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United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the Old F-Area Seepage Basin (904-49G) (U)

WSRC-RP-96-872
Revision 1.1
March 1997

Final

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

RESPONSIBILITY • SECURITY • SAFETY SRS SAVANNAH RIVER SITE

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

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

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Old F-Area Seepage Basin (SRS Building Number 904-49G)
Savannah River Site
Aiken, South Carolina

The Old F-Area Seepage Basin (OFASB) (904-49G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site. This operable unit includes the source unit (vegetation, soils [basin and ditchline], pipeline, and pipeline soils) and the groundwater unit.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the OFASB 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 RCRA/CERCLA unit.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The preferred alternative for the OFASB vegetation is to remove vegetation and dispose at an off unit facility. This alternative will eliminate direct radiation hazards associated with vegetation. Implementation of this alternative will involve removal of contaminated vegetation from the OFASB and transportation and disposal at an off unit disposal facility.

The preferred alternative for the OFASB pipeline and pipeline soils 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 site use and site clearance permits as well as access controls such as filling or grouting pipeline manholes. Implementation of the institutional controls alternative will involve both short- and long-term actions. For the short-term, signs will be posted at the waste unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owned which will contain information in compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed shall also include deed restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated in the event that 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.

Along with the institutional controls identified above, the preferred alternative for the OFASB soils (basin and ditchline) is to remove the top two feet of soils in the ditchline and place in the OFASB followed by in situ stabilization of the top two feet of basin soils and the ditchline soils placed in the basin, and cover with a low permeability cap. This alternative will eliminate direct radiation hazards and minimize potential future impacts to the groundwater from OFASB soils. Implementation of this alternative will involve excavation of contaminated effluent ditchline soils to two feet below land surface, placement of these removed ditchline soils in the OFASB, stabilizing the ditchline soils and the top two feet of contaminated soils in the basin, and covering the basin area with a minimim 10^{-5} cm/sec permeability cap.

The preferred alternative for OFASB groundwater is to continue existing institutional controls and monitor the extent of the groundwater contaminant plume. A groundwater mixing zone application (demonstration) has been approved by the appropriate regulatory agencies based on data from monitoring wells around the OFASB and groundwater modeling. This alternative will demonstrate that remedial action objectives will be met, MZCLs will be achieved throughout the groundwater aquifer, and MCLS will be achieved at the compliance point as described in the approved groundwater mixing zone application. Implementation of this alternative involves installation and monitoring of groundwater wells as described in the groundwater mixing zone application.

Statutory Determinations

Based on the OFASB RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment, the OFASB poses no significant risk to the environment but poses significant risk to human health. Therefore, treatment and capping is necessary for the OFASB soils (basin and ditchline), institutional controls are necessary for the OFASB pipeline and pipeline soils, and monitoring of the existing groundwater constituents consistent with the groundwater mixing zone application. The size, location of the waste unit, and contaminant levels preclude a remedy in which contaminants could be excavated and treated effectively.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume 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. Since hazardous substances will remain on-site above health-based standards, the three Parties have determined that a Five Year Review of the ROD for the OFASB will be performed to ensure continued protection of human health and the environment.

3/28/97
Date

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

MAY 1 4 1997
Date

John H. Hankinson, Jr.; Regional Administrator
U.S. Environmental Protection Agency

6/19/97
Date

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

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

Old F-Area Seepage Basin (904-49G)

WSRC-RP-96-872
Revision 1.1 Final
March 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
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Savannah River Operations Office
Aiken, South Carolina

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DECISION SUMMARY TABLE OF CONTENTS

I. Site and Operable Unit Name, Location, and Description

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

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS. The Federal Facility Agreement lists the Old F-Area Seepage Basin (OFASB), 904-49G, (Figure 2) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment

The OFASB is located within the SRS, approximately 600 feet north of F Area and 1 mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately 6 miles west of the basin. The OFASB is located at the top of a gentle slope at an elevation of 285 feet above mean sea level. The water table is approximately 75 feet below ground surface in the area of the OFASB. Surface drainage is to the north toward Upper Three Runs Creek which is at an elevation of 130 feet above mean sea level (155 feet below the basin elevation).

The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres. Approximate dimensions of the OFASB are 200 feet by 300 feet with an earthen berm in the interior dividing the basin into two areas. The basin remains open with growing vegetation and serves as a wet weather pond. This unit also includes one effluent ditchline adjacent to the basin which leads toward Upper Three Runs Creek and one process sewer line which fed the basin and has an average depth of 9 to 10 feet below land surface and is about 800 feet in length. Groundwater in the area has also been included in the unit assessment.

Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

Since 1955, the OFASB received occasional discharges of cooling waters and rainfall runoff. During a three month period in 1969, spent nitric acid solutions used to etch depleted uranium (M Area operations) were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969 discharge. An estimated 1.8 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay an estimated inventory of less than 0.8 curies remains. Releases to the basin of various nonradioactive chemicals also occurred during basin use. The inactive basin is currently fenced, open, and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

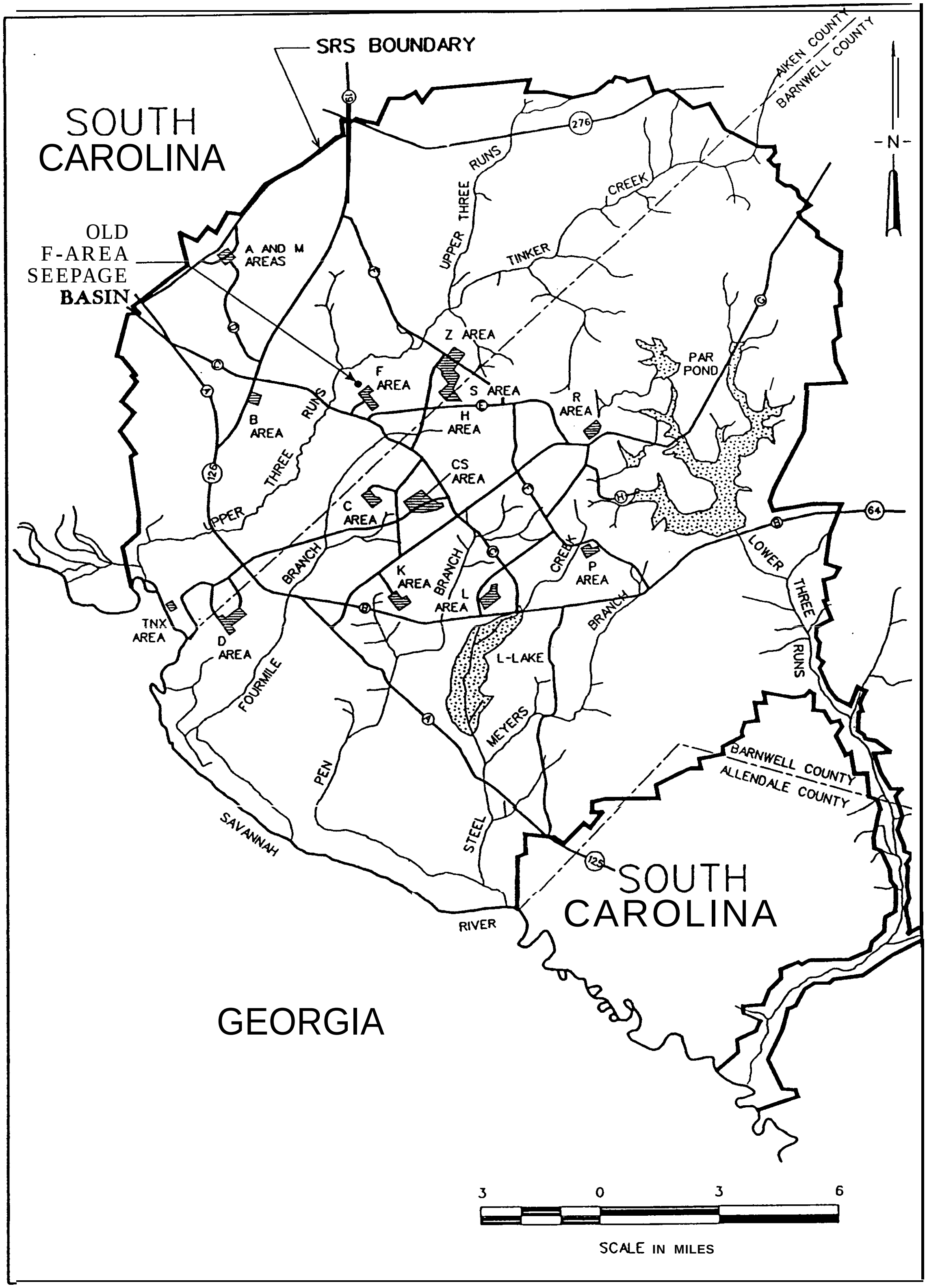

Figure 1. Location of the Old F-Area Seepage Basin **at the Savannah River Site**

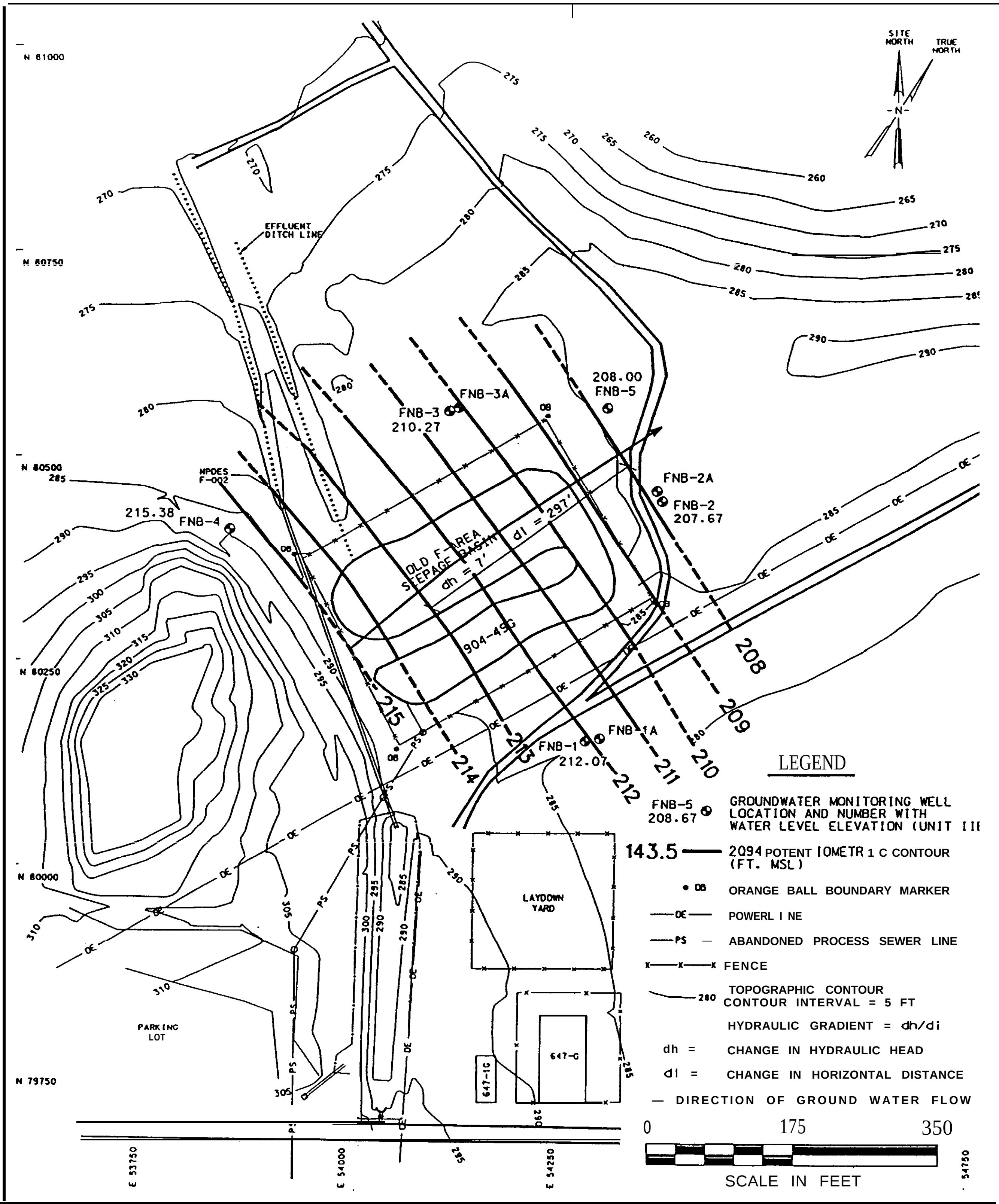

Figure 2. Topographic & Water Table Potentiometric MapoftheOFASB

IL Operable Unit History and Compliance History

Operable Unit History

The OFASB was first used between November 1954 and mid-May 1955. Nine to fourteen million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

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The inactive basin is currently fenced, open, and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

Compliance History

At SRS, waste materials are managed which are regulated under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control on September 5, 1995. Module IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

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

Section V provides a detailed description of the operable unit, history of operation, and the impact of releases to human health and the environment.

