In-situ solidification of soil and debris; soil cover	Alternative 5. Excavate debris; solidify/stabilize soil; backfill treated soil and debris; soil cover	Alternative 6. Excavate debris and soil, disposal in EAV
Long-Term Effectiveness and Permanence						
Magnitude of Residual Risks	Residual risk would be the same as that determined in the BRA.	Does not involve any form of treatment that would reduce the risks. However, residential land use is prohibited, and erosion and unauthorized excavation of subsurface soils is prevented.	Does not involve any form of treatment that would permanently reduce the risks. However, surface and subsurface risks would be reduced to risk levels associated with the soil cover (background).	Residual risks are reduced through solidification of soil, immobilization of COCs, reduction in infiltration provided by a soil cover, and access controls.	Residual risks are reduced through treatment and solidification of soil, immobilization of COCs, reduction in infiltration provided by a soil cover, and access controls.	Greatest reduction in residual risk because the contaminated material is removed from the waste unit.
Permanence	Not permanent. Threat of exposure would increase if erosion occurs.	Permanent as long as maintenance and administrative controls are maintained.	Permanent as long as soil cover and Land Use Controls are maintained.	Permanent. Solidification of soil provides long-term immobilization.	Permanent. Solidification of soil provides long-term immobilization.	Permanent. Contaminated media is permanently removed from the waste site.
Reduction in Toxicity, Mobility, or Volume Through Treatment						
Degree of Expected Reduction in Toxicity	No reduction because media would not be actively treated.	No reduction because media would not be actively treated.	No reduction because media would not be actively treated.	Media treated and isolated but left in place.	Media treated and isolated but left in place.	Media transported to another facility.
Degree of Expected Reduction in Mobility	No reduction.	No reduction.	Soil cover provided moderate reduction in infiltration and leaching.	Greater reduction in mobility by implementing in-situ solidification and the placement of soil cover.	Greater reduction in mobility by implementing ex-situ solidification and the placement of soil cover.	No reduction. No form of active treatment applied to the contaminants. Media removed from the unit.
Degree of Expected Reduction in Volume	No reduction.	No reduction.	No reduction.	An increase in volume of contaminated material up to 100%.	An increase in volume of contaminated material up to 100%.	Reduction of contaminant volume through removal to another location.

TABLE 8 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL AT THE L AND P BPOPS (CONT'D.)

CERCLA CRITERIA	Alternative 1. No Action	Alternative 2. Land Use Controls	Alternative 3. Placement of Soil Cover	Alternative 4. In-situ solidification of soil and debris; soil cover	Alternative 5. Excavate debris; solidify/stabilize soil; backfill treated soil and debris; soil cover	Alternative 6. Excavate debris and soil, disposal in EAV
Short-Term Effectiveness						
Risk to Workers	None	No exposure concerns because intrusive onsite work is not required; Workers exposed to minor short-term construction related risks (e.g., falls, cuts, heavy equipment operation) associated with site maintenance at both units.	Minor potential risk due to inhalation or direct contact during soil cover placement; applicable work safety regulations would be followed.	Moderate potential risk due to inhalation or direct contact during treatment; in-situ treatment minimizes potential contact; applicable work safety regulations would be followed	High potential risk due to inhalation or direct contact during soil excavation, handling, and treatment; applicable work safety regulations would be followed.	High potential risk due to inhalation or direct contact during soil excavation, handling, and shipment; applicable work safety regulations would be followed.
Risk to Community	None.	None.	None.	None.	None.	None.
Time to Achieve Remedial Action Objectives	RAOs not achieved	2 months	2 months	3 to 4 months	3 to 5 months	2 to 5 months

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TABLE 8 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL AT THE L AND P BPOPs (CONT'D.)

