

United States Department of Energy

Savannah River Site

**Record of Decision
Remedial Alternative Selection for the
K-Area Bingham Pump Outage Pit (643-1G) (U)**

WSRC-RP-97-178

Revision 1

October 1997

**Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808**



DISCLAIMER

This report was prepared by Westinghouse Savannah River Company (WSRC) for the United States Department of Energy under Contract No. DE-AC09-96-SR18500 and is an account of work performed under that contract. Reference herein to any specific commercial product, process, or services by trademark, name, manufacturer or otherwise does not necessarily constitute or imply endorsement, recommendation, or favoring of same by WSRC or by the United States Government or any agency thereof.

Printed in the United States of America

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

**RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)**

K-Area Bingham Pump Outage Pit (643-1G)

**WSRC-RP-97-178
Revision 1
October 1997**

**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**

This page intentionally left blank.

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

K-Area Bingham Pump Outage Pit (SRS Building Number 643-1G)
Savannah River Site
Aiken, South Carolina

The K-Area Bingham Pump Outage Pit (KBPOP) Operable Unit (OU) is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). This OU is comprised of source (soil) control and groundwater units.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the KBPOP located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific CERCLA unit.

Description of the Selected Remedy

The preferred alternative for the KBPOP operable unit is Institutional Controls which will restrict this land to nonresidential use and preclude residential use of this area. The risk levels present at the KBPOP are at the lower end of the risk range. However, the presence of buried debris with fixed contamination requires Institutional Controls in order to be protective from unauthorized removal/excavation concerns. Implementation of the Institutional Controls alternative will require both near- and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the KBPOP indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain this site for nonresidential use.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to CERCLA 120(h). These actions will include a deed notification disclosing former waste management and disposal activities as well as any 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 construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions

differ and/or contamination no longer poses an unacceptable risk under residential use. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Institutional Controls meets the remedial goals for the KBPOP operable unit by precluding future on-site residential use of the area, buried waste contact, removal, or excavation.

The RI/BRA concludes that the KBPOP is not impacting groundwater. Constituents are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential.

The post-Record of Decision (ROD) document, the KBPOP Corrective Measures Implementation/Remedial Action Report (CMI/RAR), will be submitted to the regulatory agencies four months after issuance of the ROD. The regulatory review period, SRS revision period, and final regulatory review and approval period for the CMI/RAR will be 90 days, 60 days, and 30 days, respectively.

The KBPOP is not subject to the requirements for Resource Conservation and Recovery Act (RCRA) permit modification per Appendix C of the FFA for the SRS.

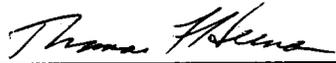
Statutory Determinations

Based on the KBPOP Remedial Investigation Report with Baseline Risk Assessment, the KBPOP poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficient for protection of human health and the environment for the KBPOP operable unit.

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 actions, and is cost-effective. The low levels of contaminants in the soil make treatment impractical. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

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. The three Parties, U.S. Department of Energy, South Carolina Department of Health and Environmental Control, and U.S. Environmental Protection Agency, have determined that a five-year review of the ROD for the KBPOP will be performed to ensure continued protection of human health and the environment.

10/14/97
Date



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

3/23/97
Date
3/23



Richard D. Green
Acting Division Director
Waste Management Division
U. S. Environmental Protection Agency - Region IV

4/14/98
Date



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

This page intentionally left blank.

**DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)**

K-Area Bingham Pump Outage Pit (643-1G)

**WSRC-RP-97-178
Revision 1
October 1997**

**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**

This page intentionally left blank.

**DECISION SUMMARY
TABLE OF CONTENTS**

Section	Page
I. SRS Site and Operable Unit Name, Location, Description, and Process History	1
II. Site and Operable Unit Compliance History	5
III. Highlights of Community Participation	7
IV. Scope and Role of Operable Unit Within the Site Strategy	9
V. Summary of Operable Unit Characteristics.....	11
VI. Summary of Operable Unit Risks	16
VII. Remedial Action Objectives and Description of Considered Alternatives for the KBPOP Source Control Operable Unit.....	25
VIII. Summary of Comparative Analysis of the Alternatives.....	30
IX. The Selected Remedy	40
X. Statutory Determinations	42
XI. Explanation of Significant Changes	42
XII. Responsiveness Summary	42
XIII. Post-ROD Document Schedule.....	43
XIV. References	45

List of Figures

Figure 1. Location of the Reactor Areas at SRS.....	2
Figure 2. Location of the K-Area Bingham Pump Outage Pit	3
Figure 3. K-Area Bingham Pump Outage Pit Dimensions	4
Figure 4. Pen Branch Watershed and Associated Operable Units.....	10
Figure 5. Conceptual Site Model for the K-Area Bingham Pump Outage Pit	12
Figure 6. Soil Sampling Locations for the K-Area Bingham Pump Outage Pit	14
Figure 7. Groundwater Sampling Locations for the K-Area Bingham Pump Outage Pit	15
Figure 8. Post-ROD Document Schedule.....	44

DECISION SUMMARY
TABLE OF CONTENTS (cont'd)

List of Tables	Page
Table 1. Estimated Radionuclide Inventory at the K-Area Bingham Pump Outage Pit	6
Table 2. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Known On-Unit Industrial Workers.....	19
Table 3. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Hypothetical Future On-Unit Residents and Industrial Workers	21
Table 4. K-Area Bingham Pump Outage Pit Remedial Goals for Constituents of Concern by Receptor and Medium	24
Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit	32

LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ASCAD™	Approved Standardized Corrective Action Design
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI/RAR	Corrective Measures Implementation/Remedial Action Report
COCs	Constituents of Concern
COPCs	Constituents of Potential Concern
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
DOE	U.S. Department of Energy
EAV	E-Area Vaults
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility Study
HI	Hazard Index
KBPOP	K-Area Bingham Pump Outage Pit
NCP	National Oil and Substances Pollution Contingency Plan
OU	Operable Unit
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RGs	Remedial Goals
RI	Remedial Investigation
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Concern
SDCF	Soils/Debris Consolidation Facility
SRS	Savannah River Site
WSRC	Westinghouse Savannah River Company

This page intentionally left blank.

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

Savannah River Site Location, Description, and Process History

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

SRS is owned by the U.S. Department of Energy (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.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) for the SRS lists the K-Area Bingham Pump Outage Pit (KBPOP), 643-1G, as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit requiring further evaluation, using an investigation/assessment process to determine the actual or potential impact to human health and the environment. The KBPOP is not subject to requirements for Resource Conservation and Recovery Act (RCRA) permit modification per Appendix C of the FFA. The K Reactor (Figure 1) is located in the west-central part of the SRS (approximately 4 miles east of the SRS boundary). The KBPOP is located immediately south and outside of the K Reactor fence line (Figure 2) with a surface boundary of approximately 400 feet in length and 60 feet in width (Figure 3).

Surface water drainage ditches surround the KBPOP to the north, west, and south. These ditches collect and redirect runoff water to reduce erosion. As depicted in Figure 2, the KBPOP is located on the west side of a small topographical high. Consequently, surface water drainage from other areas has little or no effect on the surface of the KBPOP. Generally, no surface water is found in the drainage ditches.

The KBPOP is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. The Tobacco Road formation is composed of dark red to tan, very fine to fine sandy clay and clayey sands with laminated tan and purple, silty, clayey very fine to medium sands.

