United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
M Area Operable Unit (MAOU) (U)

CERCLIS Number: 92

WSRC-RP-2008-4030

Revision 1

November 2008

Prepared by:
Savannah River Nuclear Solutions, LLC
Savannah River Site
Aiken, SC 29808

Prepared for U.S. Department of Energy under Contract No. DE-AC09-08SR22470

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

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

M Area Operable Unit (MAOU)

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 92

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy

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

The FFA is a legally binding agreement between regulatory agencies (United States Environmental Protection Agency [USEPA] and South Carolina Department of Health and Environmental Control [SCDHEC]) and regulated entities (United States Department of Energy [USDOE]) that establishes the responsibilities and schedules for the comprehensive remediation of SRS. The media associated with this operable unit (OU) is subsurface vadose zone soils contaminated with volatile organic compounds (VOCs).

Statement of Basis and Purpose

This decision document presents the selected remedy for the MAOU located in M Area at the SRS near Aiken, South Carolina. The remedy was chosen in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this site.

The USEPA, SCDHEC and USDOE concur with the selected remedy.

Assessment of the Site

There has been a release of VOCs (i.e., tetrachloroethylene [PCE] and trichloroethylene [TCE]) at the MAOU into the environment. The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

The selected remedy for the MAOU is Passive Soil Vapor Extraction (SVE) and Institutional Controls (ICs). This alternative has been selected because it effectively removes VOCs from the vadose zone and protects the groundwater by depleting the source. Although SVE system air emissions may require treatment, this system will not generate a sufficient mass/concentration each day to require treatment. BaroBall™ low energy SVE technology will be deployed to complete the remediation. ICs will be used to limit access to the area. ICs will also include grouting of the manholes for access control.

The following Land Use Control (LUC) objectives are necessary to ensure protectiveness of the selected remedy:

- restrict worker access and prevent unauthorized contact, removal or excavation of contaminated media
- prevent access through manholes and pipelines
- prohibit the development and use of property for residential housing, elementary schools, child care facilities and playgrounds
- maintain the integrity of any current or future remedial or monitoring system such as SVE systems or groundwater monitoring wells

- prevent access to or use of the groundwater until cleanup levels are met (under the RCRA program)

The selected alternative satisfies the statutory requirements in CERCLA Section 121(b) to (1) be protective of human health and the environment, (2) comply with applicable or relevant and appropriate requirements (ARARs), (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected alternative satisfies the preference for treatment as a principal element of the remedy.

The RCRA permit will be revised to reflect selection of the final remedy using the procedures under 40 of Code of Federal Regulations (CFR) Part 270, and South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.264.101; 270.

Statutory Determinations

Based on the RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment (RFI/RI/BRA) report, the MAOU poses a threat to human health and the environment. PCE and TCE are present in the MAOU vadose zone and constitute a contaminant migration and principal threat source material (PTSM) threat. Therefore, Alternative A-4, Passive Soil Vapor Extraction with Institutional Controls, has been selected as the remedy for the MAOU. The MAOU is located in an area of historically heavy industrial and nuclear land use, and future industrial land use is anticipated.

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

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and

alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

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

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

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

The selected remedy for the MAOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. The hazardous substances left in place could pose a risk if the waste is disturbed. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control and Assurance Plan (LUCAP) to ensure that the LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific Land Use Control Implementation Plan (LUCIP) incorporated by reference into this ROD will provide details and

specific measures required to implement and maintain the LUCs selected as part of this remedy. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the Corrective Measures Implementation (CMI)/Remedial Action Implementation Plan (RAIP) as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved by the USEPA and SCDHEC as needed to be protective of human health and the environment. LUCIP modification will only occur through another CERCLA document.

Data Certification Checklist

This ROD provides the following information:

- Constituents of concern (COCs) and their respective concentrations (Section V)
- Baseline risk represented by the COCs (Section VII)
- Cleanup levels established for the COCs and the basis for the levels (Section VIII)
- Current and reasonably anticipated future land and groundwater use assumptions used in the BRA and ROD (Section VI)
- Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section VI)
- Estimated capital, operation and maintenance, and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected (Section IX)
- Key decision factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria) (Section X)

- How source materials constituting principal threats are addressed (Section IV, Section XI)

12/18/08
Date

Karen C. Guevara
Assistant Manager for Closure Project
U. S. Department of Energy
Savannah River Operations Office

1/21/09
Date

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Director
Superfund Division
U. S. Environmental Protection Agency – Region 4

1/23/09
Date

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Bureau Chief
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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

M Area Operable Unit (MAOU) (U)

CERCLIS Number: 92

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Savannah River Site
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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulation
CM	contaminant migration
CM COC	contaminant migration constituent of concern
CM RCOC	contaminant migration refined constituent of concern
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	constituent of concern
CSM	conceptual site model
D&D	deactivation and decommissioning
DUS	dynamic underground stripping
EE/CA	engineering evaluation/cost analysis
ESD	explanation of significant difference
FDE	Facilities Decommissioning Evaluation
FFA	Federal Facility Agreement
FS	feasibility study
ft	feet
ft^2	square foot
HBL	health-based limit
HH	human health
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
HWMF	H-Area Waste Management Facility
IC	institutional control
IDW	investigation-derived waste
IOU	integrated operable unit
IPSL	inactive process sewer line
JCW	job control waste
LETF	Liquid Effluent Treatment Facility
LLC	Limited Liability Company
LUC	Land Use Controls
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
m^2	square meter
m^3	cubic meter
MAOU	M Area Operable Unit
MDL	minimum detection levels
MIPSL	M-Area Inactive Process Sewer Line
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ACRONYMS AND ABBREVIATIONS *(Continued)*

NEPA	National Environmental Protection Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	operable unit
O&M	operations and maintenance
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pCi/g	picocurie per gram
PPE	personal protection equipment
PRG	preliminary remedial goal
PTSM	principal threat source material
RAIP	Remedial Action Implementation Plan
RAO	remedial action objective
RBC	risk-based criteria
RCO	radiological control operations
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RSER	Removal Site Evaluation Report
SARA	Superfund Amendments Reauthorization Act
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SE	Site Evaluation
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SVE	soil vapor extraction
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethylene
TCLP	toxic characteristic leaching procedure
USDOD	United States Department of Defense
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC	Washington Savannah River Company, LLC

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

Unit Name, Location, and Brief Description

M Area Operable Unit (MAOU)

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU- 92

Savannah River Site

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

Aiken, South Carolina

United States Department of Energy (USDOE)

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

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

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the M Area Operable Unit (MAOU) as a Resource Conservation and Recovery Act (RCRA) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit requiring further evaluation.

The MAOU was evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

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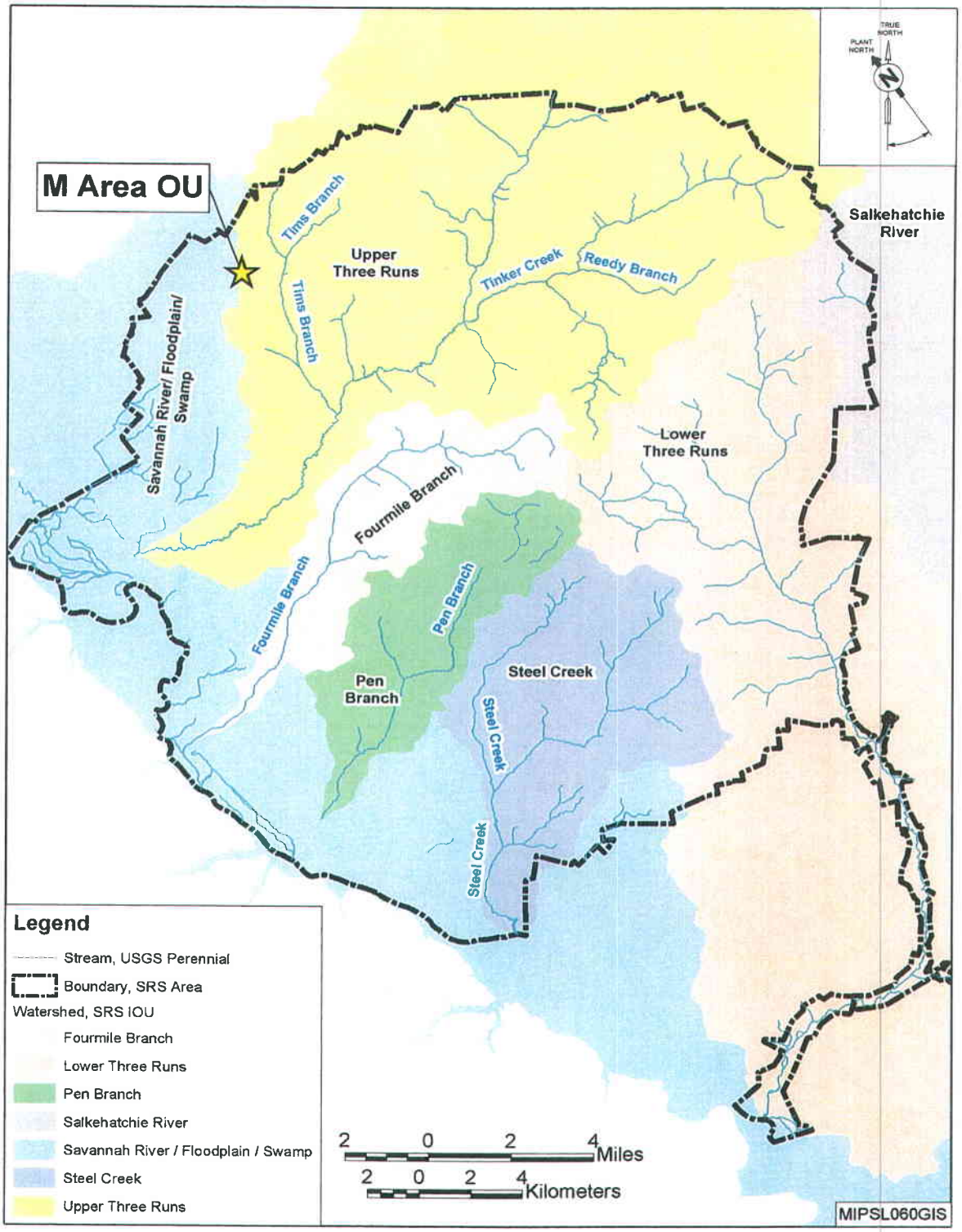

Figure 1. Location of the MAOU within the Savannah River Site

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II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational and Compliance History

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

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

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

Operable Unit Operational and Compliance History

SRS produced special nuclear materials for the United States Department of Defense (USDOD) since 1952. An important step in the production cycle was the manufacture of fuel and target assemblies in M Area for the nuclear reactors. M Area consisted of three major production buildings (313-M, 320-M, and 321-M) that began operation in the early 1950s and continued operation at various production levels until the early 1990s. In addition to the production facilities, three production support facilities (322-M, 324-M, and 340-M) were also located in this area. Southern portions of the MAOU were used as salvage yards (740-A, 743-A, and 741-A). The Liquid Effluent Treatment Facility (LETF) (341-M, 341-1M, and 341-8M) is located southwest of the Production Area. The Test Reactor Area is east of the LETF in the southern portion of the MAOU and housed two buildings (305-A and 777-10A) to determine appropriate properties of fuel element and target assemblies. There were also warehouses (330-M and 331-M) used to store slugs of depleted uranium. Several miscellaneous facilities and electrical transformers are also a part of this operable unit (OU). Most of these facilities had a history of managing radioactive material.

The manufacturing processes in the M Area consumed a large quantity of industrial cleaning solvents and water, and early practices were to discharge the spent solvents and water directly into the environment. Of the reported 3.5-million pounds of solvents discharged, approximately 2-million pounds was discarded to the M-Area Settling Basin, located south of M Area, via a process sewer line. This resulted in volatile organic compound (VOC) and radionuclide contamination at the M-Area Settling Basin and process sewer lines. The basin was closed with the installation of a protective cap in 1991 as required by the RCRA Closure Plan. The portion of the process sewer line outside of the former M-Area fence leading to the basin was removed and placed in the basin as part of this closure.