CERCLA CRITERIA	Alternative 1. No Action	Alternative 2. Land Use Controls	Alternative 3. Placement of Soil Cover	Alternative 4. In-situ solidification of soil and debris; soil cover	Alternative 5. Excavate debris; solidify/stabilize soil; backfill treated soil and debris; soil cover	Alternative 6. Excavate debris and soil, disposal in EAV
Implementability						
Availability of Materials, Equipment, Contractors	Not applicable.	Readily available.	Readily available.	Readily available materials; minor difficulties in the selection of qualified contractors.	Readily available materials; minor difficulties in the selection of qualified contractors.	Readily available materials; minor difficulties in the selection of qualified contractors.
Administrative Feasibility/ Regulatory Requirements	No administrative constraints to implementation.	No administrative constraints to implementation.	No implementation restrictions.	Special requirements may need to be followed for grouting among debris.	No implementation restrictions.	Evaluation of regulatory and acceptance criteria required.
Technical Feasibility	Readily implementable.	Readily implementable.	Implementable. Utilizes proven technologies; no site limitations identified.	Implementable. Utilizes proven technologies; no site limitations identified.	Implementable. Utilizes proven technologies; no site limitations identified.	Implementable. Utilizes proven technologies. Availability of space at disposal facility is limited.
Monitoring Considerations	Not applicable.	Periodic inspections and routine maintenance performed.	Monitoring associated with Land Use Controls.	Monitoring of radiation levels; process confirmation testing. Monitoring associated with Land Use Controls.	Air quality monitoring of fugitive dust; monitoring of radiation levels. Monitoring associated with Land Use Controls.	Air quality monitoring; monitoring of radiation levels.
Cost						
Capital	$0	$13,900	$296,600	$1,762,400	$2,711,700	$11,401,800
O & M	$50,000	$71,500	$83,800	$83,800	$83,800	$0
Total Cost for L BPOPs	$50,000	$85,400	$380,400	$1,846,200	$2,795,500	$11,401,800
Capital	$0	$13,900	$281,400	$1,650,500	$2,570,900	$10,410,100
O & M	$50,000	$70,00	$79,200	$79,200	$79,200	$0
Total Cost for P BPOP	$50,000	$83,900	$360,600	$1,729,700	$2,650,100	$10,410,100

State and community acceptance will be evaluated after the public comment period.

Alternative 2 - Land Use Controls (Access and Deed Restrictions/Notifications)

Under this alternative, Land Use Controls would be implemented and the unit would remain undisturbed. Implementation of this alternative would require both near- and long-term actions.

For the near-term, signs would be posted to indicate that the areas were used for disposal of waste material. In addition, existing SRS access controls would be used to maintain the use of the units consistent with their intended land use.

Periodic inspections would be conducted and maintenance would be performed to help ensure that no erosion or soil migration occurs. Maintenance, as needed, would consist primarily of mowing and subsidence repairs. Minor drainage modifications may be conducted as needed to prevent ponding and to promote surface water runoff.

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

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

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

All contaminated media would remain onsite and there would be no reduction in the toxicity, mobility, or volume of toxic substances or contaminated media. Long-term protection of human health and the environment would be achieved through deed restrictions and maintenance of the existing soil cover. The residual risk under this alternative is the same as that determined in the BRA. This alternative would reduce the future risks presented by the unit by limiting or preventing future exposure pathways such as those associated with excavation.

No threats to workers, the local community, or the environment would be posed during implementation of this alternative because the existing soil cover would not be disturbed and contaminated materials would not be exposed. There are no technical or administrative constraints to the implementation of this alternative. Inspections of the existing soil cover and vegetation could be performed by SRS personnel or a contractor. Likewise, SRS personnel or local firms could perform routine maintenance. Placement of deed restrictions or notices requires legal assistance. However, no administrative limitations are known.

Alternative 3 - Placement of a Soil Cover

Under this alternative, the units would be covered by a low permeability soil cover with a minimum thickness of 0.9 to 1.2 m (3 to 4 ft) (nominal in-place saturated hydraulic conductivity of 1×10^{-5} cm/sec or less). Limited site clearing and grading might be required to place the soil cover. The soil cover would have an upper surface with a slope of three to five percent to promote surface water runoff and minimize surface erosion. A topsoil (vegetative soil layer - minimum thickness 3 to 6 inches) would be placed on top of the soil cover.

The topsoil (vegetative soil layer) would be added and the area would be compacted and seeded with native grasses to increase evapotranspiration. The topsoil layer would also protect the soil cover from damage due to erosion and frost. The topsoil layer would also provide water storage capacity to reduce the rate of runoff which, if too high, could cause erosion of the soil cover.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The contaminated material would be isolated by the soil cover and contaminant mobility would be minimized by reductions in infiltration and erosion.

Because buried waste would be left in place at depth, Land Use Controls would also be necessary to restrict the area to future industrial use and to prohibit excavation of the soil cover.