Figure 1. Location of the Reactor Areas at the Savannah River Site

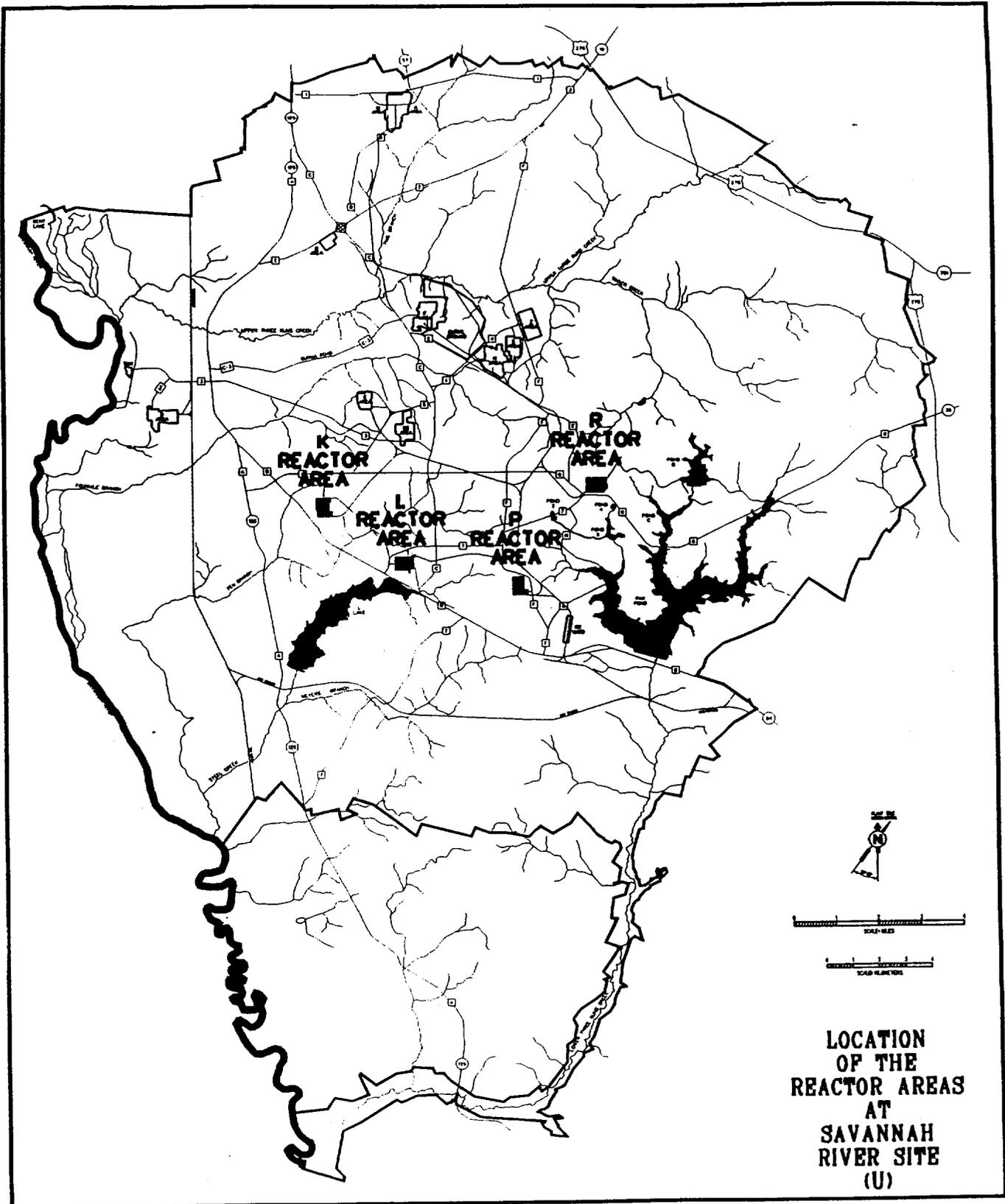


Figure 2. Location of the K-Area Bingham Pump Outage Pit

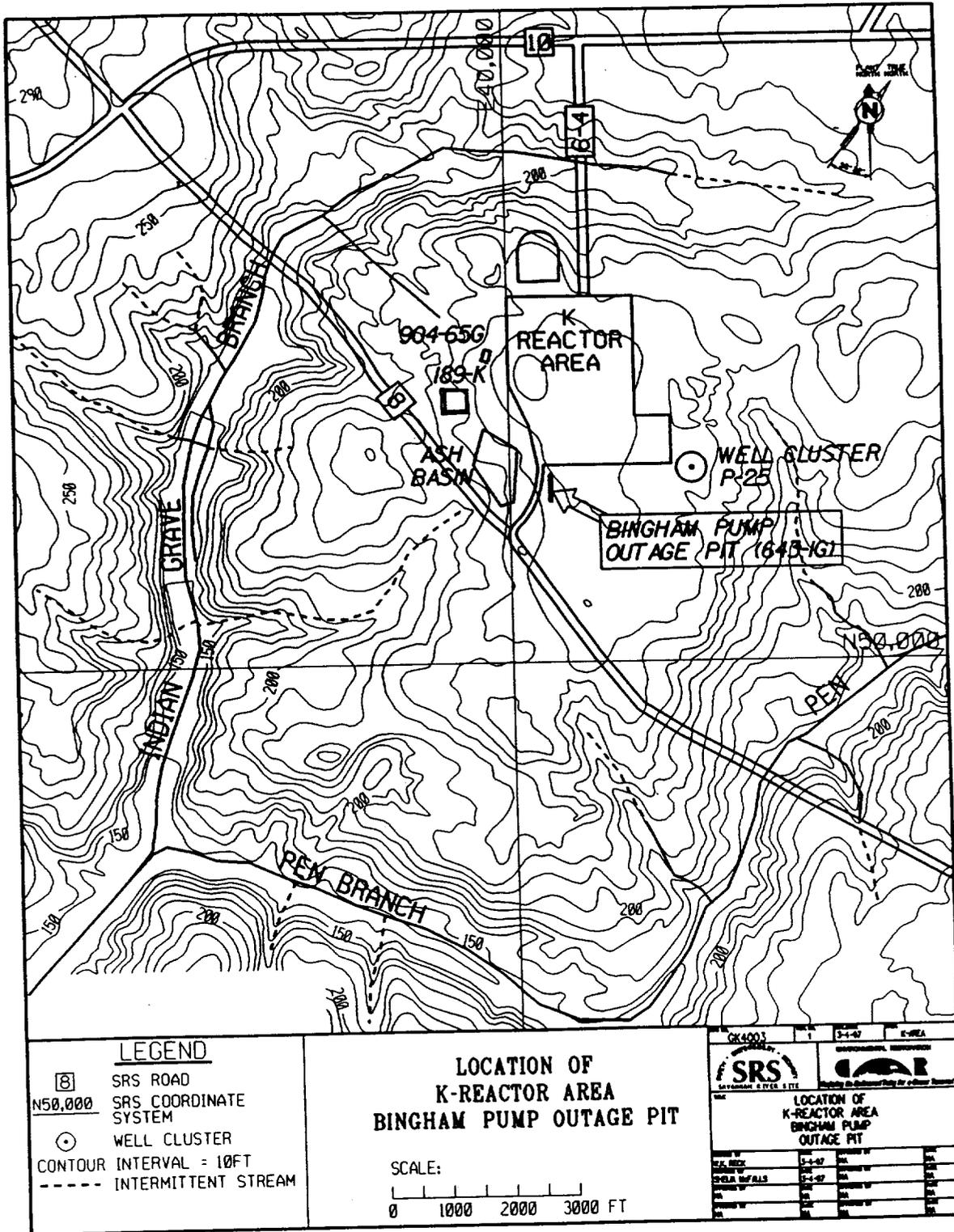
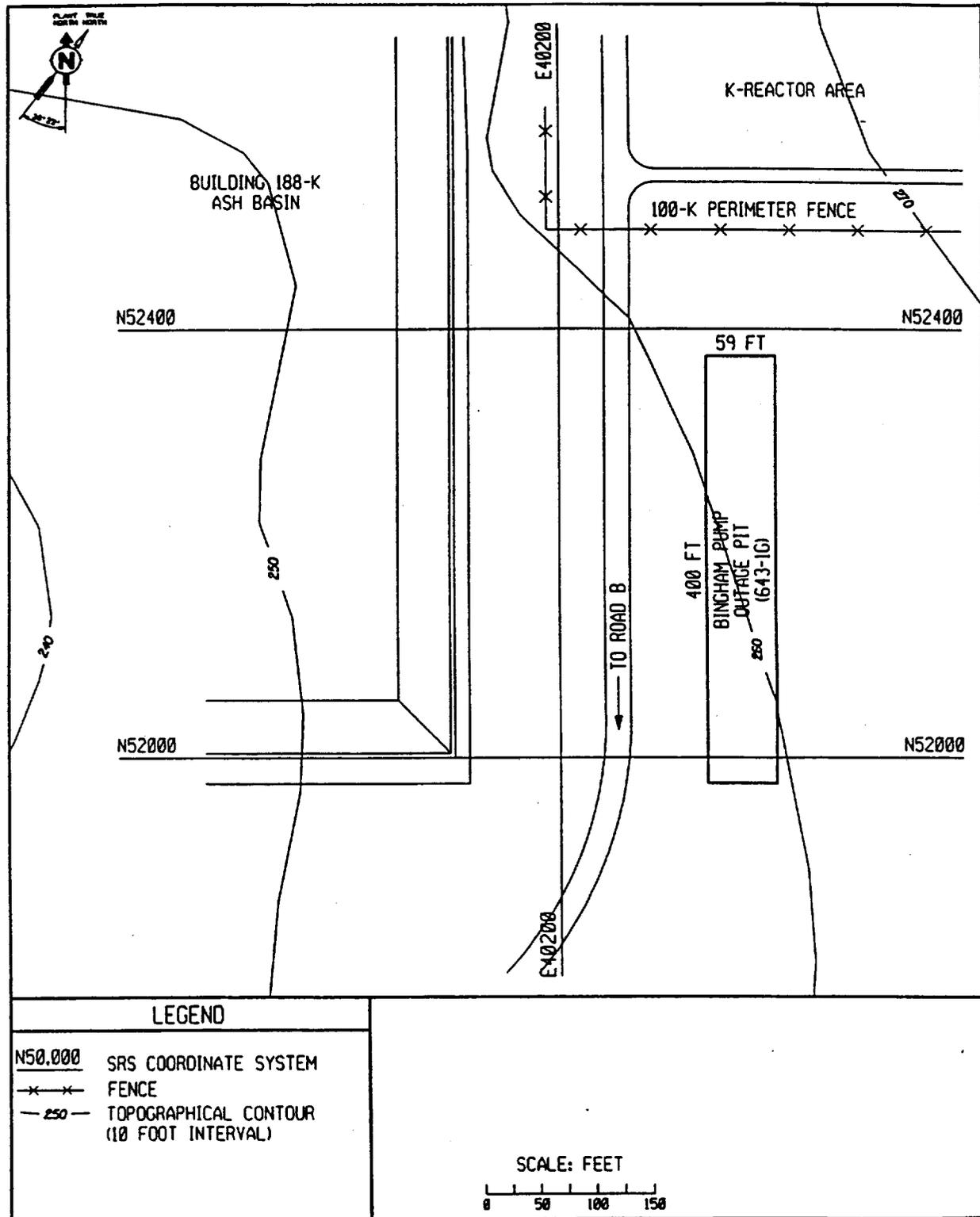


Figure 3. K-Area Bingham Pump Outage Pit Dimensions



The groundwater flow direction is to the southwest across the KBPOP and the groundwater flow rate for the water table aquifer beneath the KBPOP is estimated at approximately 91.25 ft/year.

Between 1957 and 1958, miscellaneous construction debris (pipes, cables, ladders, etc.) generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and no liquid waste was disposed of in the KBPOP. The depth of excavation at the KBPOP ranged from 9 to 14 feet, which indicates a sloping pit base (this is consistent with the use of the pit for disposal purposes). Low-level radioactive debris generated by the repairs (less than 25 mR/hr with no detected alpha activity) was buried in the KBPOP. Debris with radioactive contamination greater than 25 mR/hr was placed at the SRS Burial Ground. Table 1 illustrates the estimated inventory of activity at the time of burial and as of December 31, 1995. The estimated burial inventories provided in Table 1 are based on a conservative estimation from the process history of reactor operations and was taken from the 1987 BPOPs Environmental Information Document. This list is not considered to be an all inclusive list of radionuclides that were evaluated during the KBPOP characterization. For complete details on the list of radionuclides that were evaluated during the unit characterization, refer to the KBPOP RI Work Plan.

The KBPOP was backfilled with approximately four feet of fill material in 1958 and is now an open grassy area marked by orange ball markers and concrete monuments. Annual inspections are conducted for signs of soil subsidence; and, sunken areas are filled to grade as needed.

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 program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are 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

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required

Table 1. Estimated Radionuclide Inventory at the K-Area Bingham Pump Outage Pit

Radionuclide	Inventory at Burial (Curies)	Inventory Corrected for Decay Through December 31, 1995 (Curies)
Cobalt-60	0.172	1.34×10^{-3}
Strontium-90	0.112	4.70×10^{-2}
Ruthenium-103/106	0.130	1.12×10^{-12}
Cesium-137	0.414	1.75×10^{-1}
Promethium-147	0.172	7.50×10^{-6}
Total	1.00	2.23×10^{-1}

Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC); the permit was most recently renewed on September 5, 1995. Part V of the permit mandates that SRS establish and implement an RCRA Facility Investigation Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RCRA Facility Investigation Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with the U. S. Environmental Protection Agency (EPA) and the SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

Operable Unit Compliance History

As previously stated, the KBPOP is listed in the FFA as a CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. The KBPOP is not subject to RCRA 3004(u) permit modification requirements per Appendix C of the FFA. The Remedial Investigation (RI) Work Plan (rev. 0) was submitted to the regulatory agencies in June 1992. The RI Field Start occurred in January 1995. The RI characterization and Baseline Risk Assessment (BRA) were conducted for the unit between 1995 and 1997. The results of the RI and BRA were presented in the RI/BRA Report (WRSC, 1997b). The RI/BRA Report was submitted in accordance with the FFA and the approved implementation schedule, and was approved by the EPA and the SCDHEC in May 1997. The Feasibility Study (FS) was submitted in accordance with the FFA and the approved implementation schedule, and was approved by EPA and SCDHEC in June 1997. The Proposed Plan (PP) was also submitted in accordance with the FFA and the approved implementation schedule, and was approved by SCDHEC in June 1997 and EPA in July 1997.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires that 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 KBPOP soil and groundwater. The Administrative Record File must be established "at or near the facility at issue". The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate

public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. Section 117(a) of CERCLA, as amended, requires the 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 K-Area Bingham Pump Outage Pit* (WSRC, 1997c), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the KBPOP.

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

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through the mailings of the *SRS Environmental Bulletin*, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers. The public comment period was also announced on local radio stations.

The 30-day public comment period began on July 8, 1997 and ended on August 6, 1997. A public meeting was not requested. Since there were no comments received during the public comment period, a Responsiveness Summary was not prepared.