III. Highlights of Community Participation

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79. 124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the OFASB soils 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. SCHWMR R.61 - 79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the Old F-Area Seepage Basin (904-49G)* (WSRC, 1996b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the OFASB.

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

Similar information is available through the repositories listed below:

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 mailings of the *SRS Environmental Bulletin*, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, 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 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. A public comment meeting was held on October 15, 1996. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this Record of Decision.

IV. Scope and Role of Operable Unit Within the Site Strategy

The overall strategy for addressing the OFASB was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, chemicals 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 OFASB is an operable unit located within the Upper Three Runs Watershed. Several source control and groundwater operable units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all source control and groundwater operable units to minimize impact to the watershed. Based on characterization and risk assessment information, the OFASB does not significantly 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. The OFASB investigation considered all unit specific groundwater. Based on the investigation of the groundwater, the contamination in the water table aquifer is apparently attributable to the OFASB wastes. The proposed action for the OFASB vegetation, ditchline and basin soils, pipeline and pipeline soils, and groundwater is a final action.

V. Summary of Operable Unit Characteristics

The OFASB was first used between November 1954 and mid-May 1955. Nine to fourteen million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

Since 1955, the OFASB received occasional discharges of cooling waters and rainfall runoff. During a three month period in 1969, spent nitric acid solutions used to etch depleted uranium (M Area operations) were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969 discharge.

An estimated 1.8 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay an estimated inventory of less than 0.8 curies remains. Releases to the basin of various nonradioactive chemicals also occurred during basin use.

The inactive basin is currently fenced, open (bottom of basin is -10 feet below surrounding land surface), and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

The conceptual unit model for the OFASB is depicted in Tables 2 and 3 which identify that radionuclide contaminated soils are the primary contaminants which pose risk to both the future resident and worker scenarios. These radionuclide risks are primarily associated with external radiation exposure to basin and ditchline soils as well as ingestion of groundwater.

Media Assessment

The Data Summary Report for the Old F-Area Seepage Basin (U) (WSRC, 1995b), *RFI/RI Report for the Old F-Area Seepage Basin (U)* (WSRC, 1995c), and *Baseline Risk Assessment for the Old F-Area Seepage Basin (U)* (WSRC, 1995a) contain detailed analytical data for all of the environmental media samples taken in the characterization of the OFASB.

Pipeline &Pipeline Soils

The RFI/RI Work Plan identified a data quality objective (DQO) process which determined that characterization of the pipeline soils would be characteristic of the pipeline and pipeline soil contaminants due to:

- The length of operating history (less than 9 months of batch wastewater disposal through the pipeline),
- Pipe materials (vitrified clay pipe with a bell and hub design would not provide for long term leak prevention),
- Minimal sediments (due to the short operating life of the OFASB pipeline sediments are not expected to be present in any appreciable quantities), and
- Pipeline leakage (significant leakage is expected from historical service information on the materials and pipe design used).

Based on these factors, it is believed that the probable condition is that any contribution of contaminants from within the pipeline would not significantly increase the contaminant inventory or affect the remedy selected (institutional controls) for the pipeline and pipeline soils.

Evaluations using modeling in the CMS/FS identified that pipeline soils did not pose a risk from either direct exposure (pipe is an average of 10-12 feet below land surface) and activity levels in the pipeline soils do not pose future impact to groundwater concerns.

Basin & Ditchline Soils

Analytical data indicate that significant impact to the soil media associated with the OFASB has occurred from both radiological and nonradiological contaminants. Radiological contaminants approach background at about 25 feet below the bottom of the basin. Nonradiological contaminants are bound in the top 2 feet of the basin soils. Surficial soil contamination is isolated to the confines of the fenced basin area and effluent ditchline areas.

Gross alpha concentrations in basin soils occur above background (*i.* e. >20 pCi/g) to a depth of 25 feet below the bottom of the basin while nonvolatile beta concentrations above background *(i.e.* >50 pCi/g) in basin soils occur to a depth of 15 feet below the bottom of the basin. Although contaminants are present above background levels at depth, the predominant inventory of radiological contaminants are bound in the top 2 feet of the basin soils. Treatability testing, use of contaminant transport calculations, and evaluation of the decrease in contaminant concentrations by depth indicate that radiological contaminants present below 2 feet pose no potential future impact to the groundwater.

Major contaminants in the soils are cesium- 137 and mercury. Cesium is present at a maximum concentration of 1345 pCi/g at O to 1 foot below the basin bottom (53% of the cesium-137 is found in the top 2 feet). Mercury is present at a maximum concentration of 35.6 mg/kg at O to 1 foot below the basin bottom (97% of the mercury is found in the top 2 feet).

Groundwater

Iodine-1 29, nitrate, strontium-90, and tritium have been detected above MCLS and uranium has been detected above proposed MCLS based on groundwater monitoring data. Although radium has been decreasing over time, it has also exceeded MCLS. The groundwater plume has been identified from 8 local wells. The groundwater plume in the water table aquifer has migrated beyond the surface boundaries of the OFASB by more than 200 feet toward the Upper Three Runs Creek which is more than 2500 feet to the north of the OFASB.

VI. Summary of Operable Unit Risks

As a component of the remedial investigation process, a baseline risk assessment was prepared for the OFASB. The baseline risk assessment consists of human health and ecological risk assessments. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment. summary information for the human health and ecological risk assessments follows and has been summarized in Table 1 below.

Human Health Risk Assessment

As part of the investigation/assessment process for the OFASB waste unit, a BRA was performed using data generated 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 *RFI/RI Report for the Old F-Area Seepage Basin (U)* (WSRC, 1995c) and the *Baseline Risk Assessment for the Old F-Area Seepage Basin (U)* (WSRC, 1995a).

The process of designating the COPCs was based on consideration of background concentrations, frequency of detection, the relative toxic potential of the chemicals, and chemical nutrient status. COPCs are the constituents that are potentially site-related and whose data are of sufficient quality for use in the risk assessment.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only current exposure scenario identified for the OFASB was for the on unit visitor (researchers and samplers). Conservative future exposure scenarios identified for the OFASB included future occupational workers and future resident adults and children. The reasonable maximum exposure concentration (95th percentile) value was used as the exposure point concentration.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants (carcinogens). The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA Target Risk Range (TRR) of one in ten thousand (1.0 x 10^{-4}) to one in one million (1.0 x 10^{-6}) for incremental cancer risk at NPL sites.

Noncarcinogenic effects are also evaluated to identify a level at which there may be concern for potential noncarcinogenic health effects. The hazard quotient (HQ), which is the ratio of the exposure dose to the reference dose (RfD), is calculated for each contaminant. HQs are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), there is concern that adverse health effects might occur.

Table 1. Significant Risk Exposure Pathways for at Risk Receptors

Exposure Pathway	Future Resident	Future Worker	Current Visitor	Contaminant
METALS				
Ingestion of Groundwater	x	x		Arsenic Manganese
Ingestion of Basin Soils	x			Mercury
Ingestion of Produce WI Basin Soils	x			Mercury
RADIONUCLIDES				
External Radiation Basin Soils	x	x		Cesium-137
External Radiation Ditch Soils	x	x		Cesium-137
Ingestion of Groundwater	x	x		Iodine-129
Ingestion of Basin Soils	x			Plutonium-239
Ingestion of Produce w/ Basin Soils	X			Cesium-137

X-Indicates that exposure pathway contributes significant risk.

Current Land Use - Noncarcinogenic Hazards

The Baseline Risk Assessment shows that potential adverse noncarcinogenic health effects are not likely to occur, because the sum of the HIs for the current on unit visitor scenario do not exceed a value of one.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were characterized for the current on unit visitor. The sum of the estimated nonradiological cancer risks were less than 1.0 x 10^{-6}. Media evaluated include soil inside the basin, soil outside the basin, soil surrounding the process sewer line, soil in the effluent ditchlines, associated airborne soil particulate, surface water and sediment in the stream/wetland, and groundwater.

Estimated radiological cancer risks for exposure due to external radiation is 4.5 x 10^{-5} indicating that carcinogenic risk from the unit is limited. External radiation exposure risk results from cesium-137 (95%) and cobalt-60 (2.5%) contamination. Other exposure pathways evaluated estimated radiological cancer risks less than 1.0 x 10^{-6}.

The total of all estimated cancer risks for this exposure scenario is 4.6 x 10-5 which identifies external radiation as the primary exposure pathway (98%) for the current on unit visitor.

Future Land Use - Noncarcinogenic Hazards

The HIs exceed unity for both conservative future exposure scenarios (on unit worker and on unit resident). HIs greater than unity for the future on unit worker were exceeded for ingestion of groundwater primarily caused from elevated levels of manganese and lead. HIs greater than unity for the future on unit resident were exceeded for ingestion of the groundwater due to manganese, lead, and arsenic; ingestion of basin soil (mercury), and ingestion of fruits and vegetables grown in basin soils (mercury). Manganese and arsenic are likely naturally occurring in Southeast regional soils. Also, discharge records show that manganese was not a component of any liquid discharge to the basin.

Future Land Use - Carcinogenic Risks

No significant risk for the future on unit "worker" due to nonradiological carcinogenic risks greater than the Tarket Risk Range were identified. Exposure due to ingestion of groundwater for the future on unit "resident" estimated significant nonradiological carcinogenic risks greater than the EPA's Target Risk Range. This exposure was based on elevated arsenic concentrations which are below area background concentration averages.

The ingestion of groundwater exposure pathway for the future on unit worker estimated nonradiological carcinogenic risks within the EPA's Target Risk Range based on beryllium and arsenic. Ingestion of groundwater (beryllium), ingestion of surficial basin soil (PCB-1 254), ingestion of surficial effluent ditchline and process sewer line soil (arsenic), and ingestion of fruits and vegetables grown in effluent ditchline and process sewer line soil (arsenic) exposure pathways for the future on unit resident estimated nonradiological carcinogenic risks within the EPA's Target Risk Range.

Exposure pathways for the future on unit worker which estimate significant radiological carcinogenic risks greater than the EPAs Target Risk Range are external radiation from the basin soil (cesium-1 37), ingestion of groundwater (iodine-129, potassium-40), and external radiation from the effluent ditchline soil (cesium- 137). Exposure pathways for the future on unit resident which estimate significant radiological carcinogenic risks greater than the EPAs Target Risk Range are external radiation from the basin soil (cesium-137), ingestion of fruits and vegetables grown in basin soils (cesium- 137), external radiation from the effluent ditchline soil (cesium-1 37), and ingestion of basin soil (plutonium-239).

Significant carcinogenic risks for the future on unit worker are driven by exposure from direct radiation from the basin soils contaminated with cesium- 137 and cobalt-60. Significant carcinogenic risks for the future on unit resident are driven by exposure from direct radiation from the basin soils contaminated with cesium-1 37, cobalt-60, radium-228, and europium- 154. These risks are estimated at 9.4×10^{-3} for the future on unit worker and 1.6×10^{-2} for the future on unit resident.

The total of all estimated cancer risks for the future on unit resident exposure scenario is 1.8×10^{-2} which identifies external radiation as the primary exposure pathway (88%) for this receptor. Ingestion of groundwater serves as a secondary risk contributor (8%).

The total of all estimated cancer risks for the future on unit worker exposure scenario is 1.0×10^{-2} which identifies external radiation as the primary exposure pathway (96%) for this receptor. Ingestion of groundwater serves as a secondary risk contributor (3%). Human health risk tables (conceptual unit model) for the on unit resident (Table 2) and on unit worker and visitor (Table 3) are provided below.