Alternative 4 - In-Situ Solidification of Soil and Debris, Soil Cover

Under this alternative, a concrete-based agent would be injected into the units and mixed with the soil to form a solidified mass. The concrete material would be injected into the ground in columns in an overlapping pattern to provide treatment over the entire target area. The solidification process would produce a monolithic structure that would eliminate or reduce the mobility of the contaminants. A soil cover would then be placed over the treated site. The design of the soil cover would be the same as that discussed under Alternative 3.

Solidification would provide effective reduction or elimination of the mobility of site contaminants. The source of leachable contamination would effectively be removed from the unit. The RAOs would not be achieved through treatment, but would be achieved once the soil cover is in place. The total volume of contaminated material would be increased by up to 100 percent of the original volume. The total mass of inorganic contaminants would remain unchanged.

Because buried waste would be left in place at depth, Land Use Controls would also be necessary to restrict the area to future industrial use.

Alternative 5 - Excavate Soil and Debris, Solidify/Stabilize Soil, Backfill Treated Soil and Debris, Soil Cover

Under this alternative, the identified soil and debris would be excavated by backhoe or other similar equipment. Excavation would extend to at least four feet below the base of the debris. The excavation could go deeper if necessary. The excavated material would then be staged at the unit. Impermeable tarps would be placed on the ground prior to placement of the excavated material and similar tarps would be placed over individual piles to limit airborne particulates and contaminated runoff. Other containment measures would be implemented as needed.

The excavated soil would be treated by solidification with Portland cement. The material would be mixed with the cement to form solid blocks that would reduce or eliminate the mobility of the contaminants. Preliminary testing would be required to determine an appropriate ratio of cement to soil. The treated soil would then be backfilled into the excavation and a soil cover would be placed over the unit. The design of the soil cover would be the same as that discussed under Alternative 3.

Solidification would provide effective reduction or elimination of the mobility of site contaminants. In addition, the contaminated material would be isolated by the soil cover. The total volume of contaminated soil would be increased by up to 100 percent of the original volume. The total mass of inorganic contaminants would remain unchanged.

Excavation of soil and debris for treatment would result in fugitive dust being released to the atmosphere, potentially exposing onsite workers.

Because buried waste would be left in place at depth, Land Use Controls would also be necessary to restrict the area to future industrial use.

Alternative 6 - Excavate Soil and Debris, Dispose in E-Area Vaults

This alternative would require excavation by backhoe or similar means and removal of contaminated soil. Excavation would extend to at least four feet below the base of the debris. The excavation could go deeper if necessary. The excavated material would be hauled from the site and disposed at the E-Area Vaults (EAV). The excavation would be backfilled with soil and seeded.

Excavation would present limited short-term exposures to workers. Excavation of soil and debris would result in fugitive dust being released to the atmosphere, potentially contacting onsite workers.

Because implementation of this alternative would result in complete source term removal, Land Use Controls would not be necessary.

Remedial Alternatives for Groundwater

The RI/BRA for the L and P BPOPs established that groundwater at these units does not pose unacceptable risk to human health for any land use/receptor scenario (no human health final COCs in groundwater were identified). Therefore, groundwater RGOs were not developed and no action was required. Under this remedy, no actions would be conducted. There are no capital or operational and maintenance costs associated with this remedy.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Each of the remedial alternatives for soil was evaluated using the nine criteria established by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The criteria are:

1. overall protection of human health and the environment
2. compliance with ARARs
3. long-term effectiveness and permanence
4. reduction of toxicity, mobility, or volume through treatment
5. short-term effectiveness
6. implementability
7. cost
8. State acceptance
9. community acceptance

In selecting the preferred alternative, the above criteria were used to evaluate the alternatives developed in the focused FS (WSRC, 1999a). Seven of the criteria were used to evaluate all the alternatives, based on human health and environmental protection, cost, feasibility, and feasibility issues (Table 8). Groundwater alternatives were not carried through a detailed evaluation because no remedies other than No Action were considered.

Overall Protection of Human Health and the Environment

The results of the comparative analysis of alternatives for soil indicate that with the exception of Alternative 1 (No Action), all considered alternatives meet the RAOs. For alternatives 2 through 5, overall protection of human health and the environment is achieved through Land Use Controls, which prohibits unauthorized excavation. Alternatives 3 through 5 provide increasing levels of waste isolation, but all mandate Land Use Controls. Alternative 6 provides the highest overall protection through complete source term removal.