The MAOU is located in the northwest portion of SRS and covers approximately 45 acres. For evaluation purposes, the MAOU was divided into four distinct areas based on

the historical operations at the unit. These areas are the Production Area, the LETF, Test Reactor Facilities, and the Salvage Area.

The following investigation areas of the MAOU are depicted on Figure 2 and include Site Evaluation (SE) units and facilities that have been combined based on physical location and common problems warranting action:

- Production Area: 313-M, 321-M (including Underground Sumps #001 and #002), 320-M, 322-M, 340-M, and 324-M (including the northern portions of the M-Area Inactive Process Sewer Line [MIPSL] and associated feeder lines)
- LETF: 341-M, 341-1M, and 341-8M
- Test Reactor Facilities: 305-A and 777-10A
- Salvage Area: 740-A, 743-A, and 741-A
- Warehouses: 330-M and 331-M

The northernmost portion of the MAOU contains the Production Area, which has the earliest history of use. Fuel and target assemblies were produced in this area between 1952 and 1988.

The following major facilities were used in this capacity:

- Building 313-M – Used for the production of uranium slugs for reactor target assemblies
- Building 320-M – Used to produce the lithium-aluminum tubes for the target assemblies
- Building 321-M – Used for the production of reactor fuel assemblies

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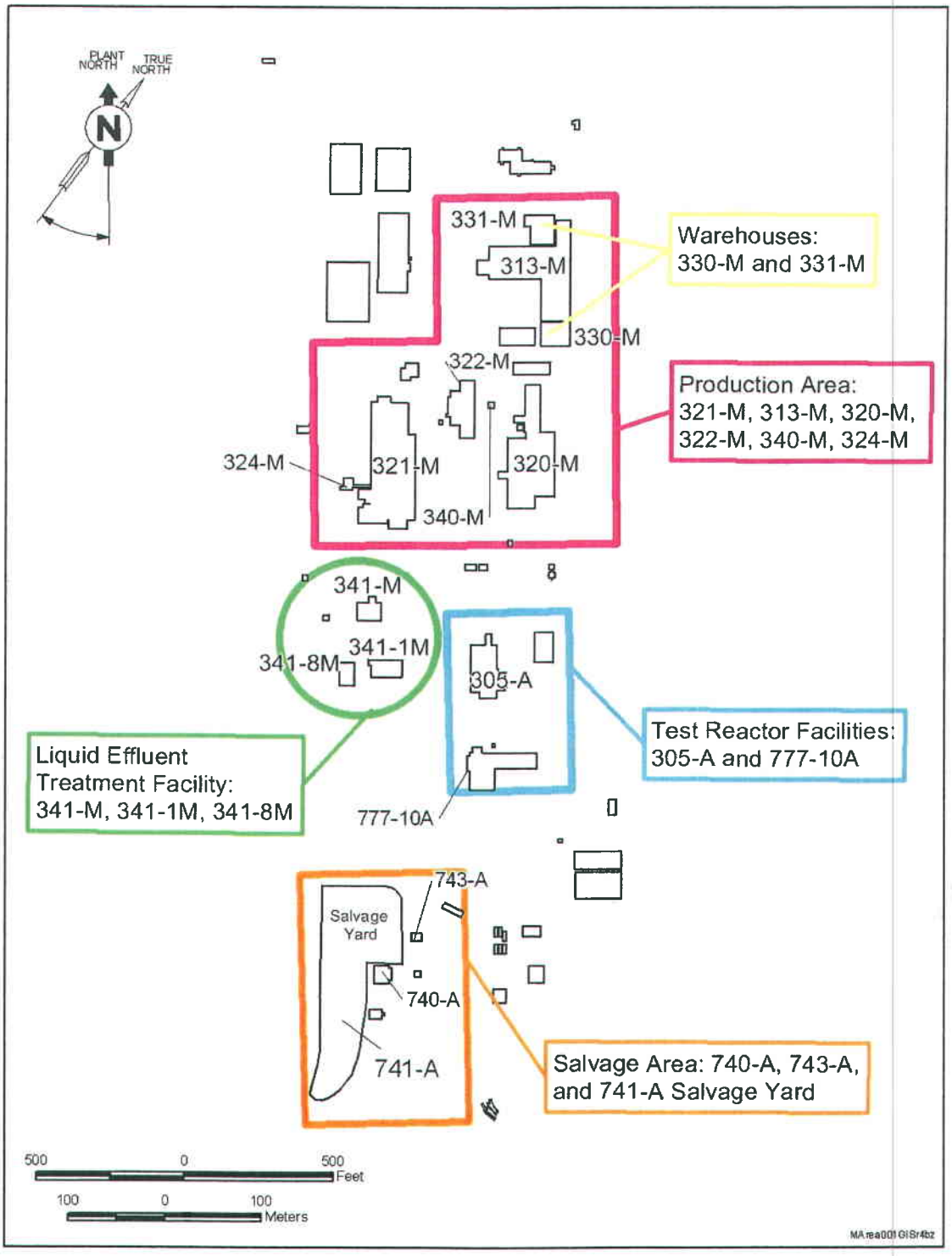

Figure 2. Layout of the M Area Operable Unit

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All of the major facilities used industrial cleaning processes and products (trichloroethylene [TCE], tetrachloroethylene [PCE], and trichloroethane [TCA]) that were discarded to the M-Area Settling Basin via process sewer lines. The portions of the process sewer lines associated with these buildings were included with the Production Area evaluation although characterization of the discharge portions of the process sewer lines was completed under the MIPSL OU. The MIPSL OU has a separate Record of Decision (ROD) (WSRC 2007a) and remedial path, which includes access controls (grouting of manholes) and management of VOC contamination in the vadose zone by soil vapor extraction (SVE) with soil fracturing.

The LETF is southwest of the Production Area. This facility was built in 1988 and all of the liquid effluent was sent to this treatment facility. This facility contained buildings that were used to treat the wastewater stream, to package and store the residue from the treatment, and to treat the residue.

The Test Reactor Facilities are east of the LETF. This area housed two buildings (305-A and 777-10A) that contained small test reactors used to determine the appropriate properties for the fuel elements and the target assemblies before a new model was placed into production.

The southern portions of MAOU were designated as the Salvage Area and includes the 741-A Salvage Yard where excess materials and equipment were stored on an approximate two-acre portion. The salvage yard contained support facilities for the personnel involved in the management of the excess material. In addition, Building 740-A was used to recondition non-nuclear material. This reconditioning involved painting and cleaning with solvents.

The 330-M Slug Warehouse and 331-M Core Storage Warehouse were used to store slugs of depleted uranium. The inventory of depleted uranium was removed prior to decommissioning. Buildings 330-M and 331-M were dismantled and removed during the

summer of 2003. Radiological Control surveyed the 330-M and 331-M pad and found no detectable radiation.

M Area is the second OU at SRS to be addressed under an area-wide remedial strategy. As part of this strategy, RCRA/CERCLA/SE units and Deactivation and Decommissioning (D&D) facilities (or remnants) in the former M-Area industrial area were consolidated into the single MAOU. As part of the area-wide remedial strategy, the facilities in the former M-Area industrial area (including the M-Area process sewer lines and feeder lines shown in Figure 3) were consolidated with the MAOU. The evaluation and analysis for these selected inactive process sewer lines (IPSLs) were documented in the *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan, RFI/RI Report with Baseline Risk Assessment (BRA) and Corrective Measures Study/Feasibility Study (CMS/FS) for M Area Operable Unit (U)* submitted in July 2006 (WSRC 2006a). This document will be referred to as the MAOU Combined Document throughout this ROD. A summary of remedial and removal actions for M-Area is shown in Table 1.

Table 1. Previous Corrective/Remedial or Removal Actions for M-Area

	Status
M-Area Salvage Yard Removal Action (Approved Removal Action Report - WSRC 2008a, July 2008)	Complete
M-Area Production Area Removal Action (Approved Removal Action Report - WSRC 2008b, August 2008)	Complete
RCRA Clean Closure for 315-4M and 316-M	Ongoing
MIPSL OU Remedial Action [1,3] (SVE Enhanced with Soil Fracturing, ICs) WSRC 2007a April 2007 (ROD)	Ongoing
M-Area Settling Basin Hazardous Waste Management Facility (HWMF) Source Control[2]	Ongoing
Metallurgical Laboratory HWMF Source Control[2]	Ongoing
M-Area Groundwater	Ongoing

[1] Separate Operable Unit
[2] Per SCDHEC RCRA Permit
[3] Subject to FFA 5-Year Remedy Review

Groundwater is not considered part of the scope for the MAOU. Any groundwater contamination resulting from the MAOU is being addressed as part of the SRS RCRA Part B Permit. A corrective action program for A/M Area vadose zone and groundwater has been in place for over a decade under the RCRA Part B Permit. The baseline technologies for removing contamination are SVE for the vadose zone sources and pump and treat for groundwater. Dynamic Underground Stripping (DUS) (steam heating) is also currently used to address large volumes of solvents in the vadose zone and groundwater.

The M Area at SRS is located in an area of historically heavy industrial and nuclear land use. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates M Area for future industrial, non-residential use. Remedial action objectives (RAOs) and likely response actions were developed consistent with future industrial non-residential land use. This area will require institutional controls (ICs) to restrict use due to the large area of vadose zone and groundwater contamination, including operation of remedial systems. Appropriate land use controls (LUCs) against unrestricted and/or residential use will be part of all remedial actions for the MAOU. The entire area will be limited to industrial use, and it is reasonable to assume that portions of the area will have further restrictions.

Site Characterization

The MAOU has been the subject of various investigations:

- Sampling of concrete slabs, below-grade concrete barriers, and soils in connection with the D&D of various buildings.
- Sampling of soils adjacent to the inactive process sewer lines as part of the MIPSL OU project.
- Sampling of concrete slabs, below-grade concrete structures and soils beneath the slab, sumps, trenches and process feeder pipelines as part of the MAOU investigation.

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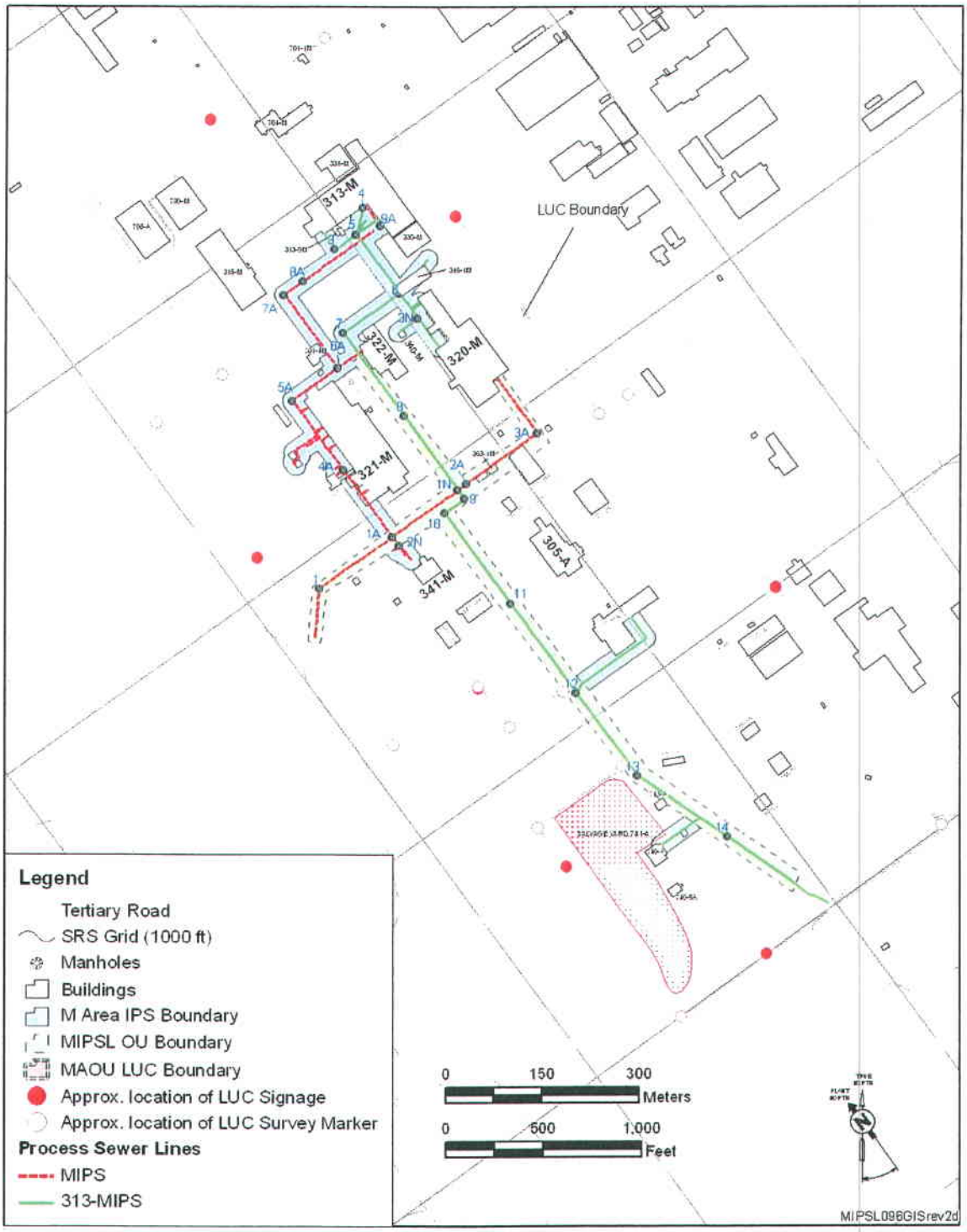

Figure 3. M-Area OU and M-Area Inactive Process Sewer OU Boundaries

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The cumulative results from these investigations were used to determine the nature and extent of contamination and identify the problems warranting action. The facilities of the MAOU were evaluated in the MAOU Combined Document (WSRC 2006a).