Ecological Risk Assessment

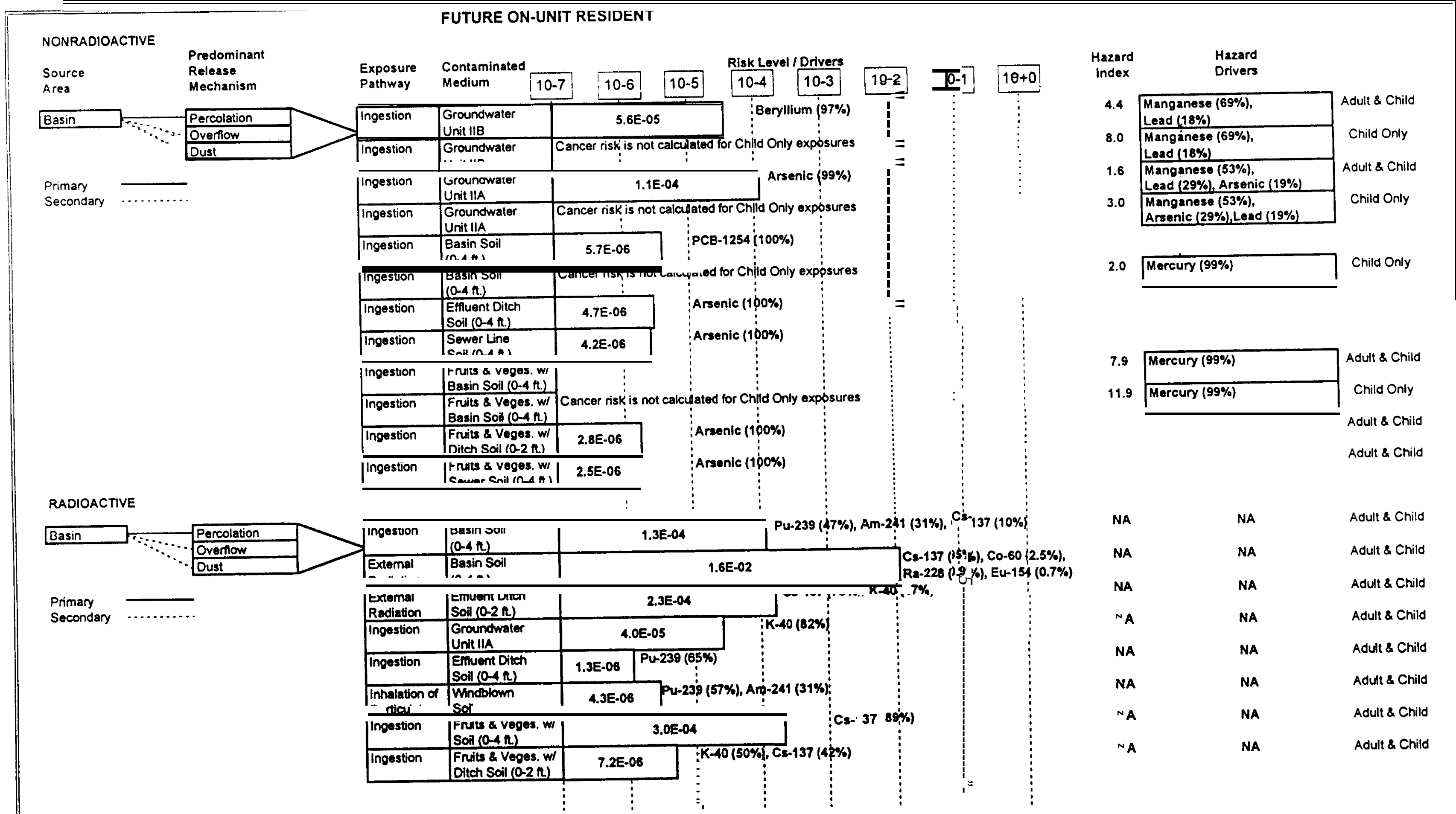
Based on characterization of the environmental setting and identification of potential receptor organisms, a conceptual site model was developed to determine the complete exposure pathways through which receptors could be exposed to COPCs.

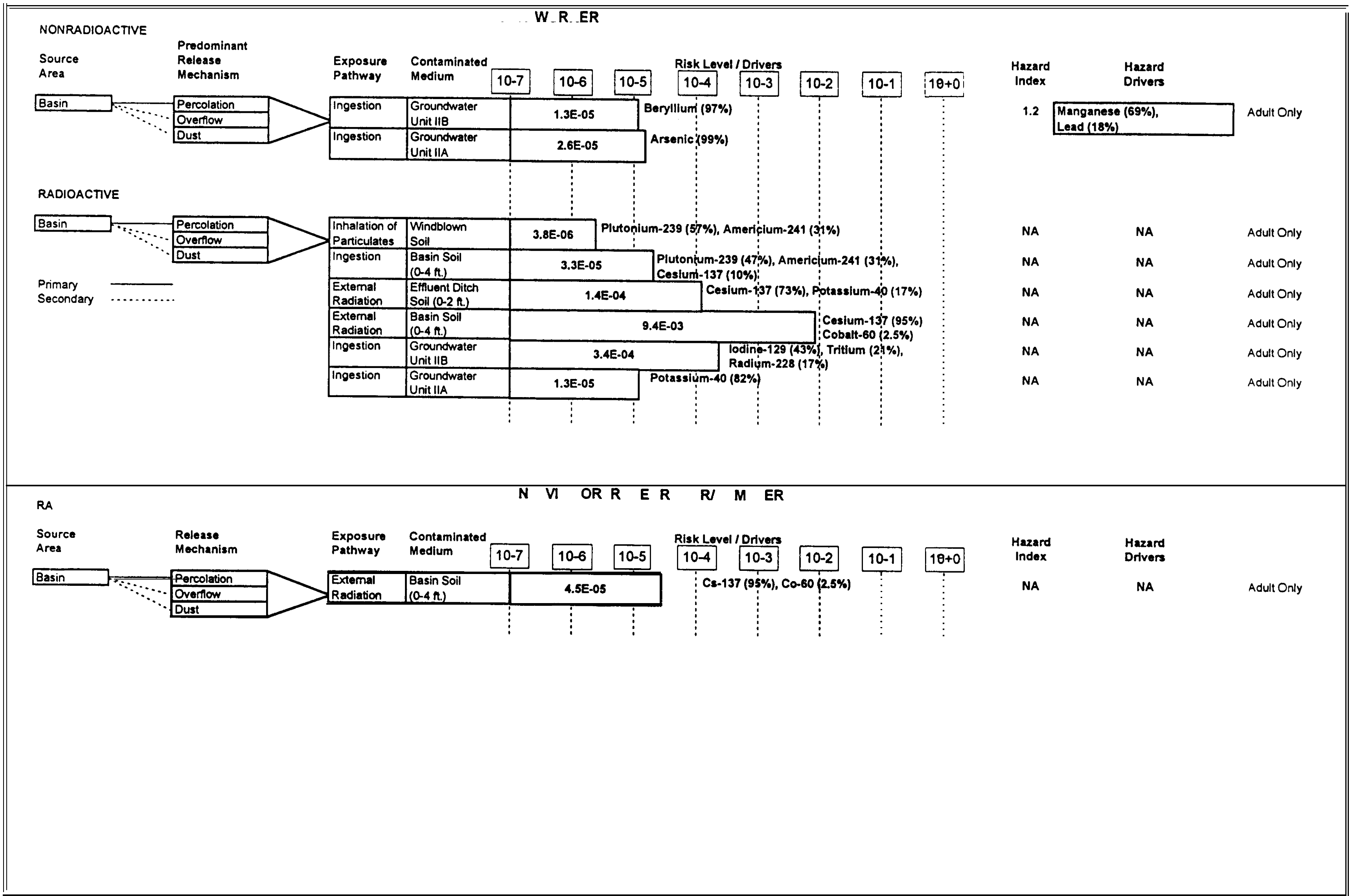
Interpretation of the ecological significance of the unit-related contamination at the OFASB indicated that there was essentially no likelihood of unit-related chemicals causing significant impacts to the community of species in the vicinity of the unit. None of the COPCs identified in soil at the OFASB are estimated to pose significant ecological risk based on their toxicity at the concentration at which they are present.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives 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 RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

Constituents of potential concern are site- and media-specific, man-made and naturally occurring inorganic and organic chemicals, pesticides, and radionuclides detected at a unit under investigation. Constituents of concern are isolated from the list of constituents of potential concern by calculating carcinogenic risks and noncarcinogenic hazard indices. A constituent of concern contributes significantly to a pathway having a carcinogenic risk greater than 1×10^{-6} and a hazard index greater than 1.0. Risk levels at or above the upper-bound of the target risk range (1×10^{-4}) are considered significant and these sites are expected to undergo remediation. Risk levels between 1×10^{-6} and 1×10^{-4} require consideration for remediation.


FUTURE ON-UNIT RESIDENT
NONRADIOACTIVE
Source Area
Predominant Release Mechanism
Exposure Pathway
Contaminated Medium
Risk Level / Drivers
10-7
10-6
10-5
10-4
10-3
10-2
10-1
10+0
Hazard Index
Hazard Drivers
Basin
Percolation
Overflow
Dust
Primary
Secondary
Ingestion
Groundwater Unit IIB
5.6E-05
Beryllium (97%)
Cancer risk is not calculated for Child Only exposures
Groundwater Unit IIA
1.1E-04
Arsenic (99%)
Basin Soil (0-4 ft.)
5.7E-06
PCB-1254 (100%)
Effluent Ditch Soil (0-4 ft.)
4.7E-06
Arsenic (100%)
Sewer Line Soil (0-4 ft.)
4.2E-06
Fruits & Veges. w/ Basin Soil (0-4 ft.)
Fruits & Veges. w/ Ditch Soil (0-2 ft.)
2.8E-06
Fruits & Veges. w/ Sewer Soil (0-4 ft.)
2.5E-06
4.4
Manganese (69%), Lead (18%)
Adult & Child
8.0
Manganese (69%), Lead (18%)
Child Only
1.6
Manganese (53%), Lead (29%), Arsenic (19%)
3.0
Manganese (53%), Arsenic (29%), Lead (19%)
2.0
Mercury (99%)
7.9
11.9
RADIOACTIVE
External Radiation
Basin Soil (0-4 ft.)
1.3E-04
Pu-239 (47%), Am-241 (31%), Cs-137 (10%)
1.6E-02
Cs-137 (15%), Co-60 (2.5%), Ra-228 (0.9%), Eu-154 (0.7%)
Effluent Ditch Soil (0-2 ft.)
2.3E-04
K-40 .7%
4.0E-05
K-40 (82%)
1.3E-06
Pu-239 (65%)
Inhalation of Particulates
Windblown Soil
4.3E-06
Pu-239 (57%), Am-241 (31%)
Fruits & Veges. w/ Soil (0-4 ft.)
3.0E-04
Cs-137 89%)
Fruits & Veges. w/ Ditch Soil (0-2 ft.)
7.2E-06
K-40 (50%), Cs-137 (42%)
NA


NONRADIOACTIVE
Source Area
Predominant Release Mechanism
Exposure Pathway
Contaminated Medium
Risk Level / Drivers
10-7
10-6
10-5
10-4
10-3
10-2
10-1
10+0
Hazard Index
Hazard Drivers
Basin
Percolation
Overflow
Dust
Ingestion
Groundwater Unit IIB
1.3E-05
Beryllium (97%)
1.2
Manganese (69%), Lead (18%)
Adult Only
Ingestion
Groundwater Unit IIA
2.6E-05
Arsenic (99%)
RADIOACTIVE
Basin
Percolation
Overflow
Dust
Primary
Secondary
Inhalation of Particulates
Windblown Soil
3.8E-06
Plutonium-239 (57%), Americium-241 (31%)
NA
NA
Adult Only
Ingestion
Basin Soil (0-4 ft.)
3.3E-05
Plutonium-239 (47%), Americium-241 (31%), Cesium-137 (10%)
NA
NA
Adult Only
External Radiation
Effluent Ditch Soil (0-2 ft.)
1.4E-04
Cesium-137 (73%), Potassium-40 (17%)
NA
NA
Adult Only
External Radiation
Basin Soil (0-4 ft.)
9.4E-03
Cesium-137 (95%) Cobalt-60 (2.5%)
NA
NA
Adult Only
Ingestion
Groundwater Unit IIB
3.4E-04
Iodine-129 (43%), Tritium (21%), Radium-228 (17%)
NA
NA
Adult Only
Ingestion
Groundwater Unit IIA
1.3E-05
Potassium-40 (82%)
NA
NA
Adult Only
RA
Source Area
Release Mechanism
Exposure Pathway
Contaminated Medium
Risk Level / Drivers
10-7
10-6
10-5
10-4
10-3
10-2
10-1
10+0
Hazard Index
Hazard Drivers
Basin
Percolation
Overflow
Dust
External Radiation
Basin Soil (0-4 ft.)
4.5E-05
Cs-137 (95%), Co-60 (2.5%)
NA
NA
Adult Only

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 or location-specific ARARs relevant to establishing remedial action objectives for the OFASB operable unit. Only Uranium Mill Tailings Radiation Control Act levels have been identified as a chemical-specific ARAR for the OFASB source unit and the waste unit currently meets these levels. Only MCLS (as identified in South Carolina R.61 -58.5 State Primary Drinking Water Regulations and Federal 40 CFR 141 National Primary Drinking Water Regulations) have been identified as chemical specific ARARs for the OFASB groundwater unit. The groundwater is not a current source of drinking water, however, all groundwater in South Carolina is classified as GB under South Carolina R.61 -68 Water Classification and Standards and as such is required to be addressed in some manner (State of South Carolina groundwaters must undergo active remediation to achieve MCLS unless a groundwater mixing zone is granted). The remedial action objectives identified below are met by the preferred remedy by ensuring that through natural mixing zone processes the nearest groundwater receptor as defined in the groundwater mixing zone application is not exposed to groundwater contaminated above MCLS and access controls are in place through establishment of institutional controls to prevent exposure to the groundwater plume.