Compliance with ARARs

Alternatives 4, 5 and 6 involve intrusive activities, which trigger action-specific ARARs and higher short-term risk to workers, particularly with Alternatives 5 and 6.

Long-Term Effectiveness and Permanence

The residual risk decreases and the permanence increases with higher levels of treatment, with Land Use Controls in Alternatives 2 through 5, providing the necessary levels of risk reduction and permanence.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The reduction in toxicity and mobility increases with increasing levels of treatment, but is associated with a greater waste volume in Alternatives 4 and 5.

Because the units do not pose a current or future threat to groundwater, each alternative adequately addresses contaminant mobility and leaching concerns.

Short-Term Effectiveness

During the construction and implementation period, minor short-term construction related risks associated with site maintenance at both units exist in Alternatives 2 through 5. The time to achieve RAOs is in the 2-5 month range for Alternatives 2-5. The time to achieve remedial action objectives is based upon the time required to implement the remedial alternative.

Implementability

No significant obstacles to implementation are identified, although minor technical and/or administrative difficulties may be encountered with Alternatives 4, 5, and 6. All alternatives can be implemented in a short period of time (within several months), and given the large distance to the nearest SRS boundary, none of the alternatives present a risk to the community.

Cost

The cost of the alternatives include capital and operations and maintenance costs. The costs for Alternatives 4-6 are significantly higher due to increased treatment. The costs were projected over a 30-year period with an interest rate of 5 percent.

State Acceptance

For the L and P BPOPs, the State and Federal regulatory agencies have accepted and approved Alternative 2 (Land Use Controls) for soil and No Action for groundwater because they have successfully met the comparative analysis criteria as well as the RAOs.

Community Acceptance

Based on the public comments received from the community and the CAB, this remedy has met community acceptance. It provides adequate protection against buried waste left in place at depth.

Based on these criteria, Alternative 2 (Land Use Controls) is selected as the preferred alternative for soil at each unit. Among the alternatives that meet the RAOs (Alternatives 2 through 6), the primary deciding criteria are cost, long-term effectiveness and permanence (magnitude of residual risk), and risk to workers.

The preferred alternative is further evaluated based on the final two criteria (State acceptance and community acceptance) in the following section.

IX. THE SELECTED REMEDY

For the L and P BPOPs, the State and Federal regulatory agencies have accepted and approved Alternative 2 (Land Use Controls) for soil and No Action for groundwater based upon the successful satisfaction of both the comparative analysis criteria and RAOs. A review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. In addition, based on the public comments received from the community and the CAB, this remedy has met community acceptance. It provides adequate protection against buried waste left in place at depth.

Land Use Controls will restrict the L and P BPOPs to future industrial use and will prohibit residential use of the areas. Unauthorized excavation will also be prohibited and the waste units will remain undisturbed. Land Use Controls will be maintained until such time that they are deemed unnecessary.

Per the US EPA Region IV Land Use Controls (LUCs) Policy (US EPA, 1998), a Land Use Control Assurance Plan (LUCAP) for SRS has been developed and submitted to US EPA and SCDHEC for approval. Based on the results of the L and P BPOPs RI/BRA, the selected remedial alternative for these OUs incorporate LUCs, and therefore, a Land Use Control Implementation Plan (LUCIP) for the L and P BPOPs will be developed and submitted to the regulators for approval. The SRS LUCAP has been submitted under separate cover, whereas the unit-specific LUCIP will be included in the L and P BPOPs Final Remediation Report (FRR) in accordance with the post-ROD document schedule provided in Figure 11. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the L and P BPOPs ROD to ensure that the remedy remains protective of human health and the environment. Upon regulatory approval, the L and P BPOPs LUCIP will be appended to the SRS LUCAP.