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA (42 United States Code Sections 9613 and 9617). These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternative for addressing the MAOU soils and groundwater. The Administrative Record File must be established at or near the facility at issue.

The SRS FFA Community Involvement Plan (WSRC 2006b) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS FFA Community Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the M Area Operable Unit (MAOU) (U)* (WSRC 2007b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the MAOU.

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

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

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

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

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

The South Carolina Department of Health and Environmental Control – Region 5
Aiken Environmental Quality Control Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 641-7670

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

The Statement of Basis/Proposed Plan (SB/PP) 45-day public comment period began on May 13, 2008 and ended on June 26, 2008. No comments were received from the public.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT

Due to the complexity of multiple contaminant areas, the SRS is divided into integrated operable units (IOUs) for the purpose of managing a comprehensive cleanup strategy. Waste units within an IOU are evaluated and remediated individually. The MAOU (Figure 1) is located within the Upper Three Runs IOU (Upper Three Runs Watershed). Upon disposition of all OUs within the watershed, a final comprehensive ROD for the Upper Three Runs IOU will be issued.

Early removal actions were completed and documented in the Removal Action Report for the Contaminated Surficial Soil in the 741-A Salvage Yard at the MAOU (WSRC 2008a) and Removal Action Report for the Production Area of MAOU (WSRC 2008b).

Following completion of the early removal actions, only vadose zone soils contaminated with TCE and PCE (PCE is at PTSM levels in deep soils at 321-M) remain as the contamination requiring remedial action. This ROD addresses the selected final action alternative for the facilities warranting action following implementation of the early actions and re-evaluation of remedial goal options (RGOs). The response action selected in this ROD will prevent impact to groundwater by removing VOC contamination from the vadose zone by treatment.

V. OPERABLE UNIT CHARACTERISTICS

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

Conceptual Site Model for the MAOU

The CSM is an objective framework for assessing data pertinent to the investigation. The CSM identifies and evaluates suspected sources of contamination, contaminant release mechanisms, potentially affected media (secondary sources of contamination), potential exposure pathways, and potential human and ecological receptors. Exposure pathways describe the course a chemical or physical agent takes from the source to the exposed receptor. The following five components comprise an exposure pathway:

- source (facility operations, spill, etc.)
- exposure media (concrete, soil, groundwater, etc.)
- exposure point (slab surface, drinking water well, etc.)

- exposure route (external radiation, ingestion, dermal contact, inhalation, etc.)
- receptor (resident, worker, wildlife, etc.)

If any of these elements is missing, the pathway is incomplete and is not considered further in the quantitative risk assessment. A pathway is complete when all five components are present to permit potential exposure of a receptor to a source of contamination. Exposure analysis is important in terms of identifying all potentially complete exposure routes, understanding the nature and extent (as well as fate and transport) of contamination, and developing preliminary remedial alternatives. In a complete pathway, exposure occurs at exposure points that may represent only a small portion of the entire exposure route. If there is no exposure point, then there is no exposure, even if contaminants have been released into the environment.

The MAOU is located in an area of historically heavy industrial and nuclear land use, and only future industrial land use is anticipated. Therefore, the most appropriate receptor for evaluation from a human perspective is the future industrial worker. From an ecological risk perspective, the industrial setting does not provide adequate habitat for community-level impacts.

In general, the primary sources of contamination at the MAOU are due to the facility operations at each of the areas. Spills, leaks, accidental releases, or simply the operation itself has resulted in a release of hazardous and/or radioactive substances. Industrial effluents generated in multiple M-Area facilities and transported through the sewer lines constitute the primary source of contamination. Leaks and other accidental releases of effluent from the sewer lines constitute the release mechanism.

Subsurface soils, concrete, and building features (e.g., sumps, trenches, pipelines, etc.) that are below the grade (i.e., >0.3 m [1 ft]) of the concrete slab, gravel, or soil offer a potential exposure pathway for a future industrial worker under an excavation scenario. This pathway was evaluated in the PTSM analysis, and approximately 70% of the PTSM identified was removed via the early actions.

Leaching of contaminants from the contaminated media (concrete, pipeline, soil) to groundwater constitutes a secondary contaminant release mechanism. The potential to leach to groundwater was evaluated in the contaminant migration analysis. Ingestion of groundwater offers a potentially complete pathway for human receptors. The ingestion of groundwater may offer a complete pathway for human receptors, but groundwater is not considered as it is regulated under the SRS RCRA Part B Permit.

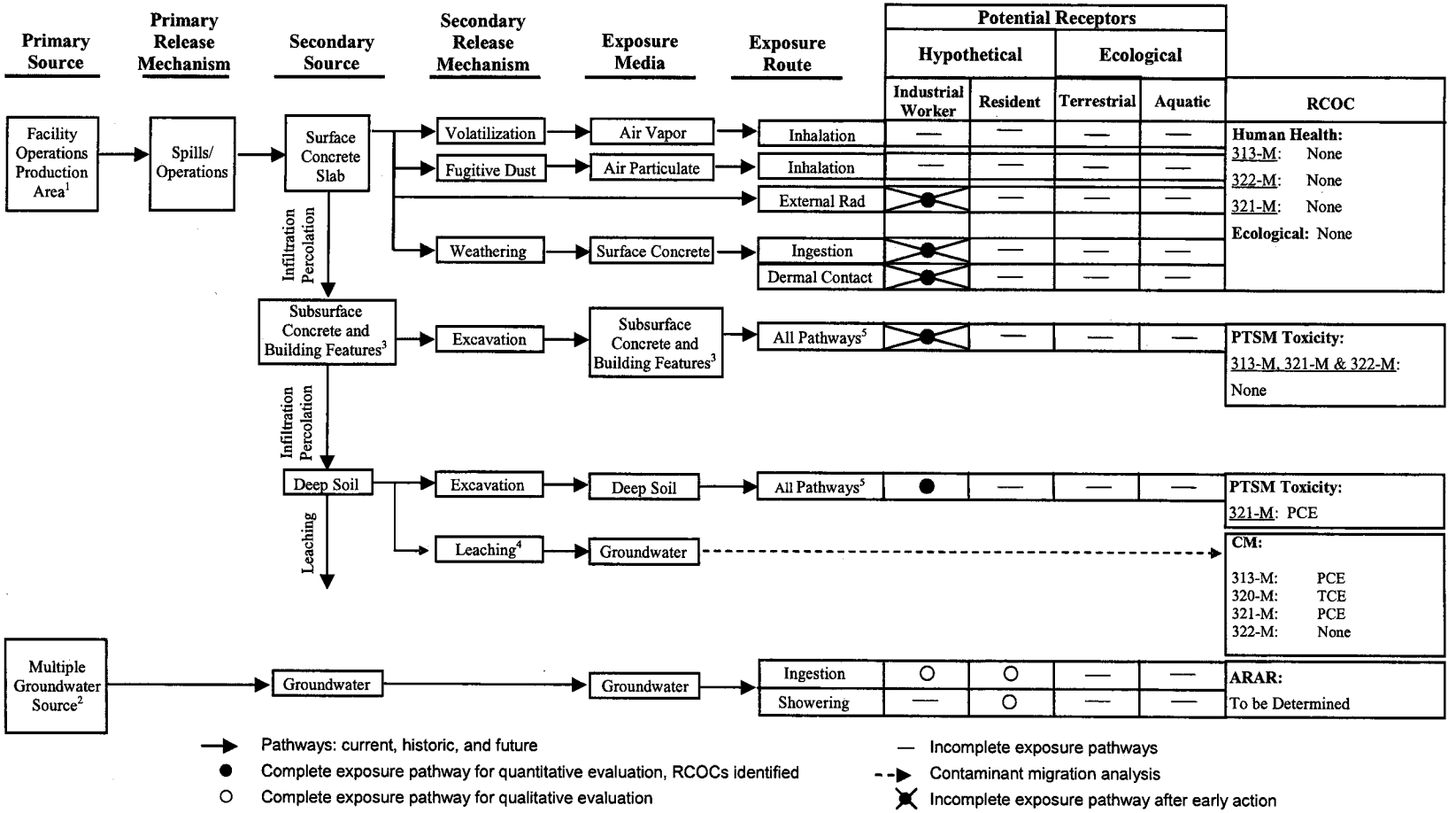
The final action CSM for the MAOU facilities is shown in Figure 4.

Media Assessment

The MAOU has been the subject of various investigations:

- Sampling of concrete slabs, below grade concrete barriers, and soils in connection with the D&D of various buildings.
- Sampling of soils adjacent to the IPSLs as part of the MIPSL OU project.
- Sampling of concrete slabs, below-grade concrete structures and soils beneath the slab, sumps, trenches and process feeder pipelines as part of the MAOU investigation.

The cumulative results from these investigations were used to determine the nature and extent of contamination and identify the problems warranting action. The facilities of the MAOU were evaluated in the MAOU Combined Document (WSRC 2006a).



1. Production Area facilities include Buildings 313-M, 320-M, 321-M, 322-M, 324-M, 340-M and the inactive process sewer lines in the northern section of the MIPSL OU and those portions from manhole 6A to the 322-M building.
2. Groundwater has been impacted by multiple sources within M Area and will be addressed under the M-Area RCRA Corrective Action Program.
3. Subsurface concrete and building features includes sumps, trenches, pipelines, etc., that are currently below grade of concrete slab.
4. Leaching represents the potential of a contaminant in deep soil to migrate to groundwater above MCLs per the contaminant migration (CM) analysis. (Does not represent a human or ecological exposure route.)
5. All pathways represent ingestion, inhalation, dermal contact, and external radiation exposure for principal threat source material (PTSM). Evaluation for toxicity.
6. This CSM depicts post early-action conditions.

Figure 4. Conceptual Site Model for the Production Area

Media Assessment Results

PCE and TCE are contaminant migration COCs (CM COCs) in the vadose zone soil at the MAOU. Specifically, the locations of CM COCs are as follows:

- PCE in soil below the 313-M Solvent Tank Pit (Figure 6)
  - PCE results ranged from 0.0015 to 62.1 mg/kg with the maximum concentration occurring 3.7 m (12 ft) below ground surface.
- PCE in soil underneath the 321-M Tube Cleaning Pit and MIPSL tie-in, and PCE at manhole 4A (Figure 8)
  - The maximum PCE concentrations are 12,300 mg/kg at station SB012 [2.4 – 3.0 m (8 to 10 ft) below pipe] and 11,400 mg/kg at station SB45 [5.5 – 6.0 m (18 to 20 ft) below pit]. The majority of the concentrations were less than 1 mg/kg.
- TCE in soil at the 320-M tie-in to the MIPSL (Figure 10)
  - The maximum TCE concentration is 110 mg/kg at 5.5 – 6.1 m (18 to 20 ft) below the pipe at SB 34.