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

The overall strategy for addressing the K Bingham Pump Outage Pit (KBPOP) was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

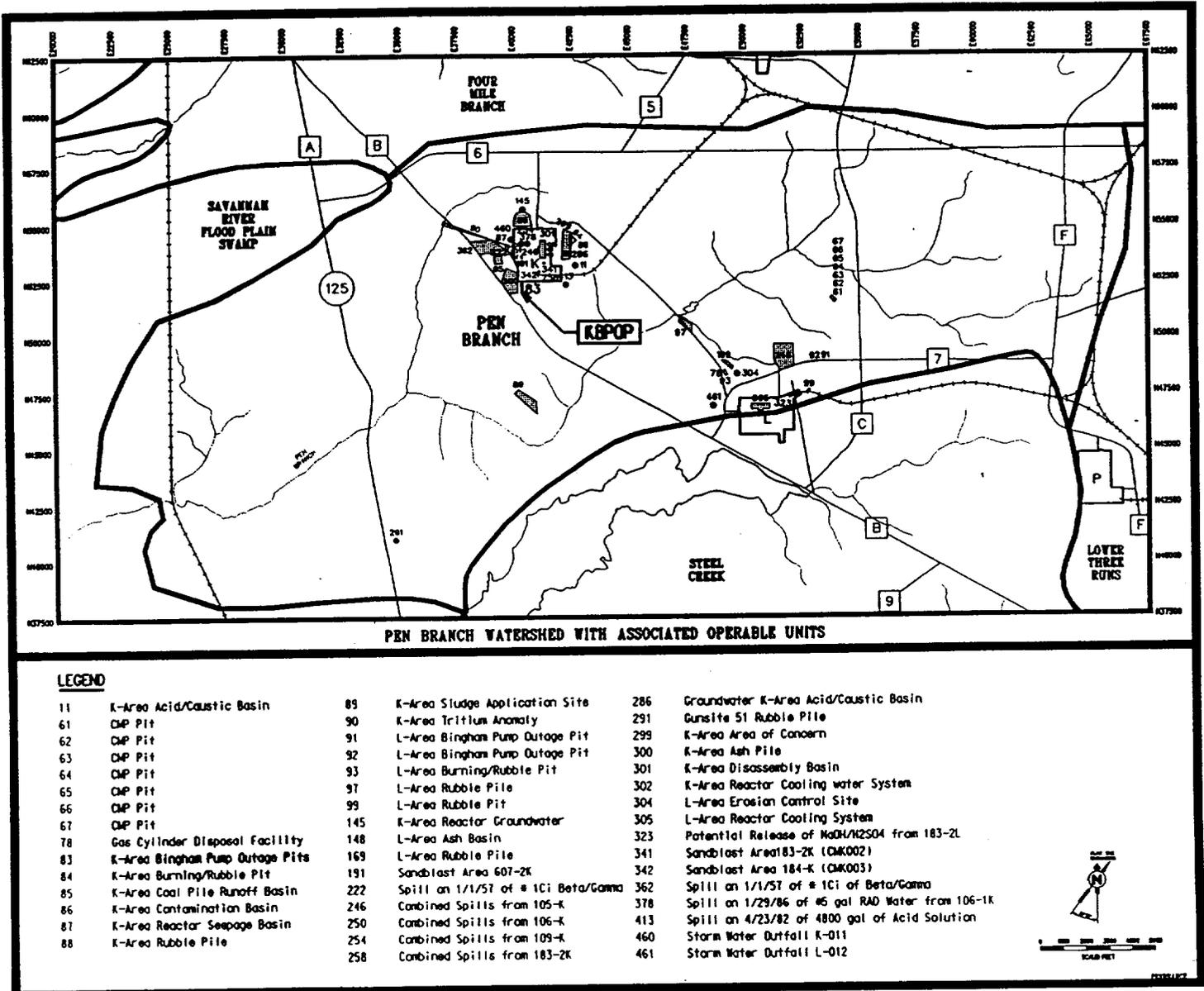
The KBPOP is an operable unit (OU) located within the Pen Branch Watershed along with several other K-Area waste units (Figure 4). No wetlands or creeks are adjacent to the area surrounding the KBPOP. Several source control and groundwater OUs within this watershed will be evaluated to determine future impacts, if any, to associated streams and wetlands. It is the intent of SRS, EPA, and SCDHEC to manage these sources of contamination to minimize impact to the watershed.

Based on characterization and risk assessment information, the KBPOP source control unit does not impact the watershed. Upon disposition of all source control and groundwater operable units within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary for the watershed. The proposed action for the KBPOP soil and groundwater aquifer is a final action.

The KBPOP is one of four Bingham Pump Outage Pit areas at the SRS, collectively referred to as the BPOP Approved Standardized Corrective Action Design (ASCAD™) waste unit group. ASCAD™ provides for complete characterization, technology evaluation, and remedial design of the KBPOP lead unit within the BPOP waste unit group. This is followed by a focused characterization, technology validation, and unit-specific design for the secondary ASCAD™ BPOP waste units (i.e., R/P/L BPOPs). ASCAD™ then provides for streamlining the design development process and projects focused technologies for remedial action for the secondary units based on the lead unit.

Under the ASCAD™ strategy, the information from the lead site, KBPOP, will be used to define the site profile envelopes for comparison to the conditions that are expected to be found at the

Figure 4. Pen Branch Watershed and Associated Operable Units



R/P/L BPOPs secondary sites. Envelopes are bounding conditions that should be met in order to apply the remedial alternative used on the lead site. The general concept is that all the Bingham Pump Outage Pits have similar operational histories, received similar wastes, and would probably have similar contamination profiles. The secondary sites will be characterized to determine if their site profile matches the profile of the lead site. If the secondary site(s) profiles are within the KBPOP site envelopes, the preferred alternative selected for the KBPOP will be implemented at the secondary site(s).

V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

A conceptual site model (CSM) was developed for the KBPOP that identifies the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for each unit. The CSM for the KBPOP is presented in Figure 5; and, is based on the data that is presented in the CERCLA documentation for this unit. The Quality Control Summary Reports (WSRC, 1995a, b) and the RI with BRA Report (WSRC, 1997b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the KBPOP. These documents are available in the Administrative Record (see Section III).

The primary source of contamination at the KBPOP is the buried waste. Leaching has been defined as the primary release mechanism and provides the initial movement of constituents from the pit into surrounding soil horizons. Dust and/or volatile emissions, a secondary release mechanism, could be transported via the air/wind and/or stormwater runoff pathways to off-unit locations.

The soil underneath the KBPOP would constitute the secondary source of contamination, if impacted. For this secondary source, infiltration/percolation would provide the means for constituents to migrate vertically, potentially reaching the groundwater. Once constituents enter the groundwater system, movement away from the unit boundaries is certain.

The only potential risk associated with the KBPOP is restricted to the soil at the unit due to external radiation exposure from the surface soil for both hypothetical future residents and workers.

Media Assessment

The *Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-1G) (U)* (WSRC, 1997b) contains detailed analytical data for all of the environmental media samples taken in the characterization of the unit.

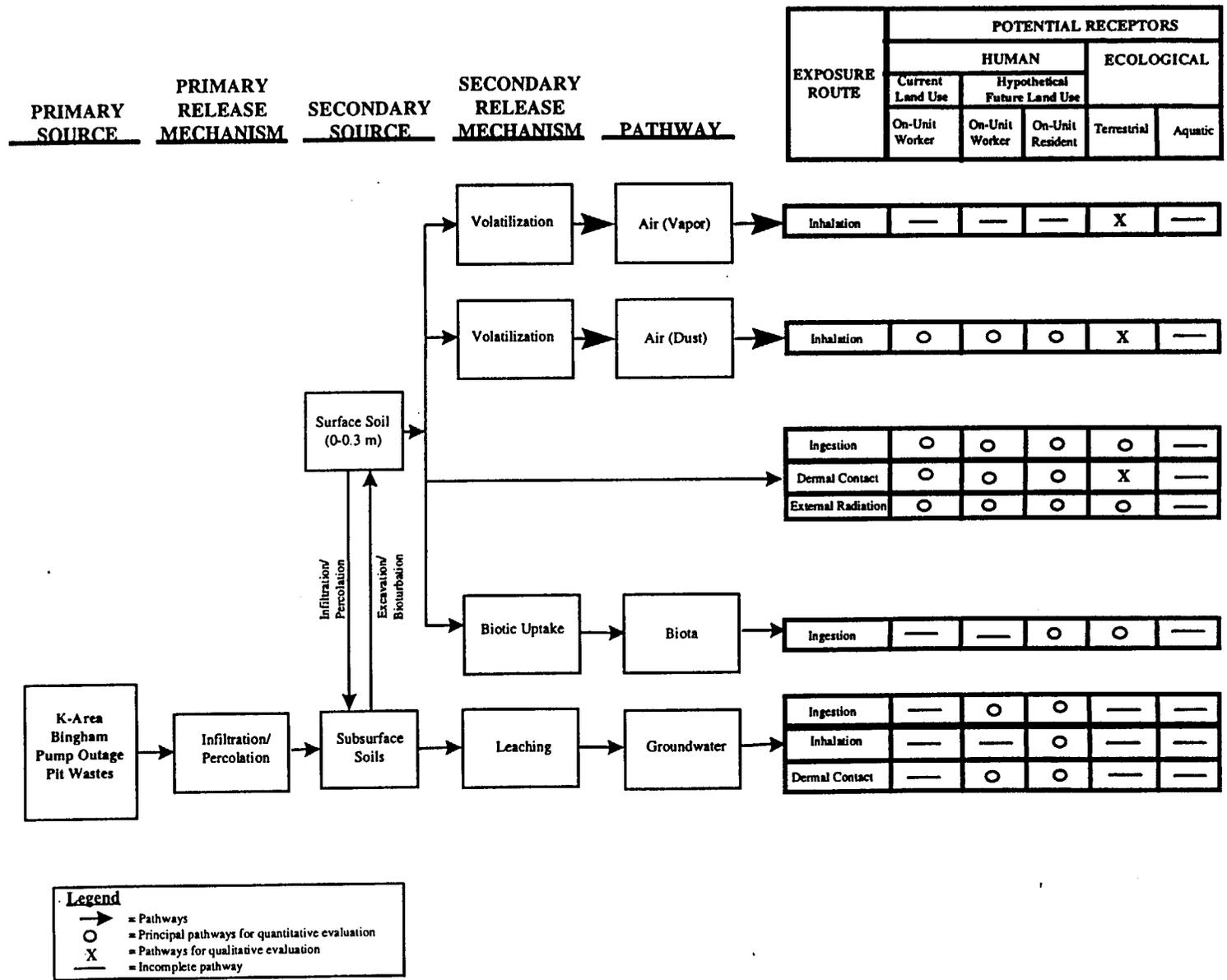


Figure 5. Conceptual Site Model for the K-Area Bingham Pump Outage Pit

The KBPOP characterization proceeded in a phased approach to collect soil and groundwater data to evaluate the nature and extent of contamination and the potential risk. A total of 36 soil, 6 groundwater, and 6 geotechnical samples were collected. The following summaries for the soil and groundwater are based on the screening that was completed for the remedial investigation and not the baseline risk assessment. Baseline risk assessment results are discussed in Section VI.

Soil

During the KBPOP remedial investigation, unit-specific background sampling was conducted at three soil boring locations (KBP1, KBP2, and KBP3) positioned upgradient from the pit (Figure 6). For the soil borings, composite samples were collected from each of five intervals (0-1 ft, 10-12 ft, 12-14 ft, 14-16 ft, and 16-18 ft). The background soil samples were divided into data sets: surface soil (0-1 ft) and deep soil (>9 ft). Soil samples were not collected in the entire 0-4 ft range since this soil interval represents the fill material that was placed at the unit in 1958.

Figure 6 also graphically depicts the thirty-six soil samples which were collected from the three pit borings (KBP6, KBP9, and KBP11) and the six perimeter borings (KBP4, KBP5, KBP7, KBP8, KBP10, and KBP12).

For soil, the results from the K Bingham Pump Outage Pit (KBPOP) sample analyses indicate that minor concentrations/activities of constituents have migrated from the pit into the surrounding soil horizons; however, horizontal migration is limited to the boundaries of the pit and vertical migration is limited to the upper clayey zones.

The geotechnical and geologic data indicate that a less permeable zone is present underneath the pit that will inhibit less mobile constituents from migrating vertically and potentially impacting the groundwater.

Groundwater

A total of six groundwater samples were collected from the water table aquifer in the vicinity of the KBPOP. These include two background samples (KH1 and KH4), an additional upgradient sample (KH3), and three down- or sidegradient samples (KH2, KH5, and KH6) (Figure 7). The initial groundwater samples were collected using temporary piezometers.