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

- prevent contact, removal, or excavation of buried waste in the area
- preclude residential use of the area

Land Use Controls required to prevent unauthorized exposure to the contaminated media at the L and P BPOPs include the following:

1. installation of warning signs at the most probable access points to indicate that the areas were used for the disposal of waste material (radioactively-

contaminated construction materials) and to advise that the waste unit custodian must be contacted prior to entry

2. use of existing SRS access controls (including security gates, guards, and the site use/site clearance program) to maintain the use of each site consistent with its intended land use

3. periodic inspections and general maintenance (primarily mowing and subsidence repairs, and minor drainage modifications as needed to prevent ponding and to promote surface water runoff)

4. evaluation of the need for deed notifications/restrictions if the property were ever transferred to non-federal ownership, as required under CERCLA Section 120(h)

5. preparation of a survey plat of the areas under LUCs, completed by a professional land surveyor, to be included in the post-ROD documents

Activity ID	Activity Description	Orig Dur
FINAL REMEDIATION REPORT		
8RR0100	EPA/SCDHEC ROD ISSUANCE	0
8RR0101	DEVELOP FINAL REMEDIATION REPORT	120
8RR0201	SRS SUBMITTAL OF REV.0 FINAL REMEDIATION REPORT	0
8RR0301	EPA/SCDHEC REVIEW	90
8RR0401	SRS INCORPORATE EPA/SCHDEC COMMENTS	60
8RR0501	SRS SUBMITTAL OF REV.1 FINAL REMEDIATION REPORT	0
8RR0601	EPS/SCHDEC FINAL REVIEW & APPROVAL	30
8RR0701	EPA/SCDHEC APPROVAL	0

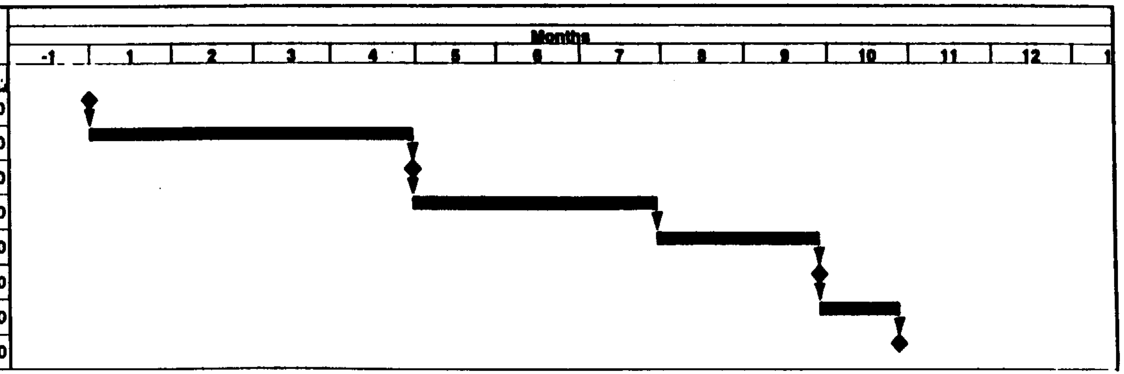

Figure 11. Post-ROD Document Schedule

In the long-term, if the L or P BPOPs property is ever transferred to non-Federal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. These actions will include a deed notification disclosing former waste management and disposal activities, as well as any remedial actions taken at the waste unit. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. The deed shall also include restrictions precluding residential use of the property. However, the need for these deed restrictions may be re-evaluated 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 deed restrictions will be done through an amended ROD with US EPA and SCDHEC review and approval. In addition, if the site is ever transferred to nonfederal ownership, a survey plan of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

No threats to workers, the local community, or the environment will be posed during implementation of this alternative because the existing soil cover would not be disturbed and contaminated materials will not be exposed. There are no technical or administrative constraints to the implementation of this alternative. Inspections of the cover and vegetation at each unit could be performed by SRS personnel or a contractor. Likewise, SRS personnel or local firms could perform routine maintenance. Placement of deed restrictions or notices requires legal assistance. However, no administrative limitations are known.

At the L BPOPs, Land Use Controls for soil and No Action for groundwater will meet the RAOs. Because no human health final COCs were identified for soil (for either industrial or residential scenarios), current and future industrial workers will not be exposed to final COCs that exceed the US EPA risk level of greater than or equal to one in one million (1×10^{-6}). The remedy prevents human exposure to the buried waste at depth by prohibiting unauthorized excavation. Because no ecological final COCs were identified for soil, the unit does not pose a threat to current or future ecological receptors. Because no CM COCs were identified, the unit does not pose a risk to groundwater. No Action is protective of groundwater because no final COCs were identified for groundwater.