Additionally, PCE is identified at PTSM levels in deep soils at 321-M.

Site-Specific Factors

No site-specific factors requiring special consideration that might affect the remedial action for the MAOU are present at the site.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

The MAOU is located in an area of historically heavy industrial and nuclear land use, and future industrial land use is anticipated. According to the *SRS Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited. The *Savannah River Site Long-Range Comprehensive Plan* (USDOE 2000) designates the MAOU as being

within a site industrial support area (Figure 5). Therefore, industrial land use is the most likely future land use scenario.

Groundwater Uses/Surface Water Uses

SRS does not use the water table aquifer for drinking water or irrigation purposes and currently controls any drilling in this area. Therefore, as long as USDOE maintains control of SRS, the aquifer beneath the MAOU will not be used as a potential drinking water source or for irrigation.

The SRS RCRA Part B Permit requires monitoring of groundwater below M Area because of the high level of TCE and PCE contamination. Several large-scale groundwater treatment and removal systems have been deployed in the area, and these types of activities are expected to continue into the future.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment

As a component of the RFI/Remedial Investigation (RI) process, a baseline risk assessment (BRA) was performed to evaluate risks associated with the MAOU. The BRA includes estimate of risks posed by the site if no action is taken. It provides the bases for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The BRA includes human health, ecological, contaminant migration, and principal threat source material risk assessments. The results of the BRA for this OU are summarized in the following section.

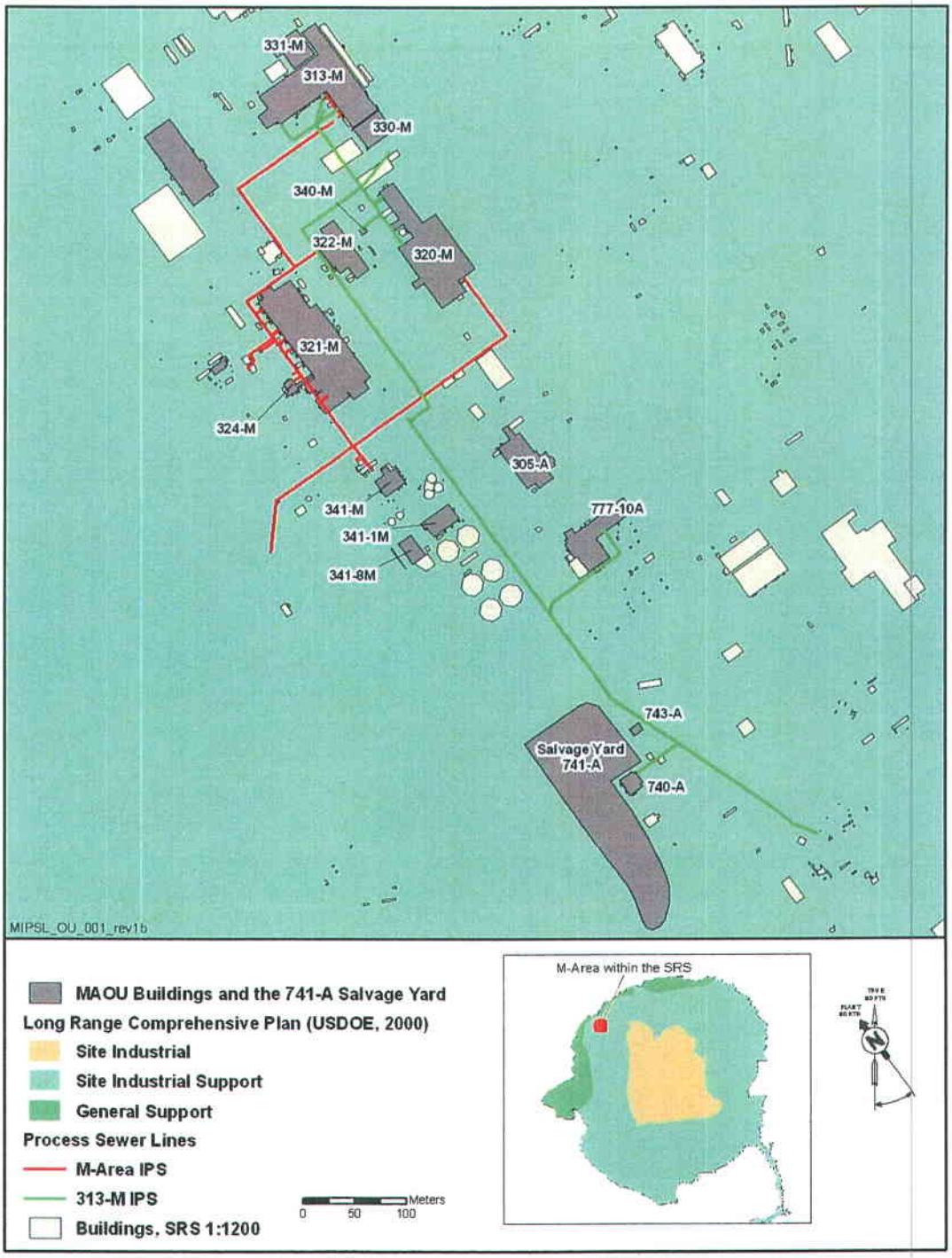


Figure 5. Land Use Map for the M Area Operable Unit

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Summary of Human Health Risk Assessment

USEPA guidance indicates that, when future residential land use is not reasonably anticipated, it is appropriate to focus the baseline risk assessment on more likely future use scenario(s), provided action is taken to insure that risks from residential exposures are prevented. *The Savannah River Site Long Range Comprehensive Plan* (USDOE 2000) designates the MAOU as being within the site industrial support area. Therefore, industrial land use is the most likely future land use scenario. Because residual underground contamination will remain at the unit following the early removal actions that could result in an unacceptable risk to a future resident, land use restrictions are warranted.

Human health risks were assessed for current and future land use scenarios. The potentially exposed receptors under the future land use scenario is the hypothetical industrial worker. Because the expected future land use is industrial, a quantitative risk assessment for the resident was not performed. Existing LUCs will ensure protection against unrestricted (i.e., residential) use.

The probable exposure routes for the future industrial worker at the MAOU are ingestion of contaminated media or biota and dermal exposure to contaminated media. The media investigated as the potential concern is surface soil.

The Production Area and Salvage Yard Removal Action Reports (WSRC 2008a and WSRC 2008b) documented the removal of human health COCs. There are no human health COCs in the MAOU vadose zone soils. Tables 2 through 4 display a summary of results of final action (post-early actions) for each facility.

Summary of Ecological Risk Assessment

The purpose of the ecological risk assessment is to document the analysis of the potential for adverse effects associated with exposure to contaminants likely to be present at the

unit. An Ecological Assessment Checklist and the CSM indicate that the MAOU does not support adequate ecological habitat. There is neither natural cover nor food or water resources that would attract wildlife receptors. Ecological effects due to the MAOU are unlikely and no further evaluation was required.

Summary of Contaminant Migration Evaluation

A contaminant migration analysis was performed to identify CM COCs. A constituent is identified as a CM COC if leachability modeling predicts the constituent will leach to groundwater and exceed maximum contaminant levels (MCLs), preliminary remediation goals (PRGs), or risk-based concentrations (RBCs) within 1,000 years. Pre-Early action CM COC results indicated the following:

- PCE in soil underneath the 313-M Core Cleaning Solvent Tank Pit,
- PCE and TCE in soil underneath the 321-M Tube Cleaning Room, PCE in soil at the MIPSL tie-in and at manhole 4A, and
- TCE in soil at the 320-M MIPSL tie-in; PCE in soil underneath the Tube Cleaning Pit

Following completion of the early removal actions, the following CM COCs remain at the MAOU:

- PCE in soil below the 313-M Core Cleaning Solvent Tank Pit,
- PCE in soil underneath the 321-M Tube Cleaning Room and MIPSL tie-ins, and PCE at manhole 4A, and
- TCE in soil at the 320-M tie-in to the MIPSL

Post-early action CM COCs are shown in Table 5.

Principal Threat Source Material Evaluation

Source materials are those materials that include or contain hazardous substances, pollutants, or contaminants that act as a reservoir for migration to groundwater, surface

water, or air, or that act as a source for direct exposure. PTSM is defined as those source materials that have a high toxicity or mobility and cannot be reliably contained or present a significant risk to human health or the environment (USEPA 1991). They include liquids and other highly mobile materials such as those released from surface soil due to volatilization or leaching, or materials having high concentrations of toxic compounds. No threshold level of toxicity/risk has been established to define "principal threat." However, treatment or removal alternatives should be considered for source materials when the cumulative risk for the future industrial worker exceeds 1×10^{-3} for carcinogens or a hazard index (HI) of 10 for noncarcinogens. The identification of PTSM based on mobility is evaluated under the contaminant migration analysis. Approximately 70% of the contaminated soils beneath the 321-M slab were able to be removed during early removal actions. PCE is at PTSM levels for toxicity below the 321-M slab.

Conclusion

For the final action, only PCE and TCE will remain as CM COCs at the Production Area (e.g., 313-M, 320-M, and 321-M facilities) in soil. Additionally, residual PCE remains below 321-M in deep soils (>10 ft below ground surface [bgs]) as PTSM. The remedial action selected for the CM refined constituents of concern (RCOCs) and deep soil PTSM will be designed to remove PCE and TCE from the soil and prevent additional impacts to the groundwater.

Table 2. Summary of Refined Constituents of Concern

		Final Action		
Subunit/Facility	**ARAR RCOCs**	**CM RCOCs**	**HH RCOCs**	**PTSM RCOCs**
Production Area				
313-M Slug Production Facility	none	*soil* PCE Core Cleaning Solvent Tank Pit	none	none
321-M Fuel Fabrication Facility	none	*soil* PCE under Tube Cleaning Pit and at adjacent MIPSL tie-ins, MIPSL Manhole 4A	none	*deep soil (>10 ft bgs)* PCE Under the Cleaning Pit
320-M Alloy Building	none	TCE at MIPSL Tie-in	none	none
322-M Metallurgical Laboratory	none	none	none	none
340-M Filter Press Bldg.	none	none	none	none
324-M Vertical Press Bldg.	none	none	none	none
Liquid Effluent Treatment Facilities				
341-M Dilute Effluent Treatment Facility	none	none	none	none
341-1M Interim Treatment Storage Facility	none	none	none	none
341-8M Vendor Treatment Facility	none	none	none	none
Test Reactors				
305-A Test Pile Facility	none	none	none	none
777-10-A Site Utilities Office Building (Physics Laboratory)	none	none	none	none
Salvage Area				
740-A Reclamation Bldg.	none	none	none	none
741-A Salvage Yard	none	none	none	none
743-A Rigging Storage Facility	none	none	none	none

ARAR – applicable or relevant and appropriate requirements; HH – human health

Table 3. Summary of Results of the Human Health Risk Assessment

Subunit/Facility	Final Action			Media
	HH RCOCs	Industrial Worker Risk Estimate	Total Cumulative Risk	
Production Area				
313-M Slug Production Facility	none	not applicable	not applicable	not applicable
321-M Fuel Fabrication Facility	none	not applicable	not applicable	not applicable
320-M Alloy Building	none	not applicable	not applicable	not applicable
322-M Metallurgical Laboratory	none	not applicable	not applicable	not applicable
340-M Filter Press Building	none	not applicable	not applicable	not applicable
324-M Vertical Press Building	none	not applicable	not applicable	not applicable
Liquid Effluent Treatment Facilities				
341-M Dilute Effluent Treatment Facility	none	not applicable	not applicable	not applicable
341-1M Interim Treatment Storage Facility	none	not applicable	not applicable	not applicable
341-8M Vendor Treatment Facility	none	not applicable	not applicable	not applicable
Test Reactors				
305-A Test Pile Facility	none	not applicable	not applicable	not applicable
777-10-A Site Utilities Office Building (Physics Laboratory)	none	not applicable	not applicable	not applicable
Salvage Area				
740-A Reclamation Building	none	not applicable	not applicable	not applicable
741-A Salvage Yard	none	not applicable	not applicable	surface soil/gravel
743-A Rigging Storage Facility	none	not applicable	not applicable	not applicable