The selected remedial action objectives for the OFASB operable unit are to:

- Prevent external exposure to radiological constituents,
- Prevent inhalation of radiological constituents,
- Prevent ingestion of soil or produce grown in soil with radiological constituents, and to
- Prevent or mitigate the release of constituents of concern to the groundwater,
- Prevent or mitigate the impact to the nearest groundwater receptor located at the Upper Three Runs Creek,
- Restore the aquifer through natural groundwater mixing processes and other processes (radioactive decay) to achieve MCLS throughout the groundwater plume (groundwater mixing zone application modeling estimates that MCLS throughout the entire groundwater aquifer will be achieved in approximately 200 years), and
- Achieve State of South Carolina groundwater mixing zone objectives
    a) control source to minimize addition of contaminants to the groundwater,
    b) establish plume monitoring and compliance wells to ensure compliance with mixing zone concentrations limits and/or maximum contaminant levels established in the groundwater mixing zone application, and

c) monitor to ensure contaminated groundwater remains on SRS until MCLS achieved throughout the plume and to ensure groundwater area or plume is decreasing concentrations.

VII. Description of the Considered Alternatives

As part of the investigation/assessment process for the OFASB waste unit, a CMS/FS was performed using data generated during the assessment phase. Detailed information regarding the development and evaluation of remedial alternatives can be found in the *Corrective Measures Study/Feasibility Study for the Old F-Area Seepage Basin (U)* (WSRC, 1996a).

The RFI/RI and BRA indicate the OFASB soil poses significant risk to human health. External radiation from basin soils for the current on unit visitor, and future on unit worker and resident result in risk within the EPA's Target Risk Range for the current land use and significant risk greater than the EPA's Target Risk Range for future use scenarios. Risks are also associated with ingestion of groundwater for the future on unit worker and resident. Therefore, a CMS/FS was conducted which included detailed analyses for soil/vegetation and groundwater alternatives. The preferred alternative for the OFASB pipeline and pipeline soils 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 site use and site clearance permits as well as access controls such as filling or grouting pipeline manholes.

VII.A Description of the Considered Alternatives for the OFASB Operable Unit Soil/Vegetation

Five alternatives were evaluated for remedial action of the OFASB operable unit soil/vegetation. Each alternative is described below:

Alternative S1 -No Action

Under this alternative, no action would be taken at the OFASB. EPA policy and regulations require consideration of a no action alternative to serve as a basis against which other alternatives can be compared. Because no action would be taken and the OFASB would remain in its present condition, there are minimal associated costs related to normal SRS maintenance activities and there would be no reduction of risk. Since five year reviews of the remedy are required, the estimated present value for these reviews and existing maintenance activities for the next 30 years is $280,000.

Alternative S2 - Cap the Basin and Vegetation

This alternative involves the placement of effluent ditchline soils (-167 cubic yards) and contaminated vegetation (-25 cubic yards) into the OFASB and construction of a cap over the OFASB. Initially, the waste unit would be prepared by clearing the trees, vegetation, fencing, and other physical obstructions immediately surrounding the OFASB. Contaminated effluent ditchline soils would be excavated and placed directly into the OFASB. Contaminated vegetation would be segregated from uncontaminated vegetation and the contaminated vegetation would be chipped and spread evenly over the OFASB soils.

The basin would then be backfilled and compacted to grade. After sufficient compaction, an engineered cap would be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration.

The low permeability engineered soil cap will have a minimum thickness of 2 feet of compacted low-hydraulic conductivity soil (in-place saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or less). The cap will also have an upper surface with a slope to promote surface runoff and minimize surface erosion. The topsoil (vegetative soil layer will be placed at a minimum thickness of 3 inches and will have the ability to survive and function with little or no maintenance. The surface slope will also promote runoff and minimize surface erosion. The cap would cover an area of approximately 3.5 acres (Figure 3). This alternative would reduce the risks associated with direct radiation exposure and minimize future potential migration of contaminants to the groundwater.

Existing SRS institutional controls would remain in effect and the capping system would be maintained resulting in a present value cost of $1,300,000.

Alternative S3A/B -In Situ Grout Soils To 2 Feet & Incinerate Vegetation at CIF or Dispose of Vegetation Off Unit

This alternative involves the consolidation of effluent ditchline soils with the OFASB soils followed by *in situ* grouting of the top 2 feet of the OFASB (-4,500 cubic yards) and effluent ditchline soils (-167 cubic yards). Upon completion of *in situ* grouting, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. These alternatives (S3A/S3B) would reduce the risks associated with direct radiation exposure and minimize, through grouting the most contaminated soils, future potential migration of contaminants to the groundwater with minimal exposure to remediation workers.

Alternative S3A includes the removal and chipping of the vegetation followed by incineration at the SRS Consolidated Incinerator Facility (CIF). Existing SRS institutional controls would remain in effect. Following remediation the unit would be maintained for a present value cost of $2,1 00,000.

Alternative S3B includes the removal of the vegetation followed by transport and disposal off unit. Existing SRS institutional controls would remain in effect. Following remediation the unit would be maintained for a present value cost of $1,800,000.

Alternative S4A/B - Ex Situ Grout Soils to 2 Feet & Incinerate Vegetation at CIF or Dispose of Vegetation Off Unit

This alternative involves the excavation and ex *situ* grouting of the OFASB and effluent ditchline. The OFASB would be excavated to a maximum depth of 2 feet. The excavated soils would be mixed with the solidification/stabilization reagents at predetermined ratios, and the soils would be placed back into the basin. When all of the OFASB soils are treated, the process would be repeated on effluent ditchline soils. Upon completion of ex *situ* grouting, the treated soils would be placed in the OFASB, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would then be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. These alternative (S4A/S4B) would reduce the risks associated with direct radiation exposure and minimize, through grouting the most contaminated soils, future potential migration of contaminants to the groundwater but since the significantly contaminated soils would require excavation prior to treatment, exposure to remediation workers could occur.

Alternative S4A includes the removal and chipping of the vegetation followed by incineration at the SRS CIF. Existing SRS institutional controls would remain in effect. Following remediation the unit would be maintained. for a present value cost of $2,300,000.

Alternative S4B includes the removal of the vegetation followed by transport and disposal at the SRS Burial Grounds which have trenches that are permitted to accept debris. Existing SRS institutional controls would remain in effect. Following remediation, the unit would be maintained for a present value cost of $1,900,000.

Alternative S5 - Dispose of 2 Feet of Soils at Envirocare, Incinerate Vegetation at CIF, and Cap

This alternative involves the excavation and off-site disposal of the top 2 feet of the OFASB (4,500 cubic yards) and effluent ditchline soils (167 cubic yards). A backhoe would be used to excavate the OFASB soils. The backhoe would start at one end of the ditchline and basin and would gradually progress along the edges and toward the middle of the ditchline and basin until all of the soil within 2 feet is removed. Excavated soils would then be placed directly onto lined trucks for transport from the waste unit. From the OFASB, the excavated soils would either be transported directly to the Envirocare facility in Clive, Utah, or transferred to a railcar for final transport to the Envirocare facility. Upon completion of the excavation and off-site disposal activities, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would then be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. This alternative would reduce the risks associated with direct radiation exposure and minimize, through off unit disposal, future potential migration of contaminants to the groundwater but since the significantly contaminated soils would require excavation prior to disposal, exposure to remediation workers could occur. Also, since transportation would be required off the SRS, the potential for exposure to the public exists.

This alternative also includes the removal of the vegetation followed by incineration at the SRS CIF. Existing SRS institutional controls would remain in effect. A present value cost of $9,000,000 is estimated for this alternative.

VII.B Description of the Considered Alternatives for the OFASB Operable Unit Groundwater

Four alternatives were evaluated for remedial action of the OFASB operable unit groundwater. Each alternative is described below.

Alternative GW1 -No Action

This alternative is the same as the no action described in alternative S 1. Because no action would be taken and the OFASB would remain in its present condition there would be no reduction of risk. The present value estimate to perform both the no action for soils/vegetation and groundwater would be $280,000 due to performance of five year reviews since waste is left in place.

Alternative GW2A - Groundwater Extraction, Treatment with Reverse Osmosis and Ion Exchange, Disposal of Residuals, and Reinfection

This alternative consists of setting up a system of 11 extraction wells on 100 foot nodes to hydraulically contain the contaminated water table aquifer plume. The groundwater would be extracted from the ground and sent to a reverse osmosis unit which would separate the stream into a concentrated retentate stream (the part of the groundwater feed stream that is retained) containing the radionuclides and metals and a permeate stream (the part of the groundwater feed stream that passes through the membrane) which contains treated water. The permeate stream would next pass through anion exchange unit designed to remove nitrate from the water. The treated water from the ion exchange unit would then be piped to a system of injection wells located up gradient from the extraction wells.

The treated water, which still contains tritium, would then be reinfected into the water table aquifer to allow additional time for natural decay to reduce the level of tritium in the groundwater. The retentate from the reverse osmosis unit and the regenerated liquid from the ion exchange unit would then be collected and disposed.

Three methods for disposal have been found to be acceptable. All three involve solidifying the waste in a cement-based matrix for final disposition. The Saltstone facility would provide the lowest cost method for treating the waste stream, however, this facility is designed to accept waste from the ITT process only. If this facility can be modified, then the Saltstone facility represents the preferred method for disposal of the concentrated liquid waste. If modifications cannot be made, then either the E-Area Vaults or the Envirocare facility can be used. This alternative would reduce risks associated with exposure due to ingestion of contaminated groundwater through treatment.

Assuming use of the Saltstone facility and that the groundwater aquifer would be maintained, the present value cost for this alternative is $17,800,000.

Alternative GW2B - Groundwater Extraction, Treatment with Reverse Osmosis, Disposal of Residuals, and Reinfection

This alternative is nearly identical to the previous alternative (GW2A) except a dual ion exchanges ystem is used in place of the reverse osmosis and ion exchange system. In this alternative, the ion exchange system would contain both an anionic and a cationic unit. For this application, one unit is designed to remove the radionuclides and metals while the other is designed to remove nitrate. The regeneration of one unit is normally done using an acid wash while the other uses a basic wash. An added advantage of this system is that the two waste streams can be used to neutralize each other before the waste is shipped for disposal. This alternative would reduce risks associated with exposure due to ingestion of contaminated groundwater through treatment.

Assuming use of the Saltstone facility and the groundwater aquifer would be maintained, the present value cost for this alternative is $13,200,000.

Alternative GW3 - Groundwater Controls Using Alternate Concentration Limits/ Mixing Zone

This alternative will involve the installation of a monitoring well network between the basin and the down gradient stream and initiation of periodic monitoring. The application for a groundwater mixing zone has been approved by the appropriate regulatory agencies. This approval is based on data from monitoring wells around the OFASB and groundwater modeling. This alternative will demonstrate that remedial goal objectives will be met and MCLS will not be exceeded beyond the groundwater mixing zone. Implementation of this alternative involves installation and monitoring of groundwater wells as described in the groundwater mixing zone application.

This alternative will reduce the risks associated with groundwater ingestion by ensuring that through natural groundwater mixing zone processes the nearest groundwater receptor is not exposed to groundwater contaminated above MCLs. Access controls are in place through establishment of institutional controls to prevent exposure to the groundwater plume.

Since five year reviews of the remedy are required, the estimated present value for these reviews, installation of monitoring wells, and monitoring is $1,300,000.

VIII. Summary of Comparative Analysis of the Alternatives

Description of Nine Evaluation Criteria

Each of the remedial alternatives was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The NCP [40 CFR § 300.430 (e) (9)] sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. 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 mentioned criteria were used to evaluate the alternatives developed in the *Corrective Measures Study/Feasibility Study for the Old F-Area Seepage Basin (U)* (WSRC, 1996a). Seven of the criteria are used to evaluate all the alternatives, based on human health and environmental protection, cost, and feasibility issues. The preferred alternative is further evaluated based on the final two criteria: state acceptance and community acceptance. Brief descriptions of all nine criteria are given below.

<u>Overall Protection of Human Health and the Environment</u> - The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls.