Figure 6. Soil Sampling Locations for the K-Area Bingham Pump Outage Pit

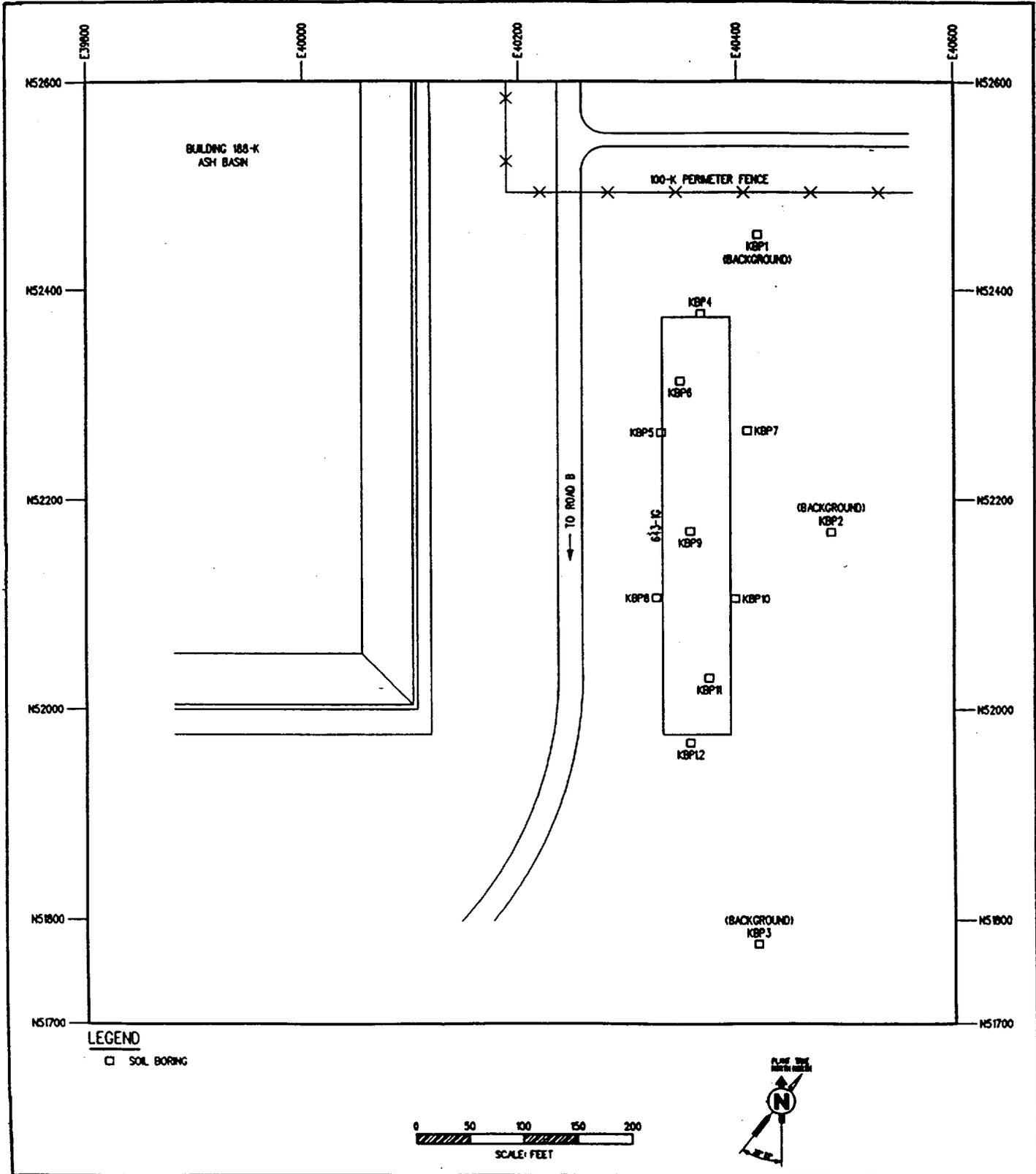
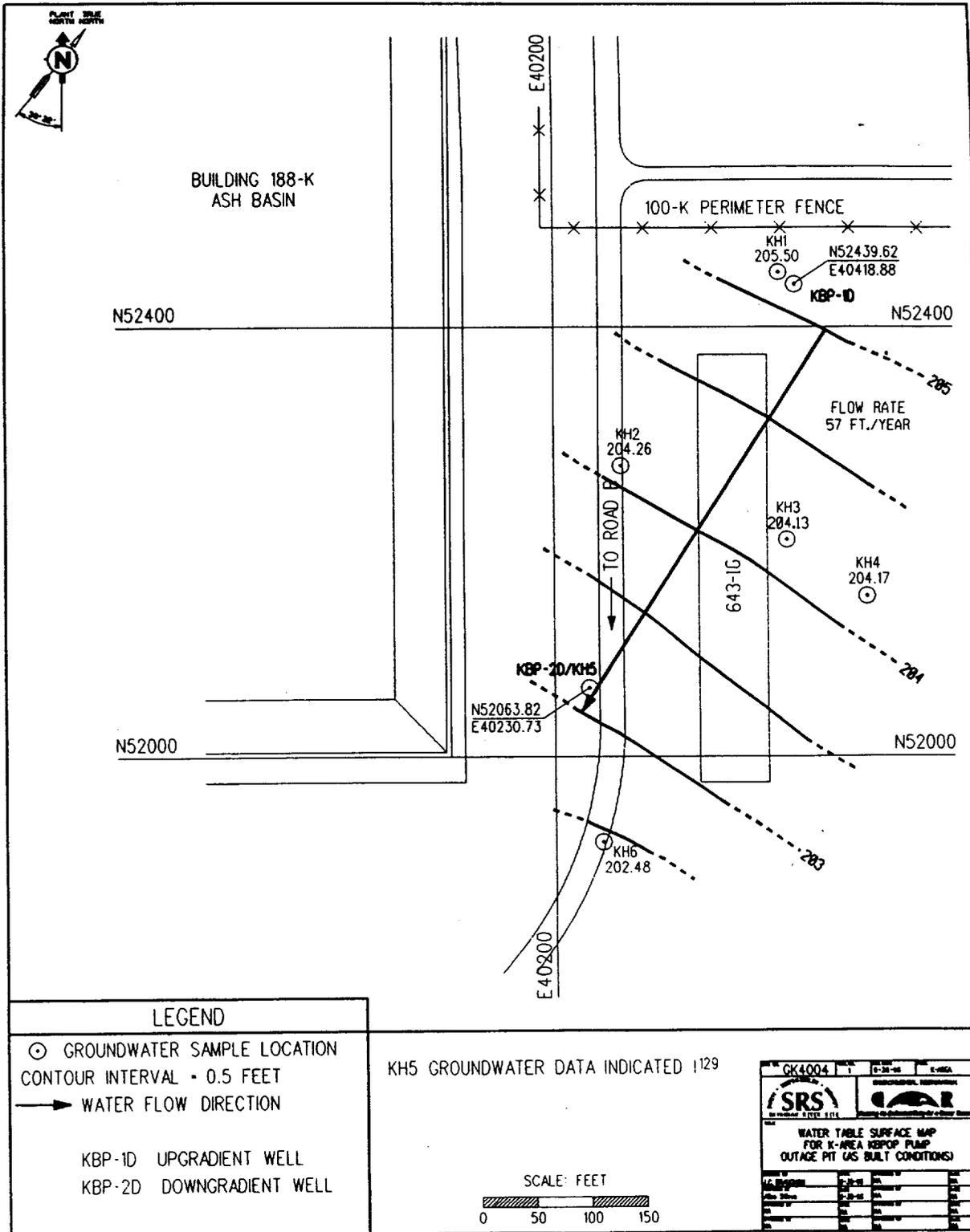


Figure 7. Groundwater Sampling Locations for the K-Area Bingham Pump Outage Pit



The metal concentrations were unusually high and were detected in both upgradient and downgradient sampling locations for the KBPOP and are interpreted to be directly related to the sampling protocol used. These unusually high metal concentrations are the indirect result of the high turbidity associated with each sample. To demonstrate the validity of this interpretation, Confirmatory Characterization was conducted in July 1996, during which two RCRA-standard groundwater monitoring wells (one upgradient (KBP1D) and one downgradient (KBP2D)) were installed at the KBPOP. Results from the sampling of these wells support the interpretation that the KBPOP has not impacted the groundwater and that the metal constituents detected are naturally occurring.

The detection of iodine-129 is suspect because no other fission products (i.e., technetium-99 and strontium-90) were detected in this temporary piezometer sample and because false positives are often associated with gamma PHA (the method used to analyze the sample). Moreover, this detection is also suspect because iodine-129 was not detected in the groundwater samples taken from the RCRA-standard monitoring wells which were installed and sampled during the KBPOP Confirmatory Characterization.

Soil Leachability Analysis

Soil leachability modeling was performed with a detailed unit-specific model. The model calculates concentrations of soil water constituents at the base of the vadose zone. Groundwater concentrations are then calculated from these values by applying the groundwater dilution factor. The nature of the input data and the analytical model assumptions are such that the estimates of groundwater concentrations are conservative.

The leachable constituents of potential concern for the KBPOP include metals, inorganic compounds, radionuclides, organics, and pesticides with the predominant risk driver for the hypothetical future on-unit resident and on-unit worker being iodine-129. As stated previously, the iodine-129 detection is highly questionable and below the reported detection limit for iodine-129. Using the highly questionable value with the conservative soil leachability models overestimates the future groundwater values. Therefore, corrective action for the groundwater is not warranted based upon the soil leachability analysis.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessment process for the KBPOP waste unit, a BRA was performed using data gathered during the assessment phase. Detailed information regarding the development of constituents of potential concern (COPCs), the fate and transport of

contaminants, and the risk assessment can be found in the *Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-1G) (U)* (WSRC, 1997b).

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during the unit-specific sampling activities. The current land use is an inactive industrial site. The only current exposure scenario identified for the KBPOP was for on-unit workers and/or visitors, who may perform environmental research on a limited and intermittent basis at the KBPOP. Conservative future exposure scenarios identified for the KBPOP 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 visitor or future industrial worker scenarios.

The following exposure pathways were evaluated for the human receptors in the KBPOP RI/BRA:

- The current (known) on-unit worker was evaluated for exposure to contaminated soils through ingestion, dermal contact, inhalation of particulates in air, and direct radiation. A drinking water pathway was determined to not be credible for the current on-unit worker since shallow groundwater is not used as a source of drinking water at the SRS.
- The hypothetical future on-unit industrial worker was evaluated for exposure to surface soil through incidental ingestion, inhalation of windblown dust in air, dermal contact, and direct radiation. In addition, exposure to groundwater through ingestion and dermal contact was evaluated. Inhalation of volatiles from groundwater was not evaluated since it was not expected to be a significant exposure pathway for the hypothetical future on-unit industrial worker.
- The hypothetical future on-unit resident (adult/child) was evaluated for exposure to surface soil through incidental ingestion, inhalation of windblown dust in air, dermal contact, direct radiation, and ingestion of homegrown produce. In addition, exposure to groundwater through ingestion, dermal contact, and inhalation of volatiles in groundwater was evaluated.