At the P BPOP, Land Use Controls for soil and No Action for groundwater will meet the RAOs. PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and dibenzo[a,h]-anthracene) and PCBs (Aroclor 1254 and Aroclor 1260) were retained as human health final COCs in soil. Each of the final COCs is identified as a COC in subsurface soil for the hypothetical on-unit resident scenario. No final COCs in surface soil pose a risk to the future industrial worker greater than or equal to the US EPA risk level. In subsurface soil, benzo(a)pyrene poses a risk slightly above the US EPA risk level for the future industrial worker (ingestion ERR = 2×10^{-6}; dermal contact ERR = 4×10^{-6}). The RAOs are met through land use restrictions which will prohibit excavation and exposure to both subsurface soil and buried waste. Because no ecological final COCs were identified for soil, the unit does not pose a threat to current or future ecological receptors. Because no final CM COCs were identified, the unit does not pose a risk to groundwater. No Action is protective of groundwater because no final COCs were identified for groundwater.

These selected remedies are intended to be the final actions. The solution is intended to be permanent and effective in both the short- and long-term. These alternatives are considered to be the lowest cost options which are still protective of human health and the environment with an estimated combined cost of $169,305. Tables B1 and B2 in Appendix B provide a detailed cost breakdown for the selected remedy. This document is consistent with US EPA guidance and is an effective use of risk management principles.

X. STATUTORY DETERMINATIONS

Based on the RI/BRA, buried waste at the L and P BPOPs would pose a risk to human health and the environment if receptors were to be exposed to buried debris left in place. In addition, final COCs were identified at the P BPOP that would pose unacceptable carcinogenic risks (at or above 1×10^{-6} [one excess human cancer in a population of one million]) if exposure to subsurface soils were to occur. For the hypothetical on-unit resident scenario, four PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[a]fluoranthene, and dibenzo[a,h]anthracene) and two PCBs (aroclor 1254 and aroclor 1260) would pose unacceptable risks if the land use was changed from industrial to residential. For the future industrial worker scenario, benzo(a)pyrene would pose unacceptable risk if contact with subsurface soils were to occur.

Land Use Controls for soil and No Action for groundwater at the L and P BPOPs satisfy the statutory requirements of CERCLA Section 121 in the following manner:

- The selected remedy for each unit is protective of human health and the environment. The selected remedy is necessary to prohibit unauthorized excavation and to maintain the areas for their intended land use. This remedy will prevent unauthorized excavation and exposure to buried debris at both units. Periodic inspections and maintenance will ensure long-term stability of the units. Because no groundwater COCs were identified, No Action is protective of the groundwater at each unit.

- The selected remedy complies with Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action.

- The selected remedy is cost effective.

- The selected remedy does not utilize permanent solutions or alternative treatment technologies because they are not required to implement land use controls.

- The selected remedy does not reflect a preference for treatment because the contaminants are considered to be Low Level Threat Waste.

- Section 300.430 (f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. US DOE, SCDHEC, and US EPA have determined that a Five Year Review of the ROD for the L and P BPOPs will be performed to ensure continued protection of human health and the environment.

Therefore, a determination has been made that Land Use Controls at each unit are necessary to prohibit unauthorized excavation and to maintain the areas for their intended land use. This remedy will prevent unauthorized excavation and exposure to buried debris at both units. Periodic inspections and maintenance will ensure long-term stability of the units. Because no groundwater COCs were identified, No Action is protective of the groundwater at each unit.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The PP provided for involvement with the community through a document review process and a public comment period. The Proposed Plan was also presented in an open public meeting to the SRS Citizens Advisory Board (CAB ER/WM Subcommittee) on June 22, 1999 and to the full CAB on July 27, 1999.

Comments that were received during the 30-day public comment period (June 10 through July 9, 1999) are addressed in Appendix A of this ROD.

There were no significant changes to the selected remedy as a result of public comments.

XII. RESPONSIVENESS SUMMARY

The Responsiveness Summary of this ROD (see Appendix A) addresses the comments received during the public comment period.

XIII. POST-ROD DOCUMENT SCHEDULE

A FRR will be submitted to the US EPA and SCDHEC after the issuance of the ROD. The FRR will describe the measures that will be taken for implementation of the preferred alternative at each unit (Land Use Controls at the L BPOPs and Land Use Controls at the P BPOP).

The post-ROD document schedule is illustrated in Figure 11. Key components of the schedule include the following:

- The Revision.0 FRR for the L and P BPOPs will be submitted for US EPA and SCDHEC review four months after issuance of the ROD. This report will contain the LUCIP as part of the submittal.
- US EPA and SCDHEC review of the Revision.0 FRR will be completed 90 days after submittal of the document.
- SRS revision of the FRR will be completed 60 days after receipt of all regulatory comments.
- US EPA and SCDHEC final review and approval of the Revision.1 FRR will be completed 30 days after submittal of the document.