All the soil/vegetation alternatives (with the exception of the no action alternative) would reduce the risks associated with direct radiation exposure, however, the in situ grouting, ex situ grouting, and off unit disposal options would further minimize the potential migration of contaminants to the groundwater. The groundwater alternatives (with the exception of the no action alternative) would reduce the risks associated with groundwater ingestion.

<u>Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)</u> - ARARs are Federal and state environmental regulations that establish standards which remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs are usually health- or risk-based levels or methodologies which, when applied to unit-specific conditions, result in the establishment of numerical values. Often these numerical values are promulgated in Federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements or limitations on actions taken with respect to hazardous substances or unit-specific conditions. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

The remedial activities are assessed to determine whether they attain ARARs or provide grounds for invoking one of the five waivers for ARARs. These waivers are:

- the remedial action is an interim measure and will become a part of a total remedial action that will attain the ARAR,
- compliance will result in greater risk to human health and the environment than other alternatives,
- compliance is technically impracticable from an engineering perspective,
- the alternative remedial action will attain an equivalent standard of performance through use of another method or approach,
- the state has not consistently applied the promulgated requirement in similar circumstances or at other remedial action in the state.

In addition to ARARs, compliance with other criteria, guidance, and proposed standards that are not legally binding, but may provide useful information or recommended procedures should be reviewed as To-Be-Considered when setting remedial objectives.

All the alternatives (with the exception of the no action alternative) for both soil/vegetation and groundwater will comply with ARARs. The mixing zone alternative will achieve MCLS at the compliance point as established in the approved groundwater mixing zone application. Aquifer restoration will occur through natural groundwater mixing processes in approximately 200 years based on modeling conducted in the approved groundwater mixing zone application.

<u>Long-Term Effectiveness and Permanence</u> - The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation

The grouting (in situ and ex situ) and off unit disposal alternatives provide more effectiveness than the capping alternative since the waste is solidified below grade or removed from the unit. The off unit disposal alternative provides the most effectiveness through removal of the source and disposal at an off unit location. The pump and treat groundwater alternatives would permanently remove most contaminants but would not improve the groundwater risks associated with tritium over the groundwater mixing zone alternative.

<u>Reduction of Toxicity, Mobility, or Volume Through Treatment</u> - The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or volume of contaminants associated with the unit.

The in situ and ex situ grouting alternatives for the soil would reduce contaminant mobility through treatment. The pump and treat alternatives for the groundwater would reduce the volume of contaminated groundwater through treatment.

<u>Short-Term Effectiveness</u> - The remedial alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts on workers, potential

environmental impacts (e.g., air emissions), and the time until protection is achieved.

In situ grouting and capping for the soil would provide the least potential for exposure to the worker while off unit disposal would pose the highest potential for exposure to the public since waste would be transported outside of the SRS. Groundwater pump and treat alternatives will provide the highest potential for exposure to workers through future disposal needs of the treatment medium (reverse osmosis, ion exchange).

Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations, administrative feasibility (regulatory requirements), and availability of services and materials.

All alternatives are easily and readily available for application at the OFASB. Separate regulatory acceptance of the groundwater mixing zone alternative is required prior to its initiation.

Cost - The evaluation of remedial alternatives must include capital and operational and maintenance costs. Present value costs are estimated within +50/-30 percent, per EPA guidance. The cost estimates given with each alternative are prepared from information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs may vary from the estimates presented herein.

The most costly alternative for the soil is off unit disposal followed by the grouting (in situ and ex situ) and capping alternatives which have similar order of magnitude costs. The pump and treat alternatives for the groundwater are significantly (an order of magnitude) more costly than the groundwater mixing zone alternative. The no action alternative requires the least cost.

State Acceptance - In accordance with the FFA, the State is required to comment/approve on the RFI/RI Report, the Baseline Risk Assessment, the Corrective Measures Study/Feasibility Study, and the Statement of Basis/Proposed Plan.

State acceptance of previous documentation as listed above has been obtained. Also, State acceptance of the groundwater mixing zone application was required.

Community Acceptance - The community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment on the remedy selection process. A public comment period was held and public comments concerning the proposed remedy are addressed in the Responsiveness Summary of the Record of Decision.

No comments through the formal public comment period or through scoping with the CAB that would cause deviation from the selected remedy were provided.

Detailed Evaluation

The remedial action alternatives discussed in Sections VII.A and VII.B have been evaluated using the nine criteria just described. Tables 4 and 5 present a summary of the evaluation of the soil/vegetation and groundwater remedial alternatives.

Ix. **The Selected Remedy**

Based on the risks identified in the Baseline Risk Assessment, the OFASB unit soils pose a significant risk to human health. Significant carcinogenic risks to the potential future worker are driven by exposure from direct radiation from the basin soils contaminated with cesium-137 to a depth of 2 feet (~4,500 cubic yards) and effluent ditchline soils to a depth of 2 feet (~167 cubic yards). Groundwater monitoring data indicates that iodine-129, nitrate, strontium-90, and tritium exceed MCLs and uranium exceeds proposed MCLs. Although radium has been decreasing over time, it has exceeded MCLs and therefore, radium will be monitored.

The preferred alternative for the OFASB pipeline and pipeline soils 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 and access controls.

Based on characterization, risk evaluations, and a detailed analysis of retained alternatives (Tables 4 and 5) the preferred alternative for remediating the OFASB soils/vegetation is S3B: <u>*In Situ* Grout Soils to 2 Feet & Dispose of Vegetation Off Unit</u> which will eliminate direct radiation risk and potential future impacts to the groundwater. The preferred alternative for remediating the OFASB groundwater is GW3: <u>Groundwater Controls Using Alternate Concentration Limits/Mixing Zone</u> which will monitor existing groundwater constituents to assess impacts to potential receptors based on the approved groundwater mixing zone application (demonstration). This mixing zone alternative will meet remedial action objectives. MZCLs will be achieved throughout the groundwater aquifer and MCLs will be achieved at the compliance point as described in the approved groundwater mixing zone application.

The OFASB is located in an area which has been recommended for industrial use by the CAB and so designated by the U.S. DOE. Institutional controls at the OFASB Operable Unit will be consistent with recommendations made in the "Savannah River Site Future Use Report Stakeholder Recommendations for SRS Land and Facilities", January 1996 which include the recommendation that "residential uses of SRS land should be prohibited." Current and future institutional controls which will include access controls (e.g. fencing, security, land use restrictions, etc.) will ensure that these recommendations are maintained. Under this land use policy alternatives S3B and GW3 (which include institutional controls) will be protective of human health and the environment.

Due to the presence of buried waste material and planned groundwater monitoring controls, institutional controls have been chosen to augment the preferred alternative for the OFASB source control operable unit including the pipeline and pipeline soils. Implementation of institutional controls will require both short- and long-term actions. For the short-term, signs will be posted at the waste unit which indicate that this area was used for disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. Additionally, administrative controls such as site use and site clearance permits as well as access controls such as filling or grouting of pipeline manholes to prevent potential worker exposure will be employed.

In the long-term, if the property is ever transferred to non-federal ownership, the U. S. Government will create a deed for the new property owner which will contain information in compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments.

The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the property is ever transferred to non-federal ownership, a survey plat of the area would be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Along with the institutional controls identified above, implementation of the soils/vegetation alternative (S3B) will involve the **removal** of contaminated vegetation and off unit disposal followed. by the removal of contaminated soils in the effluent ditchline and placement in the basin, and *in situ* grouting the top 2 feet of contaminated soils in the basin (-4,500 cubic yards) and effluent ditchline soils (-167 cubic yards). An engineered cap (low permeability) would then be constructed over the basin area (Figure 3) to minimize surface infiltration and reduce the potential for contaminant migration. *In situ* grouting will follow placement of the ditchline soils (Figure 4). Grout application may involve soil mixing or tilling and mixing, however; the actual application method and stabilization admixture to be used in remediation will be specified in the remedial design

Along with the institutional controls identified above, implementation of the groundwater alternative (GW3) will involve the placement of compliance boundary monitoring wells between the basin and the down gradient stream and periodic monitoring of these compliance wells against the MCLS.. This alternative will meet remedial action objectives. MZCLs will be achieved throughout the groundwater aquifer and MCLS will be achieved at the compliance point as described in the approved groundwater mixing zone application. All monitoring, compliance, and reporting requirements . to satisfy the groundwater mixing zone demonstration should be met in accordance with Section 5 of the approved groundwater mixing zone application (WSRC-RP-97-39, Rev. 1).

Costs (capital, O&M, and total present worth) for the selected remedy for the soil/vegetation are

$1,300,000 (capital)
<u>$ 500,000 (O&M)</u>
$1,800,000 (total present worth)

and for the groundwater are

$ 200,000 (capital)
<u>$1.1 OO,OOO (O&M)</u>
$1,300,000 (total present worth).

Total present worth costs are estimated to be approximately $3,100,000 for both the soil/vegetation and groundwater media.