Based on the results of the risk assessment COPCs that contribute significantly to an exposure pathway having a significant human cancer risk ($>1 \times 10^{-6}$) or human noncarcinogenic hazard (>1.0), or are determined to pose unacceptable ecological risk, are designated as constituents of

concern (COCs). For human health, COCs are substances associated with risks or hazards exceeding targets for the protection of human health, as defined in the NCP and CERCLA. Human health carcinogenic primary COCs are constituents with an individual cancer risk greater than or equal to 1×10^{-6} in an exposure media with a cumulative excess lifetime cancer risk greater than or equal to 1×10^{-4} . Human health carcinogenic secondary COCs are constituents with an individual cancer risk greater than or equal to 1×10^{-6} in an exposure media with a cumulative excess lifetime cancer risk greater than or equal to 1×10^{-6} . Human health primary noncancer COCs are constituents with a hazard quotient greater than or equal to 0.1 in an exposure media with a hazard index greater than or equal to 3. Human health secondary COCs are constituents with a hazard quotient greater than or equal to 0.1 in an exposure media with a hazard index greater than or equal to 1 but less than 3. For ecological resources, a weight-of-evidence type approach is conducted to identify ecological COCs. The unit-specific risks for the KBPOP are further explained below.

Human Health Risk Assessment Results for the KBPOP

Current Land Use

Under the current land use scenario, carcinogenic risks and noncarcinogenic hazards from nonradiological and radiological constituents were characterized for exposure of a known (current) on-unit industrial worker to surface soil and air. Table 2 presents the summary of risk and hazard calculations for the known on-unit worker.

Current Land Use - Carcinogenic Risk

A total carcinogenic (cancer) risk of 7×10^{-7} was derived for the known on-unit worker. This cancer risk is below 1×10^{-6} , indicating an acceptable cancer risk.

Current Land Use - Noncarcinogenic Risk and Hazard

There were no nonradiological primary or secondary constituents of concern identified for the current on-unit industrial worker; therefore, there were no nonradiological risks or hazards for the current on-unit worker.

Future Land Use

Under the future land use scenario, carcinogenic risks and noncarcinogenic hazards associated with nonradiological constituents were calculated for exposure of the hypothetical worker to surface soil, air, and groundwater. Carcinogenic risks and noncarcinogenic hazards for these same factors, plus homegrown produce, were then calculated for the hypothetical on-unit resident (adult and child). Radiological risks were calculated for exposure of the hypothetical resident

Table 2. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Known On-Unit Industrial Workers

Matrix	K BPOP Soil (0-1 ft)				
	Exposure to Radionuclides		Exposure to Chemicals		
	Route	Risk	Route	Risk	Hazard
Soil (0-1 ft)	Ingestion	1.3E-11	Ingestion	NC	NC
	Dermal	1.6E-13	Dermal	NC	NC
	Inhalation (P)	1.2E-16	Inhalation (P)	NC	NC
	External	7.3E-07	Inhalation (V)	NC	NC
Totals		7E-07		NC	NC

P - Particulates
 V - Volatiles
 NC - Not Calculated

and worker to surface soil, air, groundwater, homegrown produce (on-unit resident only), and external radiation. Table 3 presents the summary of risk and hazard calculations for the hypothetical future on-unit residents (adult/child) and workers. The 0-4 ft soil interval was not sampled in its entirety during the KBPOP characterization since this interval represents backfill soil that was placed at the unit in 1958. The 0-1 ft soil interval was sampled and is representative of the backfill material. However, the lack of data from the entire 0-4 ft interval may underestimate the risk of potential exposure of hypothetical future receptors to soil located in this interval.

Future Land Use - Nonradiological Carcinogenic Risk

The total cancer risk for nonradioactive carcinogens for the future hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was 2×10^{-6} and 6×10^{-6} , respectively. Ingestion of groundwater by the hypothetical future industrial worker and resident was the primary route for this risk level. For the worker and resident, bis(2-ethylhexyl)phthalate was the secondary COC which led to the nonradiological carcinogenic risk. However, its presence is suspect since the phthalates are common laboratory contaminants.

Future Land Use - Noncarcinogenic Hazard

The total noncarcinogenic HI for the hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was 0.7 and 4.0. For the future resident, the noncancer hazard was due primarily to the ingestion of manganese (primary COC) in groundwater. The maximum on-unit concentration of manganese was less than a factor of two greater than the background screening value, indicating that the concentration likely reflects background conditions. Although the new round of sampling did not include manganese, the results of the other sampled metals indicated that, if sampled, the concentration would be extremely low or non-detected.

Future Land Use - Radiological Carcinogenic Risk

The total cancer risk for radiological constituents for the hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was 1×10^{-5} and 5×10^{-5} , respectively. The radiological carcinogenic risk was primarily due to the ingestion of radium-228, tritium, uranium-238, and uranium-233/234 in groundwater and external exposure to cesium-137 in surface soil for both hypothetical future receptors. All of the constituents were secondary COCs for ingestion of groundwater for the future worker and resident. Tritium was also a secondary COC for the inhalation of groundwater for the hypothetical future resident. Radium-228, uranium-233/234, and uranium-238 were also detected in background samples which indicates

Table 3. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Hypothetical Future On-Unit Residents and Industrial Workers

Matrix	RESIDENTS (0-1 ft)					WORKERS (0-1 ft)				
	Exposure to Radionuclides		Exposure to Chemicals			Exposure to Radionuclides		Exposure to Chemicals		
	Route	Risk	Route	Risk	Hazard	Route	Risk	Route	Risk	Hazard
Soil	Ingestion	1.1E-08	Ingestion	NC	NC	Ingestion	2.6E-09	Ingestion	NC	NC
	Dermal	7.7E-11	Dermal	NC	NC	Dermal	3.4E-11	Dermal	NC	NC
	Inhalation (P)	2.2E-13	Inhalation (P)	NC	NC	Inhalation (P)	2.0E-13	Inhalation (P)	NC	NC
	External	1.4E-05	External	NC	NC	External	2.8E-06	External	NC	NC
Produce	Ingestion	2.1E-07	Ingestion	NC	NC	Ingestion	NA	Ingestion	NC	NC
Groundwater	Ingestion	3.3E-05	Ingestion	5.0E-06	4.0E+00	Ingestion	1.1E-05	Ingestion	1.4E-06	6.1E-01
	Dermal	1.0E-08	Dermal	7.7E-07	2.0E-01	Dermal	5.7E-09	Dermal	2.9E-07	6.7E-02
	Inhalation (V)	7.2E-06	Inhalation (V)	4.7E-08	3.9E-03	Inhalation (V)	NC	Inhalation (V)	NC	NC
Totals		5E-05		6E-06	4E+00		1E-05		2E-06	7E-01

Note: Groundwater risk calculations were revised to exclude samples taken using temporary piezometers which result in silty samples that elevate the results of the inorganic constituents.

NA - Not Applicable
 NC - Not Calculated
 P - Particulates
 V - Volatiles

that a significant portion of the estimated risks of these naturally-occurring radionuclides is the result of background conditions at the KBPOP. In the RI/BRA Report, the maximum concentrations of tritium and radium-228 in the groundwater were compared to their respective MCL values. The maximum concentrations of tritium and radium-228 were below their respective MCL values. Based on this comparison, tritium and radium-228 were not retained as COCs at the KBPOP and remedial goals were not developed for tritium and radium-228. Cesium-137 in soil was observed at levels consistent with global fallout activity.

Ecological Risk Assessment Results for the KBPOP

The ecological risk assessment evaluated the likelihood of occurrence for adverse ecological effects from exposure to chemicals associated with the KBPOP OU. The ecological setting of the unit is not unique or significant. There are no known endangered, threatened, or special concern species in the vicinity of the unit that are likely to be dependent on or affected by the habitat at the unit. The species that inhabit the unit are not rare in the region nor are they considered to be of special societal value. The area of the unit is small and the habitat is low in diversity and productivity.

Based on the characterization of the environmental setting and identification of potential receptor organisms, a CSM was developed to determine the complete exposure pathways through which ecological receptors could be exposed to COPCs. The focused evaluation addressed small mammals inhabiting the unit (represented by the oldfield mouse). The ultimate assessment endpoint was the diversity and health of the ecological community encompassing the unit.

None of the constituents detected in the soil at the KBPOP is concluded to have the potential for adverse effects to the oldfield mice that may use the unit as a foraging area. It is also unlikely that the constituents would cause a significant adverse effect on the ecological community. Therefore, there are no ecological COCS at the KBPOP.

Human Health Risk-Based Remedial Goals

Chemical-specific remedial goals (RGs) are concentration goals for individual chemicals for specific media and land use scenarios at CERCLA sites. General sources of chemical-specific RGs include: (1) concentrations based on Applicable or Relevant and Appropriate Requirements (ARARs), and (2) concentrations based on risk values from the risk assessment. RGs are derived for those contaminants in a pathway that result in an exceedance of a cancer risk of 1×10^{-6} or an HI of 1.0. These constituents are defined as constituents of concern (COCs). Separate

calculations are made for each of three target risk levels for both cancer and noncancer concerns. The target cancer risk levels are 1×10^{-4} , 1×10^{-5} , and 1×10^{-6} . The target HIs (noncancer) are 3, 1, and 0.1.

Table 4 provides a list of the RGs for the KBPOP by receptor and medium as identified in the RI/BRA. Although RGs were established in the RI/BRA Report for bis(2-ethylhexyl)phthalate, manganese, uranium-233/234, and uranium-238 in the groundwater media, remediation of the groundwater for these constituents was determined to be unnecessary due to (1) bis(2-ethylhexyl)phthalate is a common laboratory artifact and its presence is suspect, (2) manganese is suspect due to high turbidity factors at the time of sampling, and (3) uranium-233/234 and uranium-238 were detected in background samples indicating that these constituents are present as a result of background conditions at the unit.

Cesium-137 was determined to be the only soil COC at the KBPOP because of external radiation exposure from the surface soil for both hypothetical future residents and workers. However, the level of cesium-137 is consistent with global fallout. Therefore, remediation of the surface soil for cesium-137 was determined to be unnecessary. There are no groundwater or ecological COCs at the KBPOP.

Site-Specific Considerations

Site-specific considerations, based on the results of the conclusions of the RI/BRA, which suggest limited or no potential for significant risk include:

1. The miscellaneous debris at the KBPOP is covered by 4 feet of clean soil which provides an adequate barrier under the planned future use of this area.
2. Constituents detected in groundwater which led to risk and hazard exceedances for the future on-unit worker and resident are suspect due to the use of temporary piezometers. The temporary piezometers which were used to collect the groundwater samples did not have a filter pack around the screen intervals. Therefore, the samples from the piezometers were unfiltered; and, at the time of sampling, were observed to have a high turbidity factor. This high turbidity factor was believed to have caused the unusually high metal concentrations. In addition, there was only one elevated iodine-129 activity level which was believed to be a false positive reading.
3. Confirmatory sampling, which used permanent monitoring wells, was conducted and did not confirm the presence of these constituents in the groundwater. Therefore, the suspect

Table 4. K-Area Bingham Pump Outage Pit Remedial Goals for Constituents of Concern by Receptor and Medium

Receptor	Media	Constituent	RME Value in Media	Human Health Remedial Goals ^a					
				Target Cancer Risk			Target Hazard Quotient		
				1×10^{-4}	1×10^{-5}	1×10^{-6}	3	1	0.1
Future Worker	Soils	Cs-137 (pCi/g)	2.61E-01	1.06E+01 ^b	1.06E+00 ^b	1.06E-01 ^b	-----	-----	-----
Future Resident	Soils	Cs-137 (pCi/g)	2.61E-01	2.08E+00 ^b	2.08E-01 ^b	2.08E-02 ^b	-----	-----	-----
Future Worker	Groundwater	Bis(2-ethylhexyl)phthalate (mg/L)	2.85E-02	2.05E+00 ^b	2.05E-01 ^b	2.05E-02 ^b	9.39E-01 ^b	3.13E-01 ^b	3.13E-02 ^b
		Manganese (mg/L)	3.05E+00	-----	-----	-----	2.35E+00 ^b	7.82E-01 ^b	7.82E-02 ^b
Future Resident	Groundwater	Bis(2-ethylhexyl)phthalate (mg/L)	2.85E-02	4.95E-01 ^b	4.95E-02 ^b	4.95E-03 ^b	9.54E-01 ^b	3.18E-01 ^b	3.18E-02 ^b
		Manganese (mg/L)	3.05E+00	-----	-----	-----	2.35E+00 ^b	7.83E-01 ^b	7.83E-02 ^b
Future Worker	Groundwater	Uranium-233/234 (pCi/L)	6.24E+00	3.57E+02 ^b	3.57E+01 ^b	3.57E+00 ^b	-----	-----	-----
		Uranium-238 (pCi/L)	6.53E+00	2.58E+02 ^b	2.58E+01 ^b	2.58E+00 ^b	-----	-----	-----
Future Resident	Groundwater	Uranium-233/234 (pCi/L)	6.24E+00	5.87E+01 ^b	5.87E+00 ^b	5.87E-01 ^b	-----	-----	-----
		Uranium-238 (pCi/L)	6.53E+00	4.24E+01 ^b	4.24E+00 ^b	4.24E-01 ^b	-----	-----	-----

^a Calculation of human health remedial goals for noncancer hazards is not applicable to radionuclides.