HH – human health; U-235 = uranium 235; U-238 = uranium-238

Table 4. Summary of Results of the PTSM Evaluation

Subunit/Facility	Final Action		
	PTSM RCOCs	Risk Estimate	Media
Production Area			
313-M Slug Production Facility	none	not applicable	not applicable
321-M Fuel Fabrication Facility	PCE	9.4E-03	soil
320-M Alloy Building	none	not applicable	not applicable
322-M Metallurgical Laboratory	none	not applicable	not applicable
340-M Filter Press Building	none	not applicable	not applicable
324-M Vertical Press Building	none	not applicable	not applicable
Liquid Effluent Treatment Facilities			
341-M Dilute Effluent Treatment Facility	none	not applicable	not applicable
341-1M Interim Treatment Storage Facility	none	not applicable	not applicable
341-8M Vendor Treatment Facility	none	not applicable	not applicable
Test Reactors			
305-A Test Pile Facility	none	not applicable	not applicable
777-10-A Site Utilities Office Building (Physics Laboratory)	none	not applicable	not applicable
Salvage Area			
740-A Reclamation Building	none	not applicable	not applicable
741-A Salvage Yard	none	not applicable	not applicable
743-A Rigging Storage Facility	none	not applicable	not applicable

Note: Residual PCE remains below 321-M in deep soils as PTSM. The risk estimate of 9.4E-03 is based on the maximum detected concentration prior to early action. Approximately 70% of the contaminated soil beneath the 321-M slab was removed during early actions.

Table 5. Summary of Results of the Contaminant Migration Analysis

Subunit/Facility	CM RCOCs
Production Area	**Final Action**
313-M Slug Production Facility	*soil* PCE Solvent Tank Pit
321-M Fuel Fabrication Facility	*soil* PCE under Tube Cleaning Room/Sumps and at adjacent MIPSL tie-ins PCE at Manhole 4A
320-M Alloy Building	*soil* TCE at MIPSL Tie-in
322-M Metallurgical Laboratory	*none*
340-M Filter Press Building	*none*
324-M Vertical Press Building	*none*
Liquid Effluent Treatment Facilities	
341-M Dilute Effluent Treatment Facility	*none*
341-1M Interim Treatment Storage Facility	*none*
341-8M Vendor Treatment Facility	*none*
Test Reactors	
305-A Test Pile Facility	*none*
777-10-A Site Utilities Office Building (Physics Laboratory)	*none*
Salvage Area	
740-A Reclamation Building	*none*
741-A Salvage Yard	*none*
743-A Rigging Storage Facility	*none*

VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

The goals of remedial actions are to protect human health and the environment and to mitigate the effects of contamination. USEPA has established a structured process to identify and evaluate technologies for remedial applications. This process involves developing and screening a range of appropriate remedial options and selecting the most suitable approaches for corrective measures and remedial actions.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) specifies six criteria for developing this range of remedial technologies [40 Code of Federal Regulations (CFR) Part 300.430 (a) (1) (iii) (A) - (F)]:

- Whenever practical, use treatment to address principal threats posed by the unit.
- Use engineering controls for waste that poses a relatively low long-term risk or when treatment is impractical.
- Combine methods (for example, treatment plus engineering controls) to protect human health and the environment.
- Supplement engineering controls with ICs to prevent or limit exposure.
- Whenever practical, use innovative technologies.
- Return usable groundwater to beneficial uses or prevent further degradation.

RAOs are media- or OU-specific objectives for protecting human health and the environment. RAOs usually specify potential receptors and exposure pathways, and are identified during scoping once the CSM is understood. RAOs describe what the cleanup must accomplish and are used as a framework for developing remedial alternatives. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. The following RAOs are identified for the MAOU after completion of the early actions:

- Prevent human exposure to contaminants that present a risk greater than 1E-06 to a future resident. This RAO applies to all waste units/building remnants in the MAOU.
- Prevent migration of VOCs in building slabs, sumps, or vadose zone to groundwater above MCLs. This RAO applies to Buildings 313-M, 321-M, and 320-M, and the IPSL associated with these facilities.

– Building 313-M: PCE in soil media

– Building 321-M: PCE in soil media

– Building 320-M: TCE in soil media

Remedial Goal Options

RGOs are typically identified along with RAOs and represent the preliminary media-specific goals that provide a measure that the RAO will be achieved for a selected remedial action. RGOs can be qualitative statements or numerical values often expressed as concentrations in soils or groundwater, or actions (installation of engineered barriers, placement of caps and covers, etc.) that achieve the RAO. RGOs become finalized as remedial goals (RGs) after public comment and approval of the SB/PP and are documented in the ROD.

Final RGs will be monitored to determine when the remedial action is complete. RGOs for MAOU subunits with early action scope are identified in the appropriate Removal Site Evaluation Report (RSER)/Engineering Evaluation (EE)/Cost Analysis (CA) documents (WSRC 2006c, WSRC 2006d) and herein. The most restrictive RGO is identified as the lowest of the human health and contaminant migration RGOs for each RCOC. It is based on the industrial land use scenario. Note that a quantitative evaluation based on a future resident scenario was not performed in the risk assessment. However, the entire MAOU will be under ICs to prevent future residential land use. .

In contrast to the most restrictive RGOs, the most likely RGOs also are compared to background levels. Because of the inherently conservative nature of the risk assessment and RGO calculations, it is possible for the risk-based RGO to be less than levels that occur naturally in unimpacted background soils. In this case, the RGO defaults to the background concentration in order to be technically practical to achieve. The background concentration is set as the 95th percentile for unimpacted SRS-wide soils (WSRC 2006e, Appendix B-2). Final RGs were agreed upon by USDOE, SCDHEC, and USEPA concurrent with selection of a remedial action.

A large portion of the MAOU contaminated media were managed through early actions, and those RGs were addressed in the RSER/EE/CA documentation. The activities to achieve the risk thresholds to the extent practicable will be documented in the Removal Action Completion Reports. Risk-based RGOs for the RCOCs identified for the MAOU final action are summarized in Table 6. The CM RGOs in Table 6 is the soil concentration that is not predicted to impact groundwater above MCLs based on the waste unit configuration after early actions.

Table 6. Summary of Final Action RGs for MAOU

RCOC	Units	CM[1]	HH[2]	Most Restrictive RGO[3]	SRS 95th Percentile Background[4]	Most Likely RGO[5]
SOIL MEDIA						
Organics						
Tetrachloroethylene (PCE)	mg/kg	1.80[6] 3.00[8]	NA	1.80[6] 3.00[8]	NA	1.80[6] 3.00[8]
Trichloroethylene (TCE)	mg/kg	15.00[7]	NA	15.00[7]	NA	15.00[7]

1. The CM RGO is the soil concentration that is not predicted to impact groundwater above MCLs based on the waste unit configuration after early actions.
2. The HH RGO is the contaminant concentration in concrete equal to a risk of 1E-06 for a future industrial worker.
3. The most restrictive RGO is the lower of the CM RGO and HH RGO.
4. SRS sitewide background value is 95th percentile for soil from *the 2006 Background Soils Statistical Summary Report,* Appendix B-2 (WSRC 2006c).
5. The most likely RGO is the most restrictive RGO concentration, if it is greater than the SRS sitewide background concentration. If the most restrictive RGO concentration is less than the SRS background concentration, then the RGO defaults to the background value.
6. RGOs for Building 313-M.
7. RGOs for Building 320-M MIPSL Tie-in
8. RGOs for Building 321-M

NA - not applicable (no RCOCs)

Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended by the Superfund Amendments Reauthorization Act (SARA), requires that remedial actions comply with requirements and standards set forth under federal and state environmental laws.

Specifically, remedies must consider "any promulgated standard, requirement, criteria, or limitation under a state environmental or facility citing law that is more stringent than any Federal standard, requirement, criteria or limitation" if the former is an ARAR for the site and associated remedial activities. SARA requires that the remedial action for a site meet all ARARs unless a waiver is invoked. In addition to ARARs, many federal and state environmental and public health programs include criteria, guidance, and proposed standards that are not legally binding but provide useful approaches or recommendations.

Such information is required to-be-considered (TBC) when RGs are developed.

ARARs include action-specific, location-specific, and chemical-specific requirements:

Action-specific ARARs control or restrict the design, performance, and other aspects of implementation of specific remedial activities.

Location-specific ARARs reflect the physiographic and environmental characteristics of the unit or the immediate area, and may restrict or preclude remedial actions depending on the location or characteristics of the unit.

Chemical-specific ARARs are media-specific concentration limits promulgated under federal or state law. The NCP requires the development of site-specific health-based limits (HBLs) for chemicals where such limits do not exist and where there is a concern with their potential health or environmental effects. Table 7 summarizes potential ARARs for the MAOU.

Table 7. Summary of Potential ARARs for the MAOU

Citation	Status	Requirement Summary	Reason for Inclusion
Chemical-specific ARARs			
40 CFR 141 National Primary Drinking Water Regulations	Applicable	Standards for maintaining water quality	Generally applicable for maintaining groundwater quality
40 CFR 268 Land Disposal Regulations	Applicable	Identifies land disposal restrictions and specifies treatment standards for specified waste.	Applicable if water is discharged to land. Also movement of excavated material outside the site may trigger land disposal restrictions.
Action-specific ARARs			
40 CFR 50.6 National Primary and Secondary Ambient Air Quality Standards	Applicable	Regulates concentration of particulate matter in ambient air not to exceed 50 µg/m3 (annual arithmetic mean) or 150 µg/m3 (24-hour average concentration)	Dust suppression likely required to minimize dust emissions during construction/remedial action.
SC R.61-62.6 Control of Fugitive or Particulate Matter	Applicable	Regulates fugitive particulate emissions	Dust suppression likely required to minimize dust emissions during construction/remedial action.
SC R72-300 and 400 Standards for Stormwater Management and Sediment Reduction	Applicable	Regulates stormwater management and sediment control during land disturbing activities. Also discusses erosion and runoff control measures.	Land will be disturbed during construction/remedial actions and runoff and erosion may be applicable to the remedial responses. Remedial activities may require an erosion control plan.
40 CFR 257-258 Disposal of Nonhazardous Waste	Applicable	Governs the management of (sanitary and construction/ demolition) non-hazardous waste	Sanitary waste may be produced from remedial actions
40 CFR 260, 261, 262, 264, and 268 SC R.79.260, 261 and 268 Federal and State Hazardous Waste Regulations	Applicable	Defines criteria for determining whether a waste is RCRA hazardous waste and provides treatment, storage, and disposal requirements.	Would be applicable if hazardous waste is found to be present at the MAOU and removed from area of contamination.
SC R.61-62.5 Standard 8	Applicable	Toxic Air Pollutants. Identifies air concentrations and permit requirements for air emissions of toxic chemicals for new and existing sources	Would be applicable if SVE is used as a remedial action
Location-specific ARARs			
16 USC 703 to 712 Migratory Bird Treaty Act	To Be Considered	The remedial action must be conducted in a manner that minimizes effects on migratory birds and their habitats.	Migratory bird populations may be present in the vicinity of the MAOU.

IX. DESCRIPTION OF ALTERNATIVES

Remedy Components, Common Elements, and Distinguishing Features of Each Alternative

This section summarizes the remedial alternatives studied in the detailed analysis phase of the MAOU Combined Document (WSRC 2006a) that apply to post early action. Removal actions were implemented at the MAOU to target the PTSM and significant VOC source contamination. Consequently, the highest concentrations of radionuclide and VOC contamination were excavated and removed from the MAOU. Edible oils enhanced with soil fracturing were provided in the Combined Document alternatives list as an aggressive innovative technology to remediate the source zones. Since the source zones have been addressed, the presumptive remedy of SVE (modified Alternative A-4) suffices for remediation of the remaining residual contamination. Additionally, all significant radionuclide-contaminated concrete slabs were removed by early actions. Therefore, Alternatives B-1 through B-5 were no longer applicable, and the remaining slabs are manageable with ICs. In accordance with the NCP, it is desirable, when practical, to offer a range of diverse alternatives to compare during the detailed analyses.