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

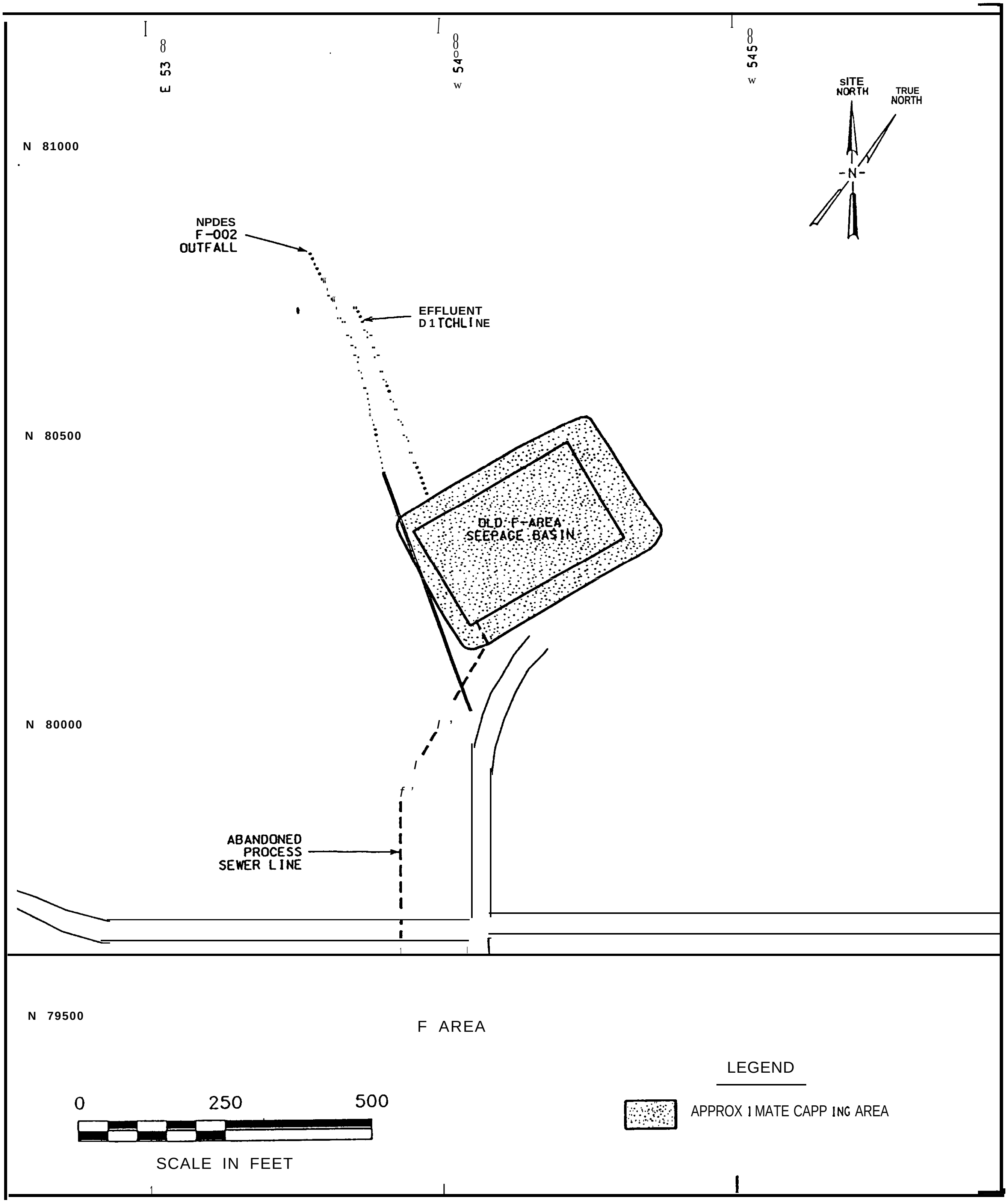


Figure 3. Approximate Capping' Area for the OFASB Preferred Alternative

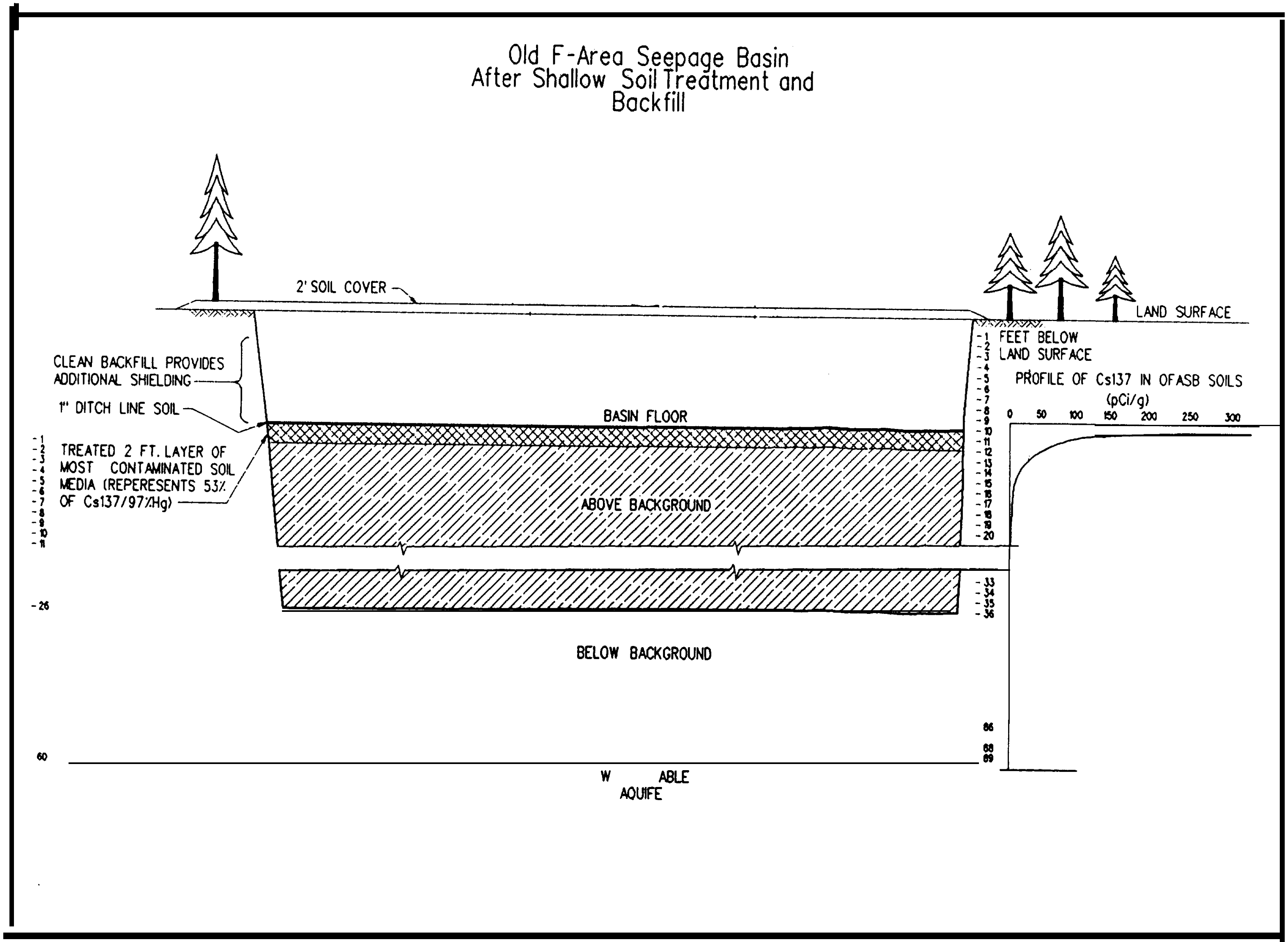


Figure 4. Conceptual Layout After Implementation of the Preferred Alternative

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation)

Criterion	OFASB Soil and Vegetation Remedial Alternatives			
	Alternative 1 (No Action)	Alternative 2 (Capping)	Alternative 3A (Insitu Grout to 2 ft/Incinerate Vegetation)	Alternative 3B (Insitu Grout to 2 W'Dispose Vegetation)
Overall Protectiveness				
Human Health	Protective as long as institutional controls are maintained	Protective	Protective	Protective
Environment	Not Protective	Protective	Protective	Protective
Compliance with ARARs				
Chemical-specific	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels
Location-specific	Not Applicable	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands
Action-specific	None	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation) (continued)

Criterion	OFASB Soil and Vegetation Remedial Alternatives			
	Alternative 1 (No Action)	Alternative 2 (Capping)	Alternative 3A (Insitu Grout to 2 ft/Incinerate Vegetation)	Alternative 3B (Insitu Grout to 2 ft/Dispose Vegetation)
Long-term effectiveness and Permanence				
Magnitude of residual risks	OFASB waste unit would be a continual source of contamination to the environment; residual risks would be very high, particularly in the absence of institutional controls.	Much reduced over current conditions, but failure of the cap could pose risks to groundwater, onsite workers, and others unless further action is taken.	Residual risks would be much lower than Alternative 2, but failure of the cap could pose risks to groundwater, onsite workers, and others unless further action is taken; vegetative debris would not pose significant risks.	Same as Alternative 3A.
Adequacy of controls	Existing institutional controls are effective for the protection of human health; but they can not be guaranteed for as long as the contamination poses a risk to human health	Existing and supplemental institutional controls would be effective, but they can not be guaranteed for as long as the contamination poses a risk to human health.	Existing and supplemental institutional controls would be effective and grouting of the most contaminated soils would limit risk to groundwater should the cap ever fail.	Same as Alternative 3A.
Reduction of Toxicity, Mobility or Volume				
Treatment type	No active treatment.	No active treatment.	Stabilization/ solidification of the most contaminated soils; incinerate vegetation.	Stabilization/ solidification of the most contaminated soils; no treatment of vegetation.
Reduction of toxicity, mobility or volume	None through treatment.	Capping would effectively reduce contaminant mobility as long as cap integrity is maintained; not a permanent reduction in contaminant mobility	Permanently reduces contaminant mobility in the most threatening soils; reduce contaminant mobility and volume in vegetation.	Permanently reduce contaminant mobility in the most threatening soils.

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation) (continued)

Criterion	OFASB Soil and vegetation Remedial Alternatives			
	Alternative 1 (No Action)	Alternate 2 (Capping)	Alternative 3A (In situ Grout to 2 ft/Incinerate Vegetation)	Alternative 3B (In situ Grout to 2 ft/Dispose Vegetation)
Short-term Effectiveness				
Risk to remedial workers	None; would involve no handling of contaminated media.	Minimal; volume of soils excavated: 130 m^3 (4.5 x $10^3 ft^3$; 1.6X $10^3 yd^3$); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3).	Low; volume of soils excavated and processed: 130 m^3 (4.5 x $10^3 ft^3$; 1.6x $10^3 yd^3$); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3)	Low; volume of soils excavated and processed: 130 m^3 (4.5 x $10^3 ft^3$; 1.6x $10^3 yd^3$); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3)
Risk to community	Negligible.	Minimal.	Very low; would revolve transport of vegetation to CIF in E Area.	Very low; would revolve transport of vegetation to off unit disposal facility.
Construction schedule	Immediately implementable.	6 months.	12 months.	12 months.
Implementability				
Potential concerns	Potential for public concern in no action is implemented.	None.	Possibility in delay of CIF startup scheduled for Jan. 1996.	None.
Relative implementability	Readily Implementable.	Readily Implementable, but would require much more effort than No Action.	Readily implementable after CIF startup; would require more effort than capping alone (Alt. 2).	Readily implementable; would require more effort than capping alone (Alt. 2), but slightly less effort than Alt. 3A.
Cost				
Basis for O&M costs	30 years.	30 years.	30 years.	30 years.
Present worth capital costs	$0	$800,000	$1,600,000	$1,300,000
present worth O&M costs	$280,000	$500,000	$500,000	$500,000
Total present worth" costs	$280,000	$1,300,000	$2,100,000	$1,800,000

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation) (continued)

Criterion	OFASB Soil and Vegetation Remedial Alternatives		
	Alternative 4A (Ex Situ Grout to 2 ft/Incinerate Vegetation)	Alternate 4B (Ex Situ Grout to 2 ft/Dispose Vegetation)	Alternative 5 (Dispose Soil to 2 W'Dispose Vegetation)
Overall Protectiveness			
Human Health	Protective	Protective	Protective
Environment	Protective	Protective	Protective
Compliance with ARARs			
Chemical-specific	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels
Location-specific	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands
Action-specific	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation) (continued)

Criterion	OFASB Soil and Vegetation Remedial Alternatives		
	Alternative 4A (Ex Situ Grout to 2 ft/Incinerate Vegetation)	Alternative 4B (Ex Situ Grout to 2 ft/Dispose Vegetation)	Alternative 5 (Dispose Soil to 2 ft/Dispose Vegetation)
Long-term effectiveness and Permanence			
Magnitude of residual risks	Residual risks would be lower than Alternatives 4A/B since treatment effectiveness would be confirmed; vegetative debris would not pose significant risks.	Same as Alternative 4A.	An estimated 53% of known Cs-137 and 97% of mercury in contaminated soil would be permanently removed; remaining Cs-137 and mercury would remain untreated and beneath cap.
Adequacy of controls	Existing and supplemental institutional controls would be effective; risk to groundwater would be very low should the cap ever fail.	Same as Alternative 4A.	Existing and supplemental institutional controls would be effective; removal of the most contaminated soils would limit risk to groundwater should the cap ever fail.
Reduction of Toxicity, Mobility or Volume			
Treatment type	Stabilization/ solidification of all contaminated soils required to protect groundwater; incinerate vegetation.	Stabilization/ solidification of all contaminated soils required to protect groundwater; disposal of vegetation	Incinerate vegetation.
Reduction of toxicity, mobility or volume	Permanently reduce contaminant mobility in contaminated soils requiring treatment; reduce contaminant mobility and volume in vegetation.	Permanently reduce contaminant mobility in contaminated soils requiring treatment;	Permanently reduce vegetative contamination mobility and volume.

Table 4. Comparative Analysis of Alternatives (Soil/Vegetation) (continued)

Criterion	OFASB Soil and Vegetation Remedial Alternatives		
	Alternative 4A (Ex situ Grout to 2 ft/Incinerate Vegetation)	Alternative 4B (Ex situ Grout to 2 ft/Dispose Vegetation)	Alternative 5 (Dispose Soil to 2 ft/Dispose Vegetation)
Short-term Effectiveness			
Risk to remedial workers	Minimal; volume of soils excavated: 130 m^3 (4.5 x 10^3 ft^3; 1.6 x 10^3 yd^3); volume of vegetat. processed 19 m^3 (660 ft^3; 24 yd^3).	Same as Alternative 4A.	High; volume of soils excavated: 3.6 x 10^3 m^3 (1.3 x 10^5 ft^3; 4.7 x 10^3 yd^3).
Risk to community	Very low; would involve transport of vegetation to CIF in E Area.	Very low; would involve transport of vegetation to Burial Grounds Debris Trenches in E Area.	Significant; assuming highway transport, Alt. 7A would involve approximately 313 round trips from SRS to Utah totaling 1.25 x 10^6 mi)
Construction schedule	<12 months.	<12 months	8 months.
Implementability			
Potential concerns	Possibility in delay of CIF startup scheduled for January 1996; need for specialized grouting equipment.	Need for some specialized grouting equipment.	Possibility in delay of CIF startup scheduled for January 1996; potential for public opposition due to waste transport concerns.
Relative implementability	Implementable after CIF startup; would require much more effort than grouting under Alternatives 3A/3B.	Implementable; would require slightly less effort than Alt. 4A for vegetation.	Readily implementable after CIF startup; would require a little more effort than ex-situ grouting under 4A/4B.
Cost			
Basis for O&M costs	30 years.	30 years.	30 years.
Present worth capital costs	$1,800,000	$1,400,000	$8,500,000
Present worth O&M costs	$500,000	$500,000	$500,000
Total present worth costs	$2,300,000	$1,900,000	$9,000,000

Table 5. Comparative Analysis of Alternatives (Groundwater)

Criterion	OFASB Groundwater Remedial Alternatives			
	Alternative GW-1 (No Action)	Alternative GW-2A (IX/RO)	Alternative GW-2B (IX)	Alternate GW-3 (ACL/MZ)
Overall Protectiveness				
human Health	Not Protective	Protective	Protective	Protective
Environment	Not Protective	Protective	Protective	Protective
Compliance with ARARs				
Chemical-specific	Does not meet SC Primary Drinking Water Regulations	Meets MCLs through hydraulic controls.	Meets MCLs through hydraulic controls.	Meets potential ACL/MZs thru monitoring
Location-specific	Not Applicable	None	None	None
Action-specific	None	Requires permits to reinject water into an aquifer.	Requires permits to reinject water into an aquifer.	Monitoring well permit.
Long-term effectiveness and Permanence				
Magnitude of residual risks	Groundwater would be a continual source for the migration of contaminants	Contaminants are removed or hydraulically contained.	Contaminants are removed or hydraulically contained.	Contaminants are monitored.
Adequacy of controls	Does not ensure unavailability of groundwater to receptors although it is unlikely.	Monitoring during processing must be maintained to ensure extraction wells are containing plume.	Monitoring during processing must be maintained to ensure extraction wells are containing plume.	Monitoring ensures contaminant levels do not impact potential receptor
Reduction of Toxicity, Mobility or Volume				
Treatment type	None.	IX and RO.	Dual IX.	None. Monitoring.
Reduction of TMV	None.	Reduces volume of contaminated media	Reduces volume of contaminated media	None. Potential impact to receptors initiates action.