^b These values represent the remedial goals in soil and groundwater for each COC required to reach the risk and hazard levels shown.

contaminants were removed from the risk considerations. When they were removed from risk consideration, the calculations fall within or below the risk range of 1×10^{-4} to 1×10^{-6} . The remaining groundwater constituents are either naturally-occurring, common laboratory artifacts, or below MCL values. There is no risk to the groundwater from a soil leachability standpoint.

4. Cesium-137 was the primary constituent which led to exceedances in the risk calculations for soil. The activity level at which cesium-137 (0.295 pCi/g) is present in the soil is consistent with activity levels of global fallout; and, cesium-137 has a half-life of 30.2 years. The KBPOP does not pose a risk to the ecological community.
5. The KBPOP is located in an area which has been recommended as an industrial zone by the Citizens Advisory Board and the *Savannah River Site Future Use Project Report* (DOE, 1996), precluding future residential use.

VII. REMEDIAL ACTION OBJECTIVES AND DESCRIPTION OF CONSIDERED ALTERNATIVES FOR THE KBPOP SOURCE CONTROL OPERABLE UNIT

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, or other information from the RI/BRA. These goals are modified, as necessary, as more information concerning the unit and potential remedial technologies become available. Final remediation goals are determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

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 KBPOP source unit.

The RI/BRA indicates that the secondary sources (i.e., KBPOP soil) associated with the KBPOP pose minimal carcinogenic risk to human health. Threatened, endangered, or sensitive species are not found at the KBPOP and the unit does not offer attractive or unique cover or forage opportunities for wildlife. Thus, ecological receptors are not at significant risk from the KBPOP OU. The RI/BRA also indicated that the KBPOP is not impacting groundwater at the unit. Constituents were not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential. Based on these conclusions, the Feasibility Study (FS) was conducted to consider possible actions which could reduce the risk associated with the KBPOP soil.

Based on the risk posed by cesium-137 in the KBPOP soil, the general remedial action objectives for the KBPOP soil are as follows:

1. Reduce risks to human health via external exposure to radiological constituents (i.e., cesium-137) in the soil.
2. Achieve RGs (see Table 4) established for unit soil.

There were no RAOs established for ecological receptors, or soil leachability contaminants, or groundwater contaminants since the RI/BRA data for the KBPOP indicated that these areas were not of concern for the unit.

The four feet of fill covering the miscellaneous construction debris buried at the KBPOP is adequate to be protective for direct radiation from the debris. At the time of burial, the radioactive contamination was less than 25 mR/hr with no detected alpha activity. Table 1 indicates greater than a factor of four decrease in curie content (two equivalent half-life).

KBPOP Soil Alternatives

As part of the investigation/assessment process for the KBPOP waste unit, a FS was performed using data generated during the assessment phase. Detailed information regarding the development and evaluation of the remedial alternatives can be found in *the Feasibility Study for the K-Area Bingham Pump Outage Pit (643-1G) (U)* (WSRC, 1997a).

The RI/BRA indicates that the KBPOP soil poses minimal risk to human health. External radiation from the KBPOP soil for the future on-unit resident and worker results in risk (i.e., 1×10^{-5} for the future resident and 3×10^{-6} for the future worker) within the range of concern (i.e., 1×10^{-4} and 1×10^{-6}). Therefore, a FS was conducted which included detailed analyses of soil alternatives. The preferred alternative for the KBPOP soil is Institutional Controls. This alternative will restrict this land to future industrial use and limit access to the soil, which might expose future workers to low concentrations of hazardous constituents, through use of administrative controls such as the site use and site clearance permits.

Six alternatives were evaluated for remedial action of the KBPOP operable unit soil. Each alternative is described below:

Alternative 1 - No Action

Under this alternative, no remedial actions would be conducted and no limitations would be placed on future uses of the site. EPA policy and regulations require the consideration of a no remedial action to serve as a baseline against which the other alternatives can be compared. Because no remedial action would be taken at the unit, the KBPOP would remain in its present condition. All contaminated soil and debris are within the KBPOP boundaries. The KBPOP is within the SRS facility and is not accessible to the public. The debris is covered by four feet of fill which is currently preventing direct contact. There would be no reduction of risk. The present worth cost of this alternative is \$280,000 which includes Record of Decision reviews every five years for thirty years.

Alternative 2 - Institutional Controls

Under this alternative, Institutional Controls would be implemented at the KBPOP and the site would remain undisturbed. Implementation of this alternative would require both near- and long-term actions.

In the near-term, signs would be posted at the waste unit which indicate that this area was used for disposal of waste materials and contains buried waste. In addition existing access controls would be used to maintain the KBPOP for nonresidential use.

Periodic inspections would be conducted and maintenance would be performed to help ensure that the cover remains intact. 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 non-federal ownership, the U.S. Government would take those actions necessary pursuant to CERCLA 120(h). These 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 would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use.

This alternative is shown to provide adequate protection of human health and the environment in the near-term. Long-term protection of human health and the environment would be achieved through deed restrictions and maintenance of the cover and signs. The present worth cost of this alternative is \$350,000 which includes periodic repairs to the KBPOP and Record of Decision reviews every five years for thirty years.

Alternative 3 - Placement of a Soil Cover

Under this alternative, the KBPOP would be covered by a low permeability soil cover with a minimum thickness of 3 feet (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 between 3-6 inches) would be placed on top of the soil cover.

The topsoil (vegetative soil layer) would be added and area would be compacted and seeded. The topsoil would be seeded with native grasses to increase evapotranspiration. The topsoil layer would also protect the soil cover from damage due to erosion, frost, and burrowing animals. 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. Institutional controls would be necessary to restrict the area to future industrial use and to prohibit excavation 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. The present

worth cost of this alternative is \$650,000 which includes labor and materials needed to place the soil cover and Record of Decision reviews every five years for thirty years.

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

Under this alternative, a concrete-based agent would be injected into the KBPOP and mixed with the soil and debris to form a solidified mass. The concrete material is injected into the ground in columns. The columns are placed in an overlapping pattern to provide treatment over the entire target area. The solidification process would produce a monolithic structure which would eliminate or reduce the mobility of the contaminants. A soil cover would then be placed over the treated site.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The source of contamination would be removed from the KBPOP. The present worth cost of this alternative is \$2,920,000 which includes labor and equipment required for in-situ stabilization of the KBPOP soil and debris, and construction of a soil cover. Site and soil cover maintenance and Record of Decision reviews every five years for 30 years are also included in the cost estimate.

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 lower boundary of the debris. The excavation could go deeper if necessary. The excavated material would then be staged at the KBPOP. 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 avoid producing airborne particulates and contaminated runoff. Other containment measures would be implemented as needed.

Debris would be separated from the soil using mechanical means such as screens and electromagnets. 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 and/or debris. The debris and treated soil would then be backfilled into the excavation and a soil cover would be placed over the KBPOP.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The present worth cost of this alternative is \$3,620,000 which includes labor and materials needed to pre-treat the soil prior to excavation for waste handling purposes,

to excavate and treat the soil and debris, and to construct a soil cover over the KBPOP and for Record of Decision reviews every five years for thirty years.

Alternative 6 - Excavate Soil and Debris, Dispose in E-Area Vaults or Soil/Debris Consolidation Facility (if applicable)

This alternative would require excavation by backhoe or similar means and removal of an estimated 13,150 cubic yards of soil and debris. Excavation would extend to at least four feet below the lower boundary of the debris. The excavation could go deeper if necessary. The excavated material would be hauled from the site and disposed at either the E-Area Vaults or the Soil/Debris Consolidation Facility (if applicable). The excavation would be backfilled with soil and seeded.

This alternative provides overall protection of human health and the environment by removing the contamination from the KBPOP. This alternative meets all of the RGs through complete source removal which eliminates the potential for long-term direct contact with contaminated soil or debris. Excavation would present limited short-term exposures to workers. The present worth cost of this alternative is \$17,000,000 which includes labor and materials needed to pre-treat soil and subsoil for waste handling purposes, to excavate the wastes, to treat the wastes following excavation for packaging and disposal requirements, to transport the waste, and to dispose of the KBPOP soil. Record of Decision reviews would not be required under this alternative because concentrations of constituents remaining at the KBPOP would not exceed RGs.

KBPOP Groundwater Alternatives

Based on the conclusion of the KBPOP RI/BRA Report (WSRC, 1997b), there was no groundwater contamination which would pose a current or future threat to human health or the environment. In addition, constituents from the KBPOP soil are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential. Therefore, there were no groundwater alternatives considered in the FS.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Each of the remedial alternatives was evaluated using the nine criteria established by the NCP. The criteria were derived from the statutory requirements of CERCLA Section 121. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,

- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above criteria were used to evaluate the alternatives developed in the FS (WSRC, 1997a). Seven of the criteria were used to evaluate all the alternatives, based on human health and environmental protection, cost, feasibility, and implementability issues. The preferred alternative was further evaluated based on the final two criteria: state acceptance and community acceptance.

Table 5 presents the evaluation of the soil remedial alternatives. A summary of the comparative analysis of soil alternatives are provided below:

Overall Protection of Human Health and the Environment

All alternatives provide immediate protection because the debris is covered by four feet of soil and no short-term health concerns were identified. Alternative 1 (No Action) provides the least long-term protection because erosion or development could increase exposure. Alternatives 2 (Institutional Controls (Access and Deed Restrictions/Notifications)) and 3 (Placement of a Soil Cover) each offer improvements in protection through reduced exposure potential. Alternatives 4 (In-Situ Solidification of Soil and Debris, Soil Cover) and 5 (Excavate Soil and Debris, Solidify/Stabilize Soil, Backfill Treated Soil and Debris, Soil Cover) provide increased protection because exposure pathways are limited through treatment. Alternative 6 (Excavate Soil and Debris, Dispose in E-Area Vaults (EAV) or Soil/Debris Consolidation Facility (SDCF) (if applicable)) provides the greatest protection of all of the alternatives because the contaminated material is removed from the KBPOP.

Compliance with ARARs

There were no chemical- or location-specific ARARs identified for Alternatives 1 through 6. In addition, there were no action-specific ARARs identified for Alternatives 1 and 2.