The range of alternatives includes options that (1) immobilize chemicals, (2) reduce the contaminant volume, or (3) reduce the need for long-term, onsite management. Some alternatives have been developed that involve little or no treatment yet provide protection to human health and the environment by preventing or controlling exposure to or migration of the contaminants through engineered or ICs. Remedial alternatives were developed to address contamination in surface materials and vadose zone soils.

Alternatives Addressing VOC-Contaminated Media

Alternative A-1. No Action

313-M, 321-M, and 320-M

Total Capital Cost	$0
Present-Worth Operations and Maintenance (O&M) Cost	$0
Total Present-Worth Cost	$0

The No Action alternative is required by the NCP to serve as a baseline for comparison with other remediation alternatives.

Under this alternative, no efforts would be made to control access, limit exposure, or reduce contaminant toxicity, mobility, or volume. This alternative would leave the MAOU in its current condition with no additional controls. This alternative does not include five-year remedy reviews.

Alternative A-3. Concrete Cap, Institutional Controls

313-M		**321-M**	
Total Capital Cost	$316,899	Total Capital Cost	$547,074
Present-Worth O&M Cost	$235,255	Present-Worth O&M Cost	$235,255
Total Present-Worth Cost	$552,154	Total Present-Worth Cost	$782,329

320-M	
Total Capital Cost	$345,946
Present-Worth O&M Cost	$235,255
Total Present-Worth Cost	$581,201

This alternative involves the use of a concrete cap to prevent contaminant migration over the 313-M Core Cleaning Solvent Tank Pit. The cover area is 18.6 m^2 (200 ft^2). Additionally, this alternative involves the use of a concrete cap to prevent VOC contaminant migration at two 321-M locations: the area west of tube cleaning room, and around manhole 4A. The approximate areas of the caps would be 1,393.5 m^2 (15,000 ft^2) and 232.2 m^2 (2,500 ft^2) respectively. Also, for 320-M, this alternative involves the use of a concrete cap to prevent exposure to VOC contaminant migration at the MIPSL tie-in area north of manhole 3N. The approximate area of the cap would be 232.2 m^2 (2,500 ft^2).

This alternative does not allow unlimited use of the area; therefore, ICs would be required to restrict excavation of soil at depth, to maintain the caps, and to prevent future residential use. Physical barriers (i.e., signs and fences) and/or land-use restrictions (i.e.,

excavation permit restrictions and deed restrictions) will be used to restrict access to, or activities that can be performed at, the impacted areas. All manholes will be grouted as part of access controls. Figures 7, 9, and 11 show the concrete cover locations for 313-M, 321-M, and 320-M, respectively. Five-year remedy reviews are included in this alternative.

Alternative A-4. Passive Soil Vapor Extraction, Institutional Controls

313-M		321-M	
Total Capital Cost	$119,635	Total Capital Cost	$932,938
Present-Worth O&M Cost	$219,369	Present-Worth O&M Cost	$350,136
Total Present-Worth Cost	$339,005	Total Present-Worth Cost	$1,283,074

320-M	
Total Capital Cost	$110,484
Present-Worth O&M Cost	$350,136
Total Present-Worth Cost	$460,620

Removal actions were implemented at the MAOU to address the PTSM and significant VOC source contamination. Consequently, edible oils enhanced with soil fracturing was no longer warranted since the removal action addresses that scope of contamination. Therefore, edible oils enhanced with soil fracturing was rejected from further consideration in the SB/PP, and Alternative A-4 is reduced to Passive Soil Vapor Extraction (SVE) and Institutional Controls.

SVE is recognized as the presumptive remedy for VOC contamination in the vadose zone. There are many methods for implementing SVE, and its effectiveness is well documented. Note that based on initial technical evaluation, a passive SVE configuration is likely and the alternatives for the MAOU are cost estimated as such.

Passive SVE applications utilizing BaroBall™ wells take advantage of atmospheric pressure fluctuations and the resultant natural pressure gradients that exist between the atmosphere and the vadose zone. If these two zones are directly connected (for example,

by a vadose zone well), the pressure differential will result in flow either into or out of the subsurface. The BaroBall™ was developed and patented to exploit this phenomenon, known as barometric pumping. BaroBall™ is a simple check valve that responds to minimal pressure changes, permitting gas to flow out of the well when barometric pressure is lower than the pressure of the soil-gas, but effectively preventing flow in the reverse direction when atmospheric pressure rises. The BaroBall™ significantly increases the effectiveness of barometric pumping by preventing the inflow of air into a venting well when atmospheric pressures reverse, a condition that can reduce contaminant removal by diluting and dispersing the pollutant.

313-M: Passive SVE operation with a BaroBall™ well would be utilized at the Core Cleaning Solvent Tank Pit. No other remnant source of VOC contamination above PRG exists at 313-M after the early action activities.

321-M: The early action for 321-M entailed auger excavation, removal, and disposal of >50 mg/kg VOC contamination west of the tube cleaning room. The scope of the digging operations involved 2.4 m (8 ft) diameter excavations to approximately 12.8 m (42 ft) below grade. These excavated holes were backfilled with sandy soil during the early action work to approximately 3.0 m (10 ft) below surface. Clean, compacted backfill was used to fill the remaining excavation to grade. The backfill materials originated from the Burma Road Landfill and were sampled in accordance with the clean fill protocol and were deemed uncontaminated.

For the final action, the top 3.0 m (10 ft) of clean backfill will be re-excavated and replaced with stockpiled soil (<50 mg/kg) from the early action. All of the stockpiled soil will be placed into the excavation from 10 ft bgs (above the auger borings), and mounded once the soil is above the grade of the adjacent surfaces. Perforated pipes will be placed within the stockpiled soil at various levels and connected to passive barometric SVE units. Perforated pipes will not be placed into the auger boring areas. A vapor infiltration control barrier will be placed on top of the stockpiled soil layer and sealed around the wells to prevent daylighting of the passive SVE operation. The vapor barrier

will be placed on top of the stockpiled soil to form a barrier between it and the 1 ft of clean backfill soils. Daylighting refers to the extracting from fissures created between SVE points and the surface atmosphere. This phenomenon would hinder the effectiveness of SVE operations. Approximately 0.3 to 0.6 m (1 to 2 ft) of clean, common fill will be provided to bring the area up to the surrounding grade level, depending on the volume of stockpiled soil. The unexcavated contamination and stockpile soils are less than PTSM threshold levels but greater than PRGs. Additionally, this alternative entails the use of passive SVE operation with BaroBall™ wells at manhole 4A.

320-M: The early action at the VOC-contaminated soil was excavation, similar to the activity at 321-M, to 9.1 m (30 ft) below grade, with sandy soil backfill and a 2 ft cover of common fill. This final action alternative will involve passive SVE operation with a BaroBall™ well at the MIPSL tie-in area north of manhole 3N.

ICs will be used to limit access to the area. Physical barriers (e.g., fences), and/or administrative restrictions (e.g., excavation permit restrictions and deed restrictions) will be used to restrict access to, or activities that can be performed at, the impacted areas. IPSL manholes will be grouted as part of access control.

Five-year remedy reviews are included in this alternative. Figures 6, 8, and 10 show the SVE locations for 313-M, 321-M, and 320-M, respectively.

MAOU Remnant Areas

For Buildings 322-M, 341-M, 341-1M, 341-8M, 305-A, 777-10A, 340-M, 324-M, 741-A, 740-A, 743-A, and all other remnants of the MAOU, ICs will be implemented to prevent human exposure to contaminants that present a risk greater than 1E-06 to a future resident. The following costs are presented for no action and ICs for the MAOU remnant areas.

Alternative 1.	**No Action**
Total Capital Cost	$0
Present-Worth O&M Cost	$0
Total Present-Worth Cost	$0

Alternative 2.	**Institutional Controls**
Total Capital Cost	$106,920
Present-Worth O&M Cost	$219,369