Table 5. Comparative Analysis of Alternatives (Groundwater) (continued)

Criterion	OFASB Groundwater Remedial Alternatives			
	Alternative GW-1 (No Action)	Alternative GW-2A (IX/RO)	Alternative GW-2B (IX)	Alternative GW-3 (ACL/MZ)
Short-term Effectiveness				
Risk to remedial workers	Meets with existing institutional controls.	Minimal.	Minimal.	Minimal.
Risk to community	Negligible.	Negligible should residual waste be disposed at SRS.	Negligible should residual waste be disposed at SRS.	Negligible.
Const. schedule	Immediately implementable.	<12 months	12 months.	-1 month.
Implementability				
Potential concerns	Potential for public concern if implemented.	Special permits are required for reinfection of water into the aquifer since it would still contain tritium.	Special permits are required for reinfection of water into the aquifer since it would still contain tritium.	Special permits are required to establish ACL/MZs and well installation,
Relative implementability	Readily implementable.	Implementable.	Implementable.	Readily implementable.
Cost				
O&M cost basis	30 years.	30 years.	30 years.	30 years.
Present worth capital costs	$0	$8,800,000*	$8,000,000”	$200,000
Present worth O&M costs	$280,000	$9,000,000	$5,200,000	$1,100,000
Total present worth costs	$280,000	$17,800,000*	$13,200,000”	$1,300,000

* Assumes Saltstone disposal of waste.

X. Statutory Determinations

Based on the OFASB RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment, the OFASB poses no significant risk to the environment but poses significant risk to human health. Therefore, treatment and capping is necessary for the OFASB soils (basin and ditchline), institutional controls are necessary for the OFASB pipeline and pipeline soils, and monitoring of the existing groundwater constituents (based on the groundwater mixing zone application) to assess impacts to potential receptors for OFASB groundwater. The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The size and location of the waste unit and the levels of the contaminants preclude a remedy in which contaminants could be excavated and treated effectively.

In situ grouting/capping and the groundwater mixing zone application provide for a significant reduction in the risks associated with direct radiation, potential future impacts to the groundwater, and groundwater ingestion. Through implementation of the selected remedy all ARARs will have been complied with through use of treatment technologies on the soils, removal and off unit disposal of the vegetation, and application of the groundwater mixing zone. Since the soil is grouted below grade, long term weathering and the potential for leaching of contaminants is minimized. Worker and public safety is maximized through minimizing handling of contaminated media. This selected remedy provides the most cost effective option considering the OFASB is located in an identified industrial zone.

This remedy utilizes permanent solutions and alternative treatment technologies and satisfies the statutory preference for remedies that employ treatment (in situ grouting) that reduces toxicity, mobility, or volume as a principal element.

XI. Explanation of Significant Changes

The Statement of Basis/Proposed Plan and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period. Comments that were received during the 45-day public comment period are addressed in Appendix A of this Record of Decision and are available with the final RCRA permit.

There were no significant changes to the selected remedy as a result of public comments. Approval of the groundwater mixing zone application was accelerated in order to obtain approval of the groundwater mixing zone application prior to approval of this Record of Decision. This groundwater mixing zone application demonstrates the appropriateness of aquifer restoration through passive remedial action.

In selecting the remedy in this Record of Decision, a Savannah River Site bulk disposal alternative was not evaluated in the feasibility study but is currently being developed and evaluated for radiologically contaminated soils/debris as a soils consolidation facility (SCF).

Should the SCF concept become a Savannah River Site remedial option for radiologically contaminated soils prior to implementation of the selected OFASB remedy, then the bulk disposal SCF alternative will be evaluated for the OFASB. This evaluation will fully consider the nine criteria established by the NCP in determining if the SCF alternative is an appropriate remedy for the OFASB and if the

SCF remedy is determined appropriate for the OFASB, the change in remedy will cause no significant loss of monetary resources.

Should use of the SCF concept be deemed appropriate at the OFASB, this Record of Decision would require modification.

XII. Responsiveness Summary

There were ten comments received during the public comment period. The Responsiveness Summary (see Appendix A) of this Record of Decision addresses these comments.

XIII. Post-ROD Document Schedule

The post-ROD document schedule is listed below and is illustrated in Figure 5.

Soil/Groundwater

1. Corrective Measure/Remedial Design Workplan (CM/RDW) Revision O for the OFASB will be submitted for EPA and SCDHEC review 86 calendar days after issuance of the ROD.
2. EPA and SCDHEC review of the OFASB CM/RDW Revision O will last 45 calendar days.
3. SRS revision of the OFASB CM/RDW will be completed 30 calendar days after receipt of all regulatory comments.
4. EPA and SCDHEC final review and approval of the OFASB CM/RDW Revision 1 will last 30 calendar days.
5. Remedial Design Report/Remedial Action Workplan (RDR/RAWP) Revision O for the OFASB will be submitted 266 calendar days after issuance of the ROD.
6. EPA and SCDHEC review of the OFASB RDR/RDWP Revision O will last 90 calendar days.
7. SRS revision of the OFASB RDR/RAWP will be completed 60 calendar days after receipt of all regulatory comments
8. EPA and SCDHEC final review and approval of the OFASB. RDR/RAWP Revision 1 will last 30 calendar days.
9. OFASB Remedial Action Start on the soils and groundwater will begin following EPA and SCDHEC approval of the RDR/RAWP.
10. OFASB Post Construction Report (PCR) Revision O will be submitted to EPA and SCDHEC 83 calendar days after completion of the remedial action.
11. EPA and SCDHEC review of the OFASB PCR will last 90 calendar days.
12. SRS revision of the OFASB PCR will be completed 60 calendar days after receipt of all regulatory comments.
13. EPA and SCDHEC final review and approval of the Revision 1 PCR will last 30 calendar days.

Vegetation

1. OFASB Vegetation Remedial Action Start will begin within 15 months after issuance of the ROD.

All vegetation within the basin and ditch line areas are considered impacted by contaminant uptake and will be removed. Vegetation sampling and analysis will be performed to characterize the vegetation as a waste to identify appropriate treatment options Removal of contaminated trees will include removal of roots and all trees will be treated off-unit. Vegetation removal will be performed in a manner so as to minimize land disturbance and therefore the potential for soil erosion. All land disturbances will be addressed in an approved soil erosion control plan which will minimize, to the extent possible, the potential for release of contaminated soil to the surrounding areas.

Contaminated vegetation will be cut, sectioned, and packaged for transport at the waste unit. Appropriate procedures will be used to ensure radiation exposure during all operations is as low as reasonably achievable (ALARA). If necessary, wind breaks and radiological huts will be employed to reduce the risk from wind blown contamination. In addition, site procedures do not allow activity in contamination areas when wind velocity reaches 10 miles per hour. Handling of trees and larger vegetation will be performed remotely, whenever possible, which may include the use of cranes or other mechanical equipment used in the logging industry.

Treatment of contaminated vegetation will not be implemented at the waste unit. It is anticipated that contaminated vegetation will be disposed at an off unit facility. Off site shipment and treatment of contaminated vegetation will comply with the "offsite rule" under CERCLA. After completion of the final remedial action, including remediation of the basin soils, a Post Construction Report will be submitted which will include the volume and disposition of all vegetation removed from the unit.

XIV. References

DOE (U.S. Department of Energy), 1994. *Public Involvement, A Plan for Savannah River Site.* Savannah River Operations Office, Aiken South Carolina.

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. *Baseline Risk Assessment for the Old F-Area Seepage Basin (U).* WSRC-RP-94-1 *174,* Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (1995a).

WSRC, 1995b. *Data Summary Report for the Old F-Area Seepage Basin (U). WSRC-RP-94-943,* Rev. O, Westinghouse Savannah River Company, Aiken, South Carolina (1995b).

WSRC, 1995c. *RFI/RI Report for the Old F-Area Seepage Basin (U). WSRC-RP-94-942,* Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (1995 c).

WSRC, 1996a. *Corrective Measures Study/Feasibility Study for the Old F-Area Seepage Basin (U).* WSRC-RP-95-385, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (1996).

WSRC, 1996b. *Statement of Basis/Proposed Plan for the Old F-Area Seepage Basin (904-49G) (u),* WSRC-RP-95-1557, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina.

ACTIVITY DESCRIPTION	ORIG DUR
RECORD OF DECISION	
… ANCE	0
CORRECTIVE MEASURE/REMEDIAL DESIGN WORKPLAN	
DEVELOP CM/RD WORKPLAN	86
SRS SUBMITTAL OF REV 0 CM/RDWP	0
… REVIEW	-
SRS INCORPORATE EPA/SCHDEC COMMENTS	30
SRS SUBMITTAL OF REV.1 CM/RDWP	0
EPS/SCHDEC FINAL REVIEW & APPROVAL	30
EPA/SCDHEC APPROVAL	0
REMEDIAL DESIGN REPORT/REMEDIAL … CTION WORKPLAN	
… RA WORKPLAN	162
SRS SUBMITTAL OF REV.0 CM/RDR/RA	0
EPA/SCDHEC REVIEW	90
SRS INCORPORATE EPA/SCHDEC COMMENTS	60
SRS SUBMITTAL OF REV.1 CM/RDR/RA	0
EPS/SCHDEC FINAL REVIEW & APPROVAL	30
EPA/SCDHEC APPROVAL	0
CONSTRUCTION ACTIVITIES	
CONSTRUCTION START VEGETATION REMOVAL	0
CONSTRUCTION START COVER/GWMZ	-
CONSTRUCTION COMPLETE	0
POST CONSTRUCTION REPORT/FINAL REMEDIATION PLAN	
DEVELOP POST CONSTRUCTION REPORT	83
SRS SUBMITTAL OF REV.0 POST CONSTRUCTION REPORT	0
EPA/SCDHEC REVIEW	90
SRS INCORPORATE EPA/SCHDEC COMMENTS	60
SRS SUBMITTAL OF REV.1 POST CONSTRUCTION REPORT	0
EPS/SCHDEC FINAL REVIEW & APPROVAL	30
EPA/SCDHEC APPROVAL	0

MONTHS: 1 2 3 4 5 6 7 … 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Plot Date 25FEB97
Data Date 31MAR97
Project Start 31MAR97
Project Finish 30AUG99

Critical Activity
Progress Bar
Milestone/Flag Activity

ENVIRONMENTAL RESTORATION
OLD F-AREA SEEPAGE BASIN
POST-ROD IMPLEMENTATION SCHEDULE

Sheet 1 of

REVISION 0

Date	Revision	Checked	Approved

APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for *the Statement of Basis/proposed Plan for Old F-Area Seepage Basin (904-49G)* began on September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15, 1996. Specific comments and responses are found below. The comments are italicized and the responses are bolded.

Public Comments

Comment 1: *Scenario for Current Land Use-Direct Radiation*

It appears that the occupancy factor for the visitor is too high. The Exposure Frequency (events/year) and Exposure Duration (years) are probably unrealistically conservative. If realistic values were used then the risk value would probably be less than 1. 0E-06. In that event, this scenario would drop from the list of significant risks. The other part of the equation that drives the risk value upward is the use of the highest detectable value (Tables 3- I 1 through 3-20) in the calculation of risk. Again this unrealistically conservative, driving the conclusion toward taking action when none may be warranted.

Response 1: **We believe the occupancy factor for the current on-unit visitor, which is defined as an SRS researcher/sampler, is reasonable. The researcher/sampler is only exposed for 6 days per year for 5 years, which is a reasonable estimate for an SREL worker or ER sampler performing environmental studies at the OFASB. The EPA standard default worker occupancy factors are 250 days per year for 25 years.**

The "use of the highest detectable value in the calculation of risk" is done according to EPA and SCDHEC guidance. The regulatory guidance is that we calculate a 9570 Upper Confidence Limit (95% UCL) on the average detected value and compare the 957i0 UCL or the maximum detected value, whichever is lower. The lower of the two values is selected as the "Reasonable Maximum Exposure" concentration. The 95% UCL can actually exceed the maximum detected value if there is a small sample size, or if there is great variation in detected values, which will result in using the maximum detect since it is the lower value.

Comment 2: *Scenario for Future Land Use-Noncarcinogenic Hazards*

In the general use of the highest detectable value in calculating the risk is not justified; a more realistic risk should be calculated.

The ingestion of groundwater (adult and child) scenarios list several nonradioactive inorganic analytes that derive the Hazard Index above unity. These include manganese, arsenic, lead, and nitrate. The Plan describes that inorganic analytes are compared to their appropriate background levels and are to be eliminated if their maximum detected concentration onsite is less than twice *their mean background concentration. The comparison of the maximum detected concentration to the mean detected concentration is like comparing apples and oranges. The comparison should be of the mean detected concentration to the mean background concentration to avoid incorrectly identifying an analyte with high variability in the environment as being of concern. If the range of background samples was compared to the range of basin samples, one could find that the maximum background sample would be in excess of the basin sample.*

The identification of manganese as a chemical of concern is not supported by the record of discharges to the basin. Arsenic is identified elsewhere as a legacy of the farming activities in the area (components of arsenic were used as pesticides). If these were detected from the risk analysis, then the only child pathway for Aquifer Unit IIB remains above a HI of 1.0.

Given that residential use of this land is not recommended by the Citizens Advisory Board, then this pathway does not constitute a risk worth remediating. A similar justification is applicable to the "ingestion of basin soil and homegrown vegetable (mercury)" pathways.

Response 2: **The maximum detected value becomes the Reasonable Maximum Exposure (RME) point concentration if it is lower than the 95UCL (see response #1 above). Use of the current data screening protocol could possibly eliminate naturally-occurring inorganic constituents, such as manganese, arsenic, and lead. Nitrates are related to SRS processes and would not be eliminated.**

The second point about ingestion of groundwater using maximum detected values to derive an HI above unity and the use of 2X background comparison was covered in the response to comment #1 above. Current regulatory guidance prescribes the use of background comparisons.

As stated above (response #l), manganese and arsenic are likely to be naturally-occurring, but they passed through the Contaminant Of Potential Concern (COPC) screening process as applied in 1994 when this Baseline Risk Assessment (BRA) was prepared. The new RCRA Facility Investigation/Remedial Investigation(RFI/RI)/BRA Scoping Process that is now being developed will allow for use of an uncertainty analysis to consider natural abundance, anthropogenic sources, and likely future land uses in considering the application of any COPC in the risk assessment process.

The use of the RFI/RI/BRA Scoping Process would allow SRS to potentially screen out future residential land use in areas that are designated for future industrial or nuclear industrial uses. However, for this waste unit, use of this screening protocol would not change the conclusion on the appropriate remedy.

Comment 3: *Future Use Scenarios-Ingestion of Groundwater-Radioactivity/Beryllium*

The ingestion of groundwater by future residents lists potassium-40 as the major contributor of risk (8270 of the total risk). Potassium-40 occurs naturally and is not a contaminant added by the operations of the Savannah River Site. The screening criteria for potassium-40 must be flawed (too low). Potassium should not appear in any of the risk calculations. Additionally, lead-212 and radium-226 occur naturally; however, they may also be contributed from SRS activities. Comparison to a valid set of background samples and use of appropriate comparison values (not maximum sample concentration to average background concentration) should reveal whether their presence is due to SRS activities. Strontium-90 could be present due to either fallout or SRS activities.

However, given that residential use is not recommended the risk does not justify cleanup actions.

The presence of beryllium in the on-unit worker scenario is puzzling. To my knowledge beryllium was not a component of the materials discharged to the basin.

Response 3: **The K-40, which is naturally-occurring, could possibly be eliminated using the current COPC screening process or the RFI/RI/BRA Scoping Process that is being developed. See background comparison responses above (response #1 and #2). Beryllium is a naturally-occurring metal that occasionally shows up at SRS waste units. However, for this waste unit, use of this screening protocol would not change the conclusion on the appropriate remedy.**

Comment 4: *Future Use Scenario-Inhalation of Soil-Radioactivity*

Worker occupancy factors are probably too high, residential use is not recommended by the CAB, risk could be eliminated with a covering (2 feet of clean soil).

Response 4: **The Future Industrial Worker scenario is the standard default exposure scenario. The 250 days per year exposure over 25 years is a suggested default assumption in EPA guidance. SRS, EPA, and SCDHEC agreed to use the standard worker scenario in all SRS Baseline Risk Assessments. Other worker exposures, such as the researcher/sampler scenario, are also evaluated in BRAs. The result of the inhalation of soil (radioactivity) pathway results actually helps the risk manager decide that an action to limit that exposure is warranted, such as the application of a 2 ft. layer of clean soil over the closed basin. Although the residential scenario was not selected as the preferred land use, additional action (grouting and a low permeability cap) is required to protect the groundwater aquifer from future impacts from the radiologically contaminated soils present at this waste unit.**

Comment 5: *Future Use Scenario-Ingestion of Soil/Vegetables-Radioactivity*

A covering of clean soil would eliminate the worker pathway, residential use is not recommend by the CAB.

Response 5: **Shielding through use of 2 to 3 feet of soil is effective in eliminating the direct radiation exposure hazards associated with the worker. Although the residential scenario was not selected as the preferred hind use, additional action (grouting and a low permeability cap) is required to protect the groundwater aquifer from future impacts from the radiologically contaminated soils present at this waste unit.**

Comment 6: *Recommendation*

The most cost-effective approach would be to excavate the ditchline soils to a depth of 2 feet and place the soil in the basin; remove the vegetation growing in the ditch and basin, chip and place in the basin; place clean soil in the ditch and basin; then grade to minimize erosion, apply topsoil and plant ground cover to control erosion.

Response 6: **Grouting of the top layer of contaminated soils at this waste unit eliminates the need for a more protective cap (*i.e.* with grouting a cap with only a 1OE-5 cm/sec hydraulic conductivity is required to protect the groundwater verses the requirement of a 1OE-6 cm/sec hydraulic conductivity cap without grouting). Grouting is also more permanent since the solidified soil would not be exposed to weathering and requires no long-term maintenance. Also, with the use of a 1OE-5 cm/sec cap, maintenance is easier and less costly (primarily due to the availability of 1OE-5 cm/sec soil at SRS).**

Capping the vegetation was evaluated in the Corrective Measures Study/Feasibility Study for this waste unit. Since grouting is the primary treatment only a 1OE-5 cm/sec cap is needed. Also, extra handling and storage of the vegetation would be required while the grouting process is being conducted causing increased costs and environmental management concerns. The grouting process is expected to take several months to complete.

Ditchline soils are planned to be moved into the basin and clean soil in the ditch and basin are planned to return the ditch to natural grade and to provide shielding to workers in the basin. The cap will be constructed to promote surface water runoff and a vegetative cover will be prepared to provided added evapotranspiration benefits in minimizing infiltration of surface water into the basin area.

Public Meeting Comments

The following comments were taken from the October 15, 1996 OFASB Public Meeting transcript.

Comment 7: *Why isn 't the proposed soils consolidation facility being considered to permanently take care of the situation with the limited depth of contamination since with the soils consolidation facility would not have to permanently take care of the waste unit or maintain the cap or soil cover after excavation and transportation to the soils consolidation facility? (paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit)*

Response 7: **This waste unit consists of soil contamination to a depth of about 26 feet below the basin bottom. Therefore, there is a significant quantity of soil that may require excavation and transport to the pm-conceptual soil consolidation facility (-58,000 cubic yards in place volume).**

The Corrective Measures Study/Feasibility Study considered a number and range of alternatives for remediation of the source unit. However, the soil consolidation facility has been considered for this waste unit in the Proposed Plan but without a site, design, or available capacity at the present time or short term is not considered feasible at this time. (The use of a soils consolidation facility would not necessarily provide additional protectiveness to human health or the environment.) The selected remedy identified in this ROD meets the requirements under CERCLA and the NCP. Therefore, it was determined that if this soil consolidation facility comes on line and that the soils from this waste unit are acceptable to this soil consolidation facility, then; the action at this waste unit may be reevaluated to consider the soil consolidation facility.

Comment 8: *What kind of risk modeling and prioritization based on the associated risks have been studied and reviewed for this waste unit? (paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit)*

Response 8: **The groundwater at this waste unit has been contaminated from the basin operations. Modeling was performed to determine if current contaminant concentrations in the basin and ditchline soils serve as a continuing source to groundwater contamination above primary environmental standards. This modeling identified that contaminant concentration in the top two feet of the basin and ditchline soils could cause future impacts to the groundwater aquifer. This is the primary basis for treating this soil layer using stabilization/solidification techniques.**

Comment 9: *The risk has been identified as a risk to the workers that are going to be working in the vicinity of that area (the waste unit). Just how significant is the risk in terms of radiation exposure to the workers that are close to those areas? And how do you compare that risk which is probably quite small, to the risk that will be essentially taken by the workers that will go in to do the remediation of this site? Heavy equipment disturbing contaminated soil, getting radiation exposure, those activities, how do you balance the two to say it would probably be better to just push clean dirt over the top of it and not disturb the soil, not to do anything that does that? Because apparently it's not a risk to the public sector, it's only a risk to the worker, as opposed to actually going in and actively doing things to disturb the soil, to do the grouting in place, and those type of activities, how does the other side of the equation get weighed in when you make a decision that this is an area that we need to go and remediate ? (from the public meeting transcript during the formal comment period for this waste unit)*

Response 9: **Existing institutional controls in the area of this waste unit prevent access and therefore radiation exposure to workers in the vicinity of this waste unit. No risks are identified for the current worker based on a visitor/sampler scenario (see response 1). The future industrial worker risks are significant based on the EPA standard default scenario (see response 4). These risks along with the risks to the remediation worker are evaluated qualitatively in the detailed analysis of alternatives, specifically the short term effectiveness criteria, It is this evaluation that drives the preference of in situ treatment technologies over ex situ treatment technologies.**

The selected remedy identifies a minimal amount of movement of contaminated soil (-167 cubic yards from the ditchline to be placed in the basin). Following placement of the ditchline soils in the bottom of the basin a layer of clean soil will be placed over the contaminated soil to provide shielding from radioactive contaminants. After the clean soil is placed (-3 feet) the top 2 foot layer of contaminated basin soil and the ditchline soil will be grouted followed by backfilling the basin to grade and placement of a low permeability cap over the basin area.

comment 10: *Mike Rourak: My name is Mike Rourak and my question is directed directly to Mr. Brian Hennessey's earlier discussion [unintelligible] Silverton Road property, for example. In the Future Use Manual that was sent out to some of us about the disposal of close to a million acres of property for DOE, in your deed restrictions there're things that we cannot do. And we're going to need a little bit before we can respond back 10 Washington. Those of us who received the manual, we almost are going to need to know what those deed restrictions are because if we cannot have a subdivision then there's no need to bid the price accordingly or say that's what we want to use it for. If we cannot graze cattle there like we do in Tennessee at [unintelligible] or-something or grow crops because we cannot put a well in for contamination, then we are left with only looking at it for the pine trees.*

So being federal, you own this property. Even with deed restrictions you 've got to give us either a Phase I, II, or III audit. In this case, it's the seller who has to provide this liability, not necessarily the buyer's neglect of liability to due diligence. So it would really help if we knew what deed restrictions would be there to a more extent and also what we can use the land for. If I want to use it for applying 50--- under the Code of Federal Regulations 503, if I want to use it for bio solid disposal, can I do so? Because it's adjacent to your other property. So the deed restrictions that you brought up were of immense concern about responding back to the future use and the disposal of roughly 849,000 acres nationwide for – to be "put back into – I understand from Washington, they would like to put it back mainly into public use to get the taxes off of it. Maybe not so much for the government, but for the local entities who lose the tax base. Thank you. (from the public meeting transcript)

Response 10: The SRS Future Use Project Report was distributed to inform citizens of the planned future uses of SRS. The recommendations that were presented in the report may change over time and will be discussed with the stakeholders. Deed restrictions for federal property are not determined until the land is transferred to non-federal control. At the time of property transfer, the need for deed restrictions will be evaluated. Due to natural attenuation, decay, etc., the conditions at specific areas may not warrant any deed restrictions. All legal requirements will be met at the time of property transfer.