Action-specific ARARs identified for Alternatives 3 through 6 are generally similar. These alternatives require erosion control plans, Occupational Safety and Health Administration safety and health plans, and closure performance standards. Alternatives 4 through 6 are required to

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls (Access & Deed Restrictions)	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Debris; Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 6 Excavate Soil & Debris; Dispose at E- Area Vaults or Soil/Debris Consolidation Facility (if applicable)
OVERALL PROTECTIVENESS						
<i>Human Health Protection</i>	Provides immediate protection as all other alternatives, but affords lower long-term protection due to possibility of cover or site development. Current risks are within EPA's acceptable limits.	Provides immediate protection through access restrictions; provides long-term protection through access and use restrictions.	Provides immediate and long-term protection through elimination of exposure pathways.	Same as Alternative 3, except provides additional protection by solidification.	Same as Alternative 4.	Provides protection of human health by removing contaminated material.
<i>Environmental Protection</i>	Lowest degree of environmental protection because cover erosion could result in contaminant exposure.	Greater long-term protection than Alternative 1 because site contact would be minimized.	More than Alternative 2 because soil cover would further reduce contact with contaminates material.	More than Alternative 3 because solidification would further reduce contact with contaminants.	Same as Alternative 4.	Provides protection of environment by removing contaminated material.
COMPLIANCE WITH ARARS						
<i>Chemical-Specific ARARs</i>	None identified.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
<i>Location-Specific ARARs</i>	None identified.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls (Access & Deed Restrictions)	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Debris; Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 6 Excavate Soil & Debris; Dispose at E- Area Vaults or Soil/Debris Consolidation Facility (if applicable)
COMPLIANCE WITH ARARS (cont'd)						
<i>Action-Specific ARARs</i>	None identified.	None identified.	Meets all identified ARARs.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
LONG-TERM EFFECTIVENESS AND PERMANENCE						
<i>Magnitude of Residual Risk</i>	Least reduction of all alternatives because no reduction would occur and threat could increase if site is not maintained. Current risk is within EPA's acceptable limits.	Slightly less than Alternative 1 because site would be maintained.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Greatest protection because all contaminated material is removed.
<i>Adequacy and Reliability of Controls</i>	No Controls.	Controls can prevent contact with contaminated media.	More reliable than Alternative 2.	More reliable than Alternative 3.	Same as Alternative 4.	Greatest reliability because all contaminated material is removed.
<i>Need for 5-year Review</i>	All alternatives except 6 requires 5-year review.	All alternatives except 6 requires 5-year review.	All alternatives except 6 requires 5-year review.	All alternatives except 6 requires 5-year review.	All alternatives except 6 requires 5-year review.	No review is necessary because no waste would remain at K BPOP.
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT						
<i>Treatment Process Used</i>	None.	None.	None.	Directly treats inorganics.	Same as Alternative 4.	None.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls (Access & Deed Restrictions)	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Debris; Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 6 Excavate Soil & Debris; Dispose at E- Area Vaults or Soil/Debris Consolidation Facility (if applicable)
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT (cont'd)						
<i>Amount Destroyed or Treated</i>	None.	None.	None.	Treats all inorganics within site, but total mass of organics remains the same.	Same as Alternative 4.	None.
<i>Reduction of Toxicity, Mobility, or Volume Through Treatment</i>	None.	None.	Mobility of contaminants reduced by soil cover.	Volume of contaminated material would be increased by up to 100% of the original volume; mobility of contaminants would be less than under Alternative 3.	Same as Alternative 4, except debris would not be treated by solidification.	None.
<i>Irreversible Treatment</i>	Not applicable; no treatment.	Not applicable; no treatment.	Not applicable; no treatment.	No further remedies could be undertaken on the treated material.	Same as Alternative 4.	Material would be removed.
<i>Type and Quantity of Residuals Remaining after Treatment</i>	Not applicable; no treatment.	Not applicable; no treatment.	Not applicable; no treatment.	Same remaining residuals as Alternatives 1 through 3, but volume would increase & residuals would be solidified.	Same as Alternative 4.	Not applicable; no treatment.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls (Access & Deed Restrictions)	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Debris; Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 6 Excavate Soil & Debris; Dispose at E- Area Vaults or Soil/Debris Consolidation Facility (if applicable)
SHORT-TERM EFFECTIVENESS						
<i>Community Protection</i>	No threat to community during implementation.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
<i>Worker Protection</i>	No threat of exposure to worker.	Same as Alternative 1.	Same as Alternative 1.	Greater than Alternatives 1, 2, and 3 because treatment would require limited contact with contaminate material.	Greater than Alternative 4 because treatment would require excavation of contaminated material.	Same as Alternative 5.
<i>Environmental Impacts</i>	No environmental threat during implementation.	Same as Alternative 1.	Same as Alternative 1.	Slight environmental threat because of limited contact with contaminated materials.	Greater than Alternative 4 because treatment would require excavation of contaminated material.	Same as Alternative 5.
<i>Time Until Action is Complete</i>	Immediate.	Immediate.	Immediately effective, but onsite action would require 1 to 2 months after remedial design and contractor selection.	Immediately effective, but onsite action would require 2 to 3 months after remedial design and contractor selection.	Same as Alternative 4.	Same as Alternative 4.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls (Access & Deed Restrictions)	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Debris; Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover	Alternative 6 Excavate Soil & Debris; Dispose at E- Area Vaults or Soil/Debris Consolidation Facility (if applicable)
IMPLEMENTABILITY						
<i>Ability to Construct and Operate</i>	No construction or operation.	Same as Alternative 1.	Simple to construct and maintain.	More difficult than Alternative 3 because special equipment is required for treatment.	Similar to Alternative 4.	Requires regulatory evaluation and comparison to waste acceptance criteria.
<i>Ease of Doing More Action if Needed</i>	Additional action easily implemented.	Same as Alternative 1.	Same as Alternative 1.	No further remedies could be undertaken on treated waste.	Same as Alternative 4.	Contaminated material would be removed from site, so additional remedies would not be necessary.
<i>Ability to Monitor Effectiveness</i>	Alternative includes no monitoring; future exposure could occur in absence of controls.	Frequent inspection of property would provide notice of changes.	Same as Alternative 2.	Same as Alternative 2, except effectiveness of solidification would not be monitored.	Same as Alternative 4.	No need to monitor because waste would not remain on site.
<i>Availability of Services and Equipment</i>	No services or equipment needed.	Services are available locally.	Services and equipment are available.	Less than Alternative 3, longer lead time may be needed to secure services and equipment.	Same as Alternative 4.	Same as Alternative 4.
COST						
<i>PW Capital Cost</i>	\$0	\$30,000	\$330,000	\$2,600,000	\$3,300,000	\$17,000,000
<i>PW O & M Cost (5-year)</i>	\$0	\$320,000	\$320,000	\$320,000	\$320,000	\$0
<i>Total PW Cost</i>	\$280,000	\$350,000	\$650,000	\$2,920,000	\$3,620,000	\$17,000,000

meet proper disposal and decontamination specifications as listed in 40 Code of Federal Regulations (CFR) 264.114. Alternative 5 is required to meet waste pile design, operation, and closure requirements as listed in 40 CFR 264.251 and 40 CFR 264.258(a). Alternative 6 requires transportation of hazardous materials which would require adherence to 49 CFR 107. Alternatives 3 through 6 would comply with the appropriate ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence can be measured in broad terms by (1) the magnitude of residual risk associated with the waste unit, and (2) the adequacy of controls after implementation of the remedial alternative. Of the alternatives being considered, Alternative 1 provides the least long-term effectiveness because the threat of exposure may increase as the cover erodes. The residual risk present at the KBPOP is the same for Alternatives 1 through 5 because contaminants will remain the KBPOP. Alternatives 2 (Institutional Controls) provide added controls for limiting future exposures through maintenance and administrative controls. Alternative 3 (Placement of a Soil Cover) provides added controls for limiting future exposures through minimization of infiltration reaching the waste. However, these alternatives do not involve any form of treatment that would permanently reduce the magnitude of residual risk. Alternatives 4 and 5 involve treatment of contaminated media and placement of a soil cover. Alternative 6 provides the greatest reduction in residual risk because the contaminated material is removed from the waste unit. Alternative 4 (In-situ Solidification of Soil, backfill, and Soil Cover), Alternative 5 (Excavation and Solidification of Soil, Backfill; and Soil Cover), and Alternative 6 (Excavate, Dispose at EAV or SDCF (if applicable), Soil cover) offer a greater reduction in the magnitude of residual risk than would Alternatives 1 (No Action), 2 (Institutional Controls), and 3 (Placement of a Soil Cover).

Existing SRS institutional controls would be adequate for the protection of human health as long as the institutional controls are maintained. In the absence of existing controls, the No Action alternative would not be protective of human health. Based upon the hypothetical scenario that institutional controls cannot be guaranteed and/or proposed caps could be allowed to fail, the need for institutional controls to maintain protectiveness would decrease corresponding to the extent to which contaminated media are treated to permanently reduce the magnitude of residual risk. Consequently, the need for controls is greatest for the alternatives that do not treat or remove any of the contaminated media (Alternative 1 - No Action, Alternative 2 - Institutional Controls, and Alternative 3 - Placement of a Soil Cover) followed by alternatives that treat all known contaminated soil at the KBPOP (Alternative 4 - In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover and Alternative 5 - Excavate Soil and Debris, Solidification of Soil,

Backfill Treated Soil and Debris, Soil Cover). Alternative 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) would require the least controls of all alternatives being considered since it would involve the permanent removal of all contaminated soil known to exceed concentration-based remediation goals.

All alternatives, except Alternative 6, require 5-year review because contaminated material would be left at the waste unit.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 (No Action), 2 (Institutional Controls), 3 (Placement of a Soil Cover), and 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) offer no form of active treatment and, therefore, do not satisfy the NCP preference for remedial alternatives that offer a reduction in contaminant toxicity, mobility, or volume through treatment. Alternative 6, however, does reduce the volume of contaminated material at the KBPOP through removal to another location. Alternative 3 provides mobility reduction through the placement of a soil cover. Alternatives 4 (In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover) and 5 (Excavate Soil and Debris, Solidification of Soil, Backfill Treated Soil and Debris, Soil Cover) each offer greater reduction in mobility by implementing solidification in addition to the placement of a soil cover. However, these alternatives will increase the volume of contaminated material by up to 100%.

Short-Term Effectiveness

The short-term risks to remedial workers increases with the volume of contaminated media directly handled or processed and project duration. Handling (e.g., excavating, moving) and/or processing (e.g., treating) contaminated media increases the risk of remedial worker exposure to radiation effects. In addition, remedial workers are exposed to potential construction-related risks (e.g., falls, cuts, heavy equipment operation) which increases with corresponding increases in project duration; however, potential short-term risks should be manageable for all alternatives being considered. With strict adherence to project health and safety plans, it should be possible to maintain short-term risks of all considered alternatives within acceptable limits.

None of the alternatives present any threats to surrounding communities during implementation. The potential risk to remedial workers would be lowest for Alternatives 1 (No Action) and 2 (Institutional Controls) which do not require intrusive on-site work, so no worker exposure concerns are presented by these alternatives. Alternative 3 (Placement of a Soil Cover) is not

expected to present any significant worker exposure either, as soil cover construction will not generate significant contact with the contaminated material.

Alternatives 4 (In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover), 5 (Excavate Soil and Debris, Solidification of Soil, Backfill Treated Soil and Debris, Soil Cover), and 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) each involve contact with the contaminated material; and, therefore present some degree of worker risk. Because Alternative 4 provides in-situ treatment, contact would be minimal and the worker risk would be less than for Alternatives 5 and 6. Alternatives 5 and 6 each require excavation; and, therefore present the highest level of worker exposure. Adequate personal protection could be provided for workers under each alternative.

None of the alternatives would require significant amounts of time to complete. A maximum of 3 months after remedial design and contractor selection is estimated for completion of on-site activities.