XIV. REFERENCES

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APPENDIX A RESPONSIVENESS SUMMARY

Responsiveness Summary

The 30-day public comment period for the Proposed Plan for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G) began on June 10, 1999 and ended on July 9, 1999. The Proposed Plan was also presented in an open public meeting to the SRS Citizens Advisory Board (CAB ER/WM subcommittee) on June 22, 1999 and the full CAB on July 27, 1999. Specific comments and responses and CAB recommendations are found below.

Public Comments

None.

Public Meeting Comments

On July 27, 1999 the SRS Citizens Advisory Board passes a motion to send a letter to US DOE supporting the remedial action selected in the Proposed Plan.

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APPENDIX B COST ESTIMATES

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TABLE B1 L BPOP COST ESTIMATE (LAND USE CONTROLS)

		Quantity	Price	Estimate	Totals
1.0	Access Restrictions				
1.1	Fence Construction	0 lf	$17.80 /lf	$0	
	Subtotal				$0
2.0	Deed Restrictions				
2.1	Deed Restrictions	1	$5,000 lump sum	$5,000	
	Subtotal				$5,000
	Subtotal of Construction Costs				$5,000
	Contingency @ 10%				$500
	Total Construction Costs (1.0+2.0)				$5,500
3.0	Engineering Costs				
3.1	Surveying	1	$2,000 lump sum	$2,000	
3.2	Closure Documents	80 hrs	$80 /hr	$6,400	
	Subtotal				$8,400
	Total Capital Costs (1.0+2.0+3.0)				$13,900
4.0	O&M Costs				
4.1	Mowing & Inspection, semiannual	2 /yr	$500 /each	$1,000	
4.2	Repairs (soil additions/spreading, reseeding, etc.)	0.4 acres	$1,000 /acre	$400	
4.3	Fence Repair/Maintenance	0 lf	$18 /lf	$0	
	Subtotal Annual O&M Costs				$1,400
	Interest Rate (i)	0.05 %			
	Number of Years (n)	30 yrs			
	Present Worth Factor = {[(1+i)^n])-1} / {[i(1+i)]^n}	15.37			
	O&M Present Worth (Annual O&M x PWF)				$21,521
5.0	Agency Reporting				
5.1	ROD Reviews, Present Worth	1	$50,000 lump sum	$50,000	
	Subtotal				$50,000
	TOTAL COST ALTERNATIVE L-2				**$85,421**

TABLE B2 P BPOP COST ESTIMATE (LAND USE CONTROLS)

		Quantity	Price	Estimate	Totals
1.0	Access Restrictions				
1.1	Fence Construction	0 lf	$17.80 /lf	$0	
	Subtotal				$0
2.0	Deed Restrictions				
2.1	Deed Restrictions	1	$5,000 lump sum	$5,000	
	Subtotal				$5,000
	Subtotal of Construction Costs				$5,000
	Contingency @ 10%				$500
	Total Construction Costs (1.0+2.0)				$5,500
3.0	Engineering Costs				
3.1	Surveying	1	$2,000 lump sum	$2,000	
3.2	Closure Documents	80 hrs	$80 /hr	$6,400	
	Subtotal				$8,400
	Total Capital Costs (1.0+2.0+3.0)				$13,900
4.0	O&M Costs				
4.1	Mowing & Inspection, semiannual	2 /yr	$500 /each	$1,000	
4.2	Repairs (soil additions/spreading, reseeding, etc.)	0.3 acres	$1,000 /acre	$300	
4.3	Fence Repair/Maintenance	0 lf	$18 /lf	$0	
	Subtotal Annual O&M Costs				$1,300
	Interest Rate (i)	0.05 %			
	Number of Years (n)	30 yrs			
	Present Worth Factor = {[(1+i)^n])-1} / {[i(1+i)]^n}	15.37			
	O&M Present Worth (Annual O&M x PWF)				$19,984
5.0	Agency Reporting				
5.1	ROD Reviews, Present Worth	1	$50,000 lump sum	$50,000	
	Subtotal				$50,000
	TOTAL COST ALTERNATIVE P-2				**$83,884**

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