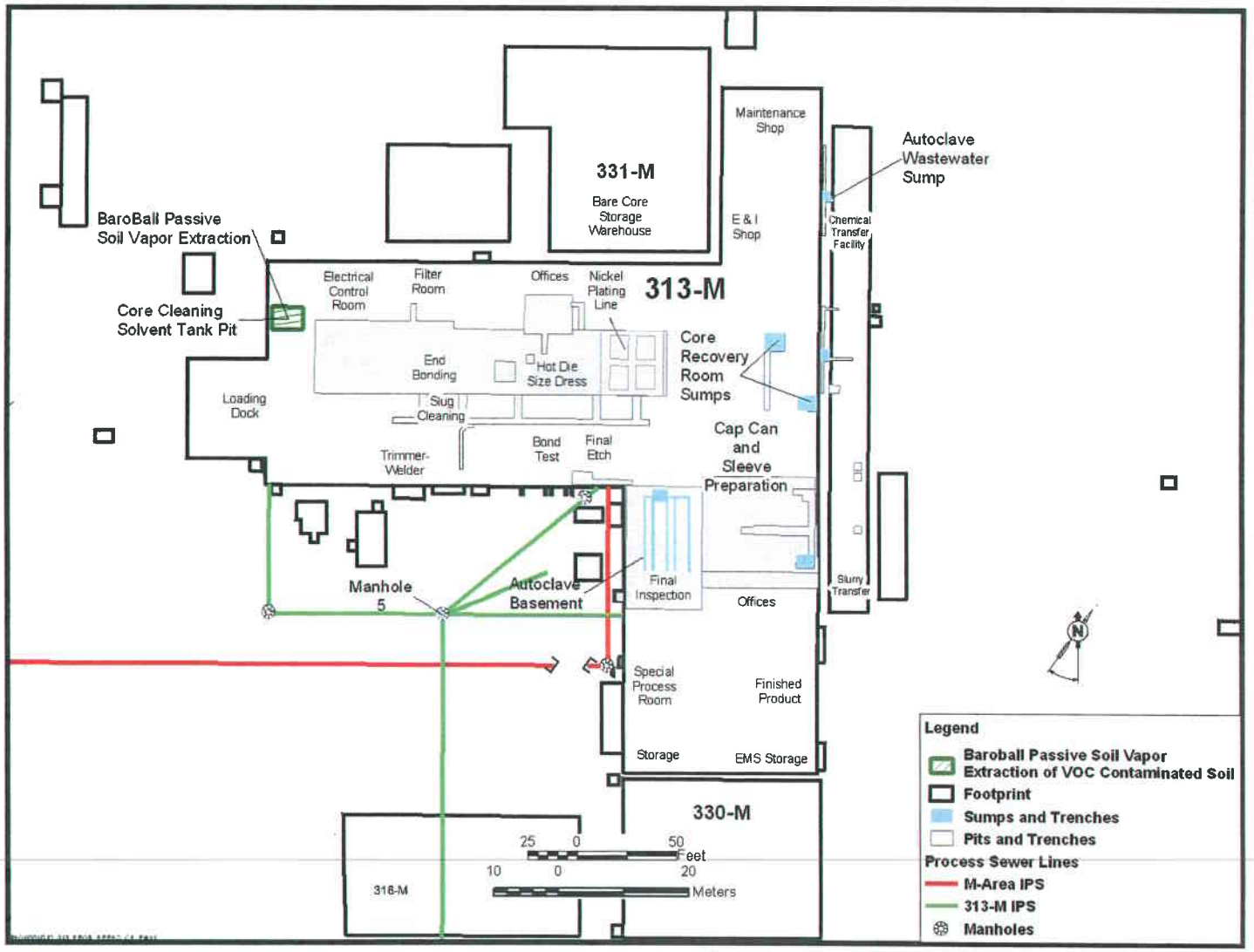

Figure 6. Building 313-M, Alternative A-4

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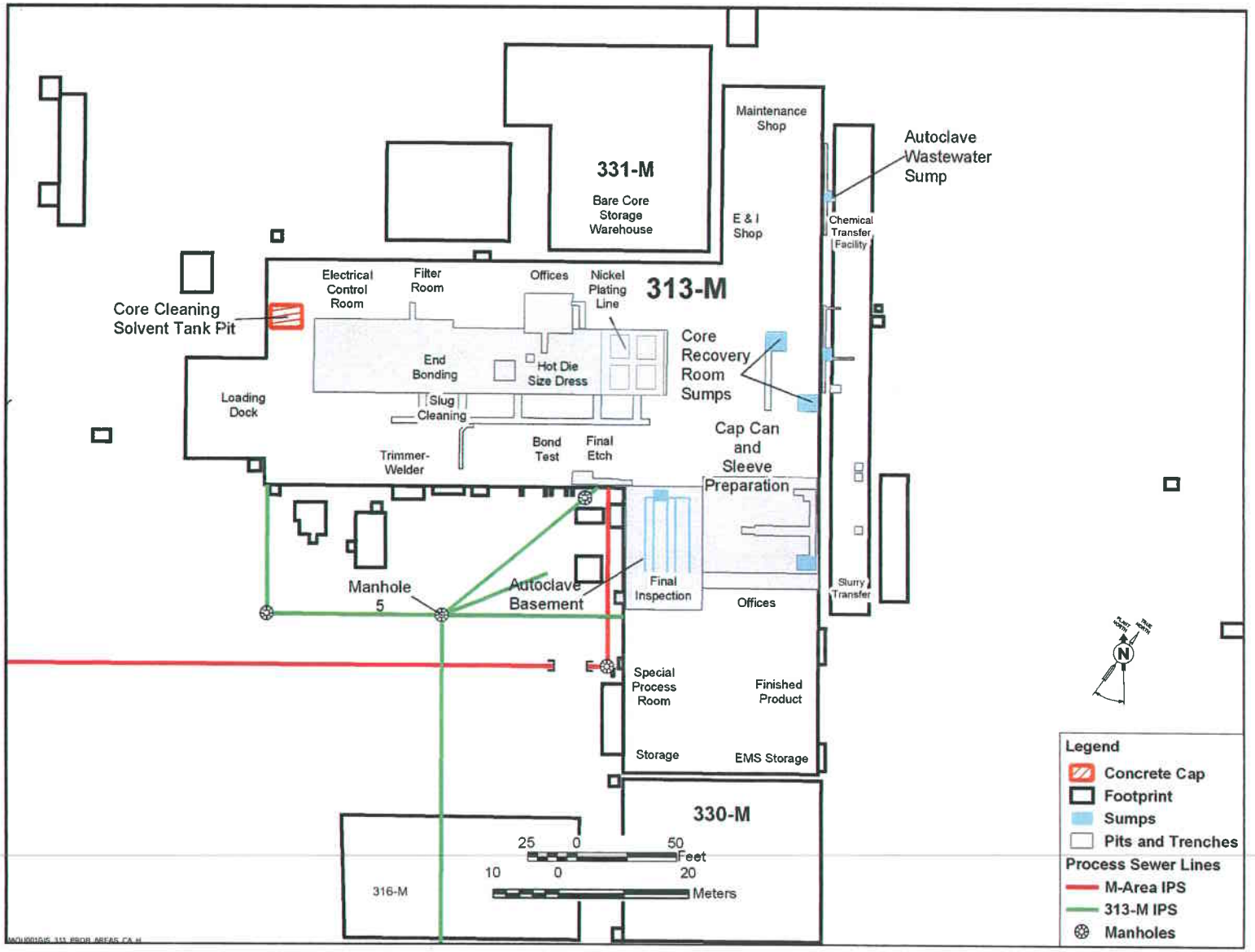

Figure 7. Building 313-M, Alternative A-3

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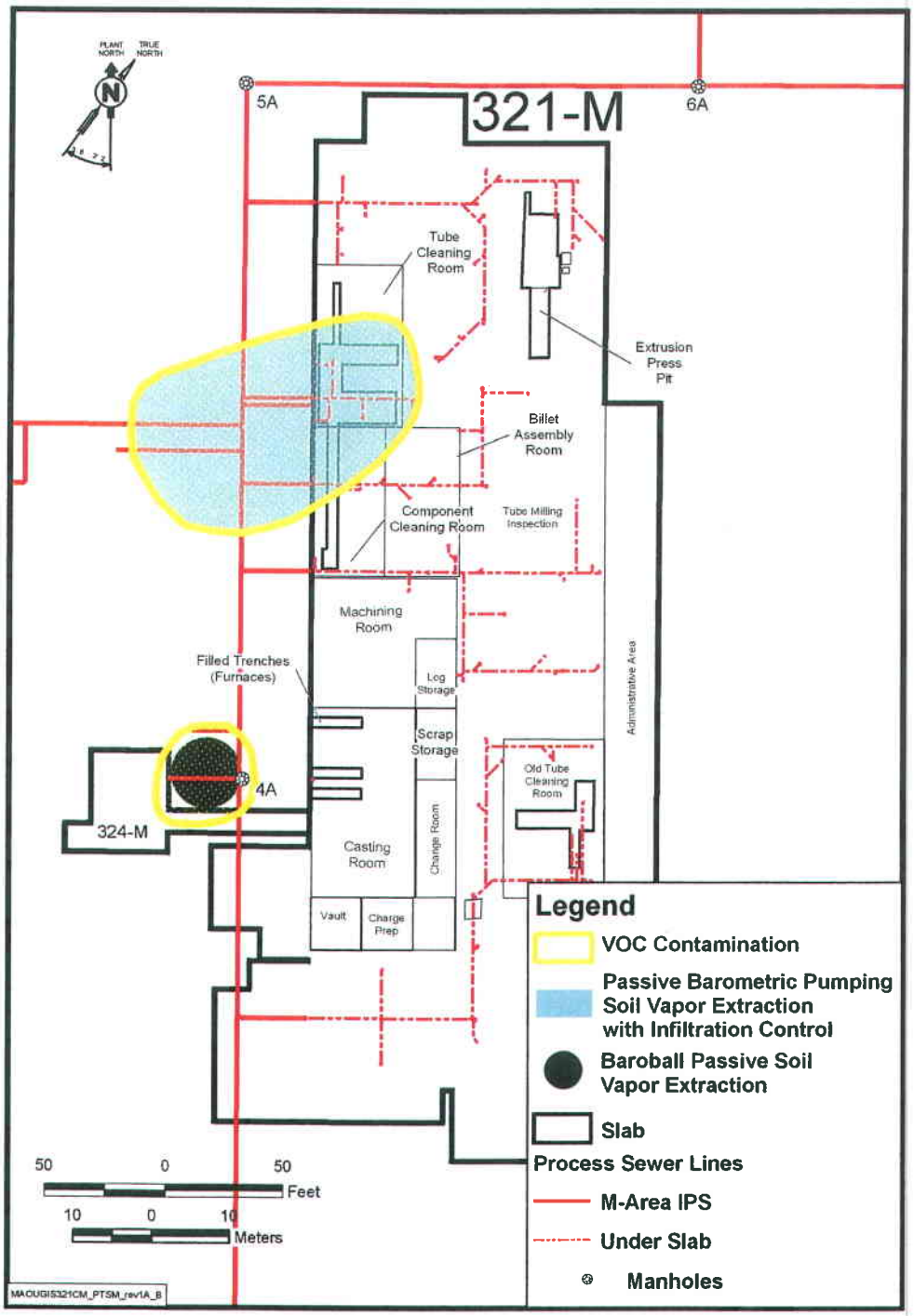

Figure 8. Building 321-M, Alternative A-4

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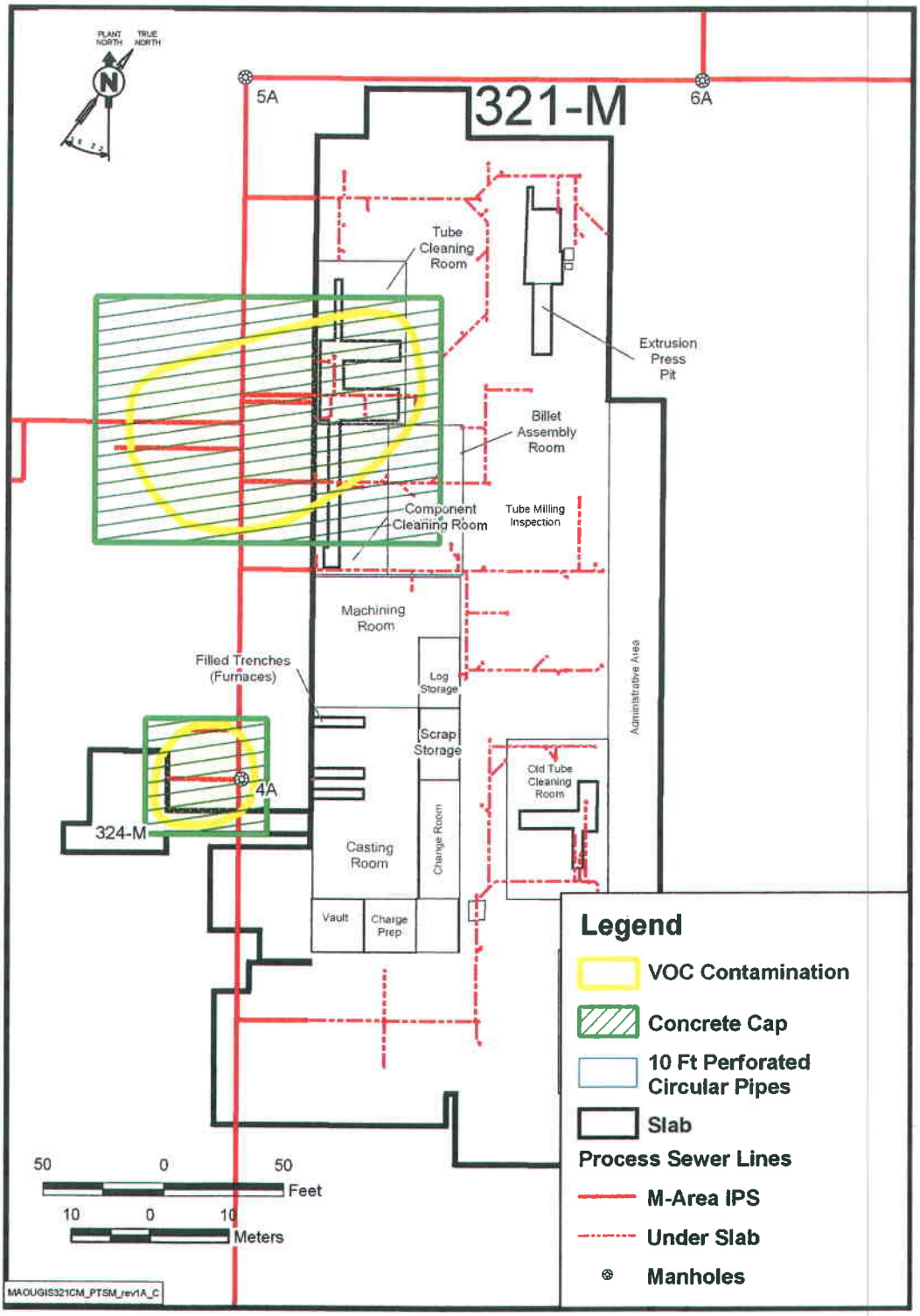

Figure 9. Building 321-M, Alternative A-3

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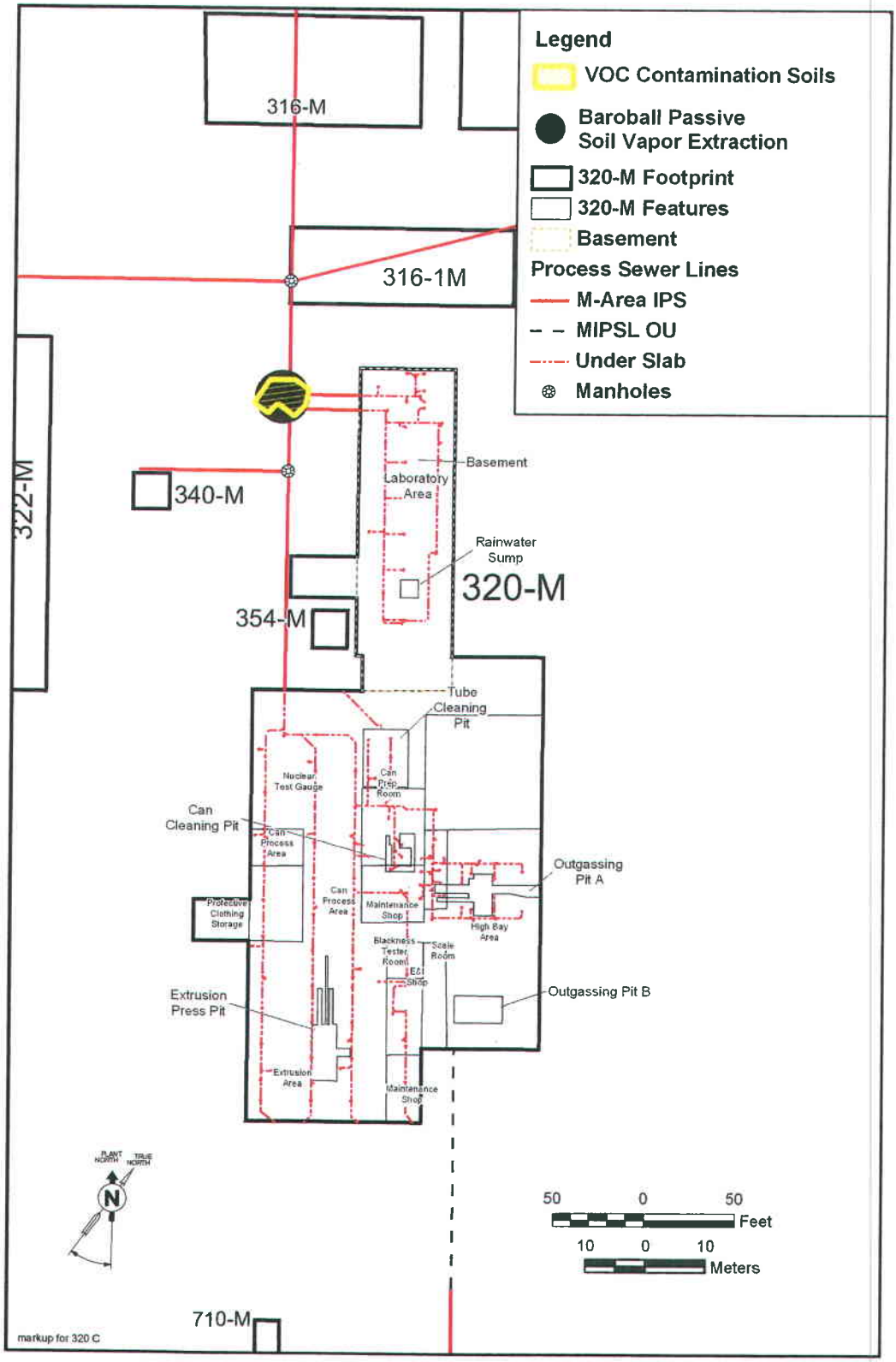

Figure 10. Building 320-M, Alternative A-4

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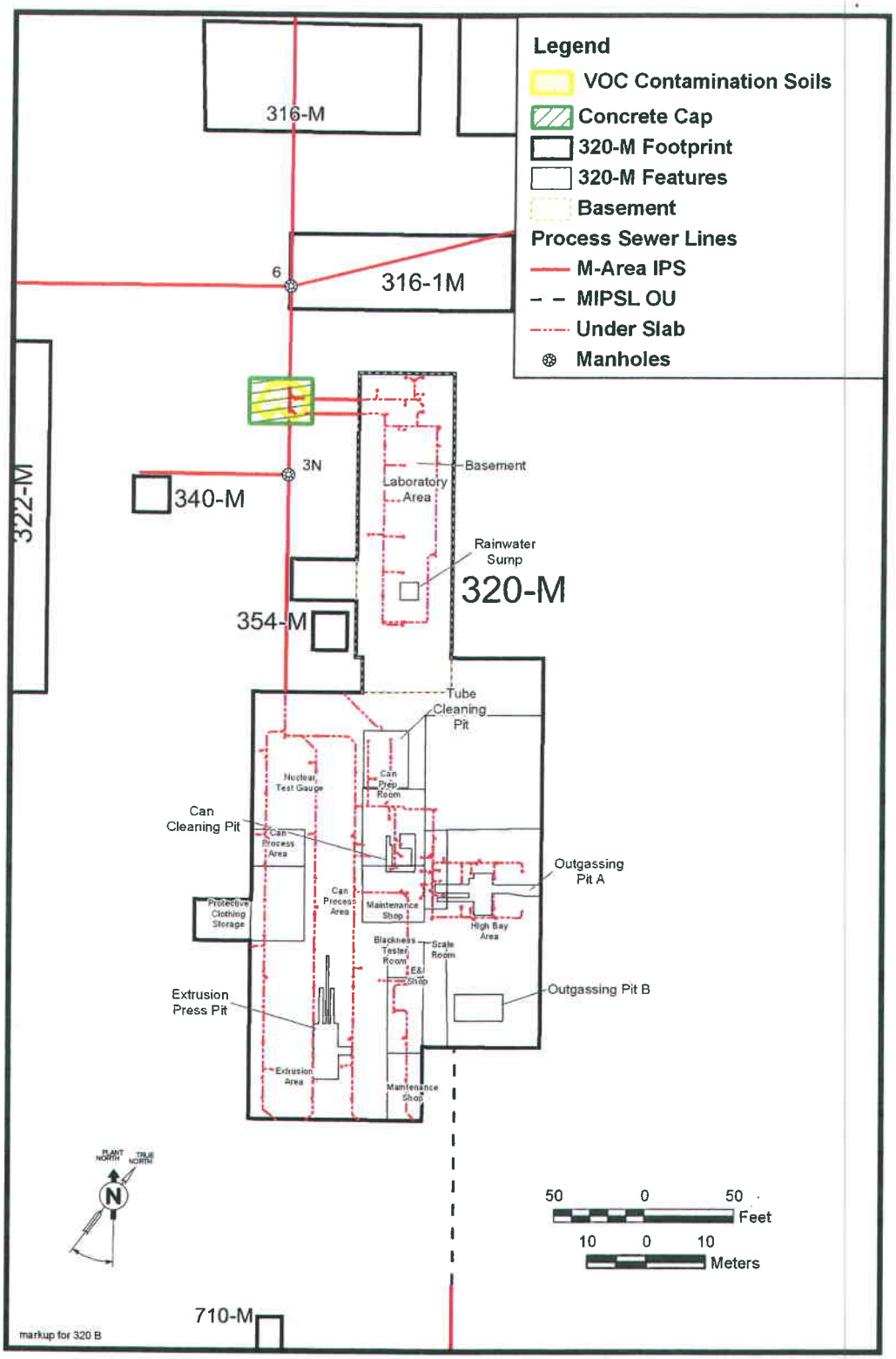

Figure 11. Building 320-M, Alternative A-3

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X. COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP [40 CFR 300.430(e)(9)] requires that potential remedial alternatives undergo detailed analysis using relevant evaluation criteria that will be used by decision makers to select a final remedy. The results of the detailed analysis are then examined to compare alternatives and identify key tradeoffs among alternatives.

The statutory requirements that guide the evaluation of remedial alternatives in a CERCLA Feasibility Study (FS) state that a remedial action must:

- Be protective of human health and the environment
- Attain ARARs or define criteria for invoking a waiver
- Be cost effective
- Use permanent solutions to the maximum extent

USEPA has established nine evaluation criteria to address these statutory requirements under CERCLA. The criteria fall into the categories of threshold criteria, primary balancing criteria, and modifying criteria. Modifying criteria (i.e., state or support agency acceptance and community acceptance) will be evaluated after the public comment period on the SB/PP. Evaluation criteria categories and the nine evaluation criteria are listed and explained in the following discussion.

Threshold Criteria

Each alternative must meet the following threshold criteria to be selected as a permanent remedy under CERCLA.

1) **Overall protection of human health and the environment** - The overall protection of human health and the environment is evaluated for each alternative on the basis of how the alternative reduces the risk of exposure to contaminants from potential exposure pathways through engineered or ICs. Each alternative is examined as to whether it

creates any unacceptable short-term risks to human health. In addition, the RCRA criterion specifying control of source releases is evaluated.

2) **Compliance with ARARs** - Remedial actions under CERCLA are required to attain all ARARs. 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 (chemical-, action-, and location-specific) have been developed to simplify identification and compliance with environmental requirements. Chemical-specific requirements are media-specific and HBLs developed for site-specific levels of constituents in specific media. These limits establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. Location-specific ARARs are restrictions placed on the concentration of hazardous substances for the conduct of activities solely because they occur in special locations. Location-specific ARARs must consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area. Location-specific ARARs were evaluated to determine applicability to the Corrective Measures Study/Feasibility Study (CMS/FS).

Primary Balancing Criteria

Primary balancing criteria are factors that identify key tradeoffs among alternatives.

3) **Long-term effectiveness and permanence** - Long-term effectiveness and permanence are evaluated for each alternative on the basis of the magnitude of residual risk and the adequacy and reliability of controls used to manage remaining waste after response objectives have been achieved. Alternatives that offer long-term effectiveness and

permanence halt or otherwise mitigate any potential for offsite contaminant transport and minimize the need for future engineered controls. The degree of uncertainty with regard to treatment effectiveness is also evaluated.

4) **Reduction of mobility, toxicity, or volume through treatment** - The statutory preference is to select a remedial action that employs treatment to reduce the toxicity, mobility, or volume of hazardous substances. The degree to which alternatives employ recycling or treatment is assessed, including how treatment is used to address the principal threats posed by the unit.

5) **Short-term effectiveness** - Evaluation of alternatives for short-term effectiveness takes into account protection of remedial workers, members of the community, and the environment during implementation of the remedial action and the time required to achieve RAOs/RGs. Schedule estimates are based on projected availability of materials and labor and may have to be updated at the time of remediation.

6) **Implementability** - Each alternative is evaluated with respect to the technical and administrative feasibility of implementing the alternatives as well as the availability of necessary equipment and services. This criterion includes the ability to obtain services, capacities, equipment, and specialists necessary to construct components of the alternatives; the ability to operate the technologies and monitor their performance and effectiveness; and the ability to obtain necessary approvals from other agencies.

   Construction schedules are based on good weather, the ability to create and receive adequate and authorized access, and the availability of required utilities. All time estimates assume that the selected remedial design, including construction drawings, has been approved, and all negotiations with contractors and regulators have been concluded.

7) **Cost** - Accuracy of present-worth costs is +50/-30 percent according to USEPA guidance. Detailed cost estimates are derived from current information including vendor quotes, conventional cost-estimating guides (e.g., Means Site Work Cost Data), and costs associated with similar projects. Indirect cost percentages for capital and O&M costs are based upon estimating guidance, technical judgment, site overhead, and regulatory guidance considering the range of scope for an alternative. The cost estimates are included for comparison only and are not intended to forecast actual budgetary expenditures. The actual costs of the project depend on labor and material costs, site conditions, competitive market conditions, final project scope, and implementation schedule at the time that the remedial activities are initiated. In estimating the present-worth costs, a discount rate of 3.9% is used and inflation is assumed to be 0%. Present-worth costs for review of the site remedy every five years are given for each alternative for which residuals remain at the site. Present-worth costs for these items are based on an estimated time frame of operation. Cost estimates are presented in Appendix A.

Modifying Criteria

Modifying criteria (i.e., state or support agency acceptance; community acceptance) was considered during remedy selection.

8) **State or support agency acceptance** - The selected alternative should be acceptable to state and support agencies. State acceptance criteria was evaluated based on scoping meetings held between USDOE, USEPA, and SCDHEC, and based on comments received on the final SB/PP.

9) **Community Acceptance** - The concerns of the community should also be considered in presenting alternatives that would be acceptable to the community. Community acceptance was