Implementability

No major implementation problems were identified for Alternatives 1 (No Action), 2 (Institutional Controls), and 3 (Placement of a Soil Cover). Alternatives 4 (In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover) and 5 (Excavate Soil and Debris, Solidification of Soil, Backfill Treated Soil and Debris, Soil Cover) may present minor difficulties in selection of qualified contractors. Alternative 4 may also present potential implementation problems because of the requirements for grouting through debris. Alternative 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) may present potential implementation problems if the availability of space at the disposal facility hinders disposal. Evaluation of regulatory and acceptance criteria would also be required for Alternative 6.

Cost

Total estimated present worth costs range between \$280,000 for Alternative 1 (No Action) to \$17,000,000 for Alternative 6 (Excavate Soil and Debris, Dispose in E-Area Vaults or Soil/Debris Consolidation Facility (if applicable)). Alternative 2 (\$350,000) involves institutional controls including placement of access and deed restrictions. Alternative 3 (\$650,000) involves placement of a soil cover. Alternative 4 (\$2,920,000) involves in-situ stabilization of the contaminated soil, backfilling the treated soil and debris, and placement of a soil cover. Alternative 5 (\$3,620,000) involves excavation of the soil and debris, solidification of the soil, backfilling the treated soil and debris, and placement of a soil cover.

With the exception of Alternatives 1 and 6, the estimated operation and maintenance of costs of all alternatives are approximately \$320,000 for the long-term (30 years) maintenance of the soil cover and 5-year remedy reviews. The estimated operation and maintenance costs for the No Action alternative (Alternative 1) is \$280,000 because it only involves conducting 5-year remedy reviews. Alternative 6 would have no additional operation and maintenance costs since it would permanently remove all contaminated soil and debris from the KBPOP waste unit and would not require 5-year remedy reviews. All cost estimates are provided for comparison purposes only and are not intended to forecast actual budgetary expenditures.

State and Community Acceptance

The State and Federal regulatory agencies have accepted and approved Alternative 2 (Institutional Controls) primarily because it is the least expensive alternative that is still protective of human health and the environment since the waste unit poses minimal risk to the hypothetical future industrial worker and future resident and no risk to the current worker. The KBPOP Proposed Plan public comment period ended on August 6, 1997 and there were no public comments received. Therefore, the community has shown acceptance of Alternative 2 as the final remedial alternative for the KBPOP.

IX. THE SELECTED REMEDY

The miscellaneous construction debris (i.e., pipes, cables, ladders, etc.) with fixed contamination (primary source) has been buried in the KBPOP since 1958. The presence of the debris plays a primary role in the remedy selection. There was no indication from the characterization data that the contamination present on the debris has moved and the level of radioactivity as shown in Table 1 has diminished over the years. The degree of exposure toxicity to the waste is considered minimal and the potential for exposure is also considered to be minimal.

In addition, based on the risks identified in Section VI, the KBPOP soil poses minimal risk to human health. Carcinogenic risks to the potential future worker (3×10^{-6}) or resident (1×10^{-5}) are driven by external exposure to the soil at 0-1 ft. which is contaminated with cesium-137. Since the entire 0-4 ft soil interval was not sampled, the risk present at the unit may be underestimated.

In order to manage the uncertainty associated with the possibility of direct exposure and unrestricted excavation, probable underestimation of risk, and to ensure that the degree of and the potential for exposure remain minimal, institutional controls are appropriate for the KBPOP operable unit..

An evaluation of potential alternatives was performed in accordance with the NCP as summarized in Section VIII. Based on this evaluation, the selective alternative for the KBPOP operable unit is Alternative 2 - Institutional Controls. Institutional Controls meets the remedial action objectives (i.e., reduction of risk to human health via external exposure to cesium-137 in the soil) and remedial goals (see Table 4) for the KBPOP operable unit by precluding future on-site residential use of the area, buried waste contact, removal, or excavation.

Based on the RI/BRA, there is no need for remediation of the KBPOP from an ecological standpoint.

The Institutional Controls alternative is intended to be permanent and effective in the near- and long-term. Alternative 2 is considered to have the lowest cost option which is still protective of human health and the environment.

Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted at the KBPOP indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain this site for nonresidential use.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to CERCLA 120(h). These 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 construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use.

Throughout the period of Federal ownership, as well as for any future ownership, under Institutional Controls (Alternative 2), there will be no risk greater than 3×10^{-6} to the future industrial worker. Furthermore, there will be no appreciable risk to the environment.

Based on the conclusions of the RI/BRA, the KBPOP is not impacting groundwater. Constituents are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential.

This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X. STATUTORY DETERMINATIONS

Based on the KBPOP Remedial Investigation Report with Baseline Risk Assessment, the KBPOP poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficient for protection of human health and the environment for the KBPOP operable unit.

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 actions, and is cost-effective. The low levels of contaminants in the soil make treatment impractical. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

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. The three Parties, DOE, SCDHEC, and EPA, have determined that a five-year review of the ROD for the KBPOP will be performed to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The *Proposed Plan for the K-Area Bingham Pump Outage Pit (643-1G)* provided for involvement with the community through a document review process and a public comment period. No comments were received during the 30-day public comment period (July 8, 1997 - August 6, 1997). There were no changes made to the preferred alternative as presented in the Proposed Plan; therefore, there were no significant changes made to the presentation of the alternative in this Record of Decision.

XII. RESPONSIVENESS SUMMARY

A public meeting was not requested during the PP public comment period and there were no comments received during the public comment period; therefore, a Responsiveness Summary is not required for the KBPOP.

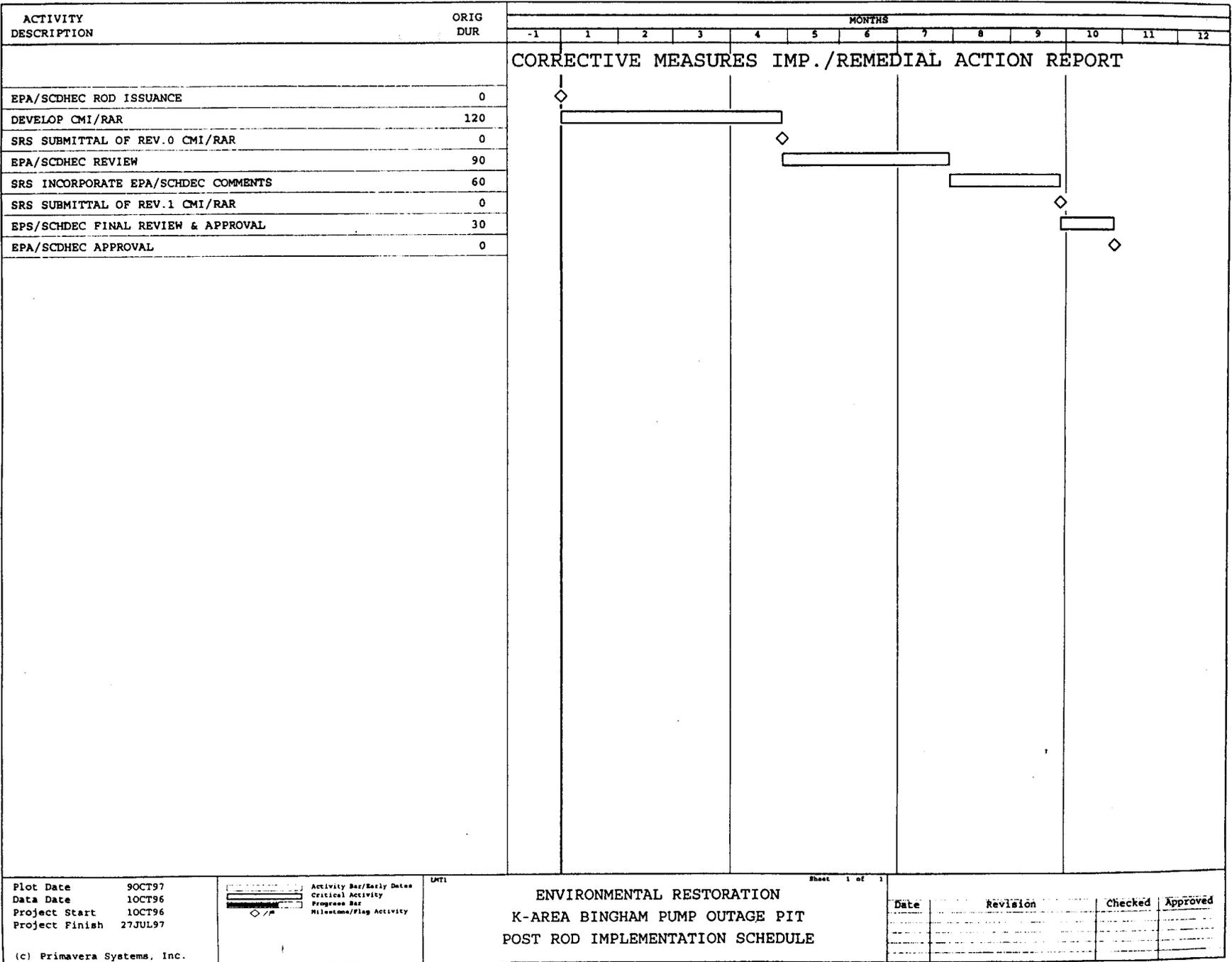
XIII. POST-ROD DOCUMENT SCHEDULE

Due to the limited actions (i.e., posting signs, use of existing access controls, site maintenance, etc.) involved with the implementation of the Institutional Controls alternative, a streamlined post-ROD document is appropriate for the KBPOP. The actions involved with implementation of the selected remedy do not require any design.

The post-ROD document and implementation schedule is summarized below and is illustrated in Figure 8:

1. Corrective Measures Implementation/Remedial Action Report (CMI/RAR) (rev. 0) for the KBPOP will be submitted for EPA and SCDHEC review four months after issuance of the ROD.
2. EPA and SCDHEC have 90 days to review the KBPOP CMI/RAR (rev. 0).
3. SRS has 60 days to revise the KBPOP CMI/RAR (rev. 0) after receipt of regulatory comments.
4. EPA and SCDHEC have 30 days for final review and approval of the KBPOP CMI/RAR (rev. 1).

Figure 8. Post-ROD Document Schedule



XIV. REFERENCES

- DOE (U.S. Department of Energy), 1994. *Public Involvement, A Plan for the Savannah River Site*. Savannah River Operations Office, Aiken, South Carolina (1994).
- DOE, 1996. *Savannah River Site Future Use Project Report, Stakeholder Recommendations for Savannah River Site Land and Facilities (U)*. Savannah River Operations Office, Aiken, South Carolina (January 1996).
- FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).
- WSRC (Westinghouse Savannah River Company), 1995a. *Quality Control Summary Report for the K-Area Bingham Pump Outage Pit, Stage 3 and 4*. ESH-EMS-950561, Environmental Protection Department (Environmental Monitoring Section), Westinghouse Savannah River Company, Aiken, South Carolina (June 1995).
- WSRC (Westinghouse Savannah River Company), 1995b. *Quality Control Summary Report for the RFI/RI Assessment of the K-Area Bingham Pump Outage Pit, Stage 1*. ESH-EMS-950392, Environmental Protection Department (Environmental Monitoring Section), Westinghouse Savannah River Company, Aiken, South Carolina (June 1995).
- WSRC (Westinghouse Savannah River Company), 1997a. *Feasibility Study for the K-Area Bingham Pump Outage Pit (643-1G) (U)*. WSRC-RP-96-831, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (May 1997).
- WSRC (Westinghouse Savannah River Company), 1997b. *Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-1G) (U)*. WSRC-RP-95-1555, Rev. 1.2, Westinghouse Savannah River Company, Aiken, South Carolina (February 1997).
- WSRC (Westinghouse Savannah River Company), 1997c. *Proposed Plan for the K-Area Bingham Pump Outage Pit (643-1G) (U)*. WSRC-RP-97-106, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (June 1997).

This page intentionally left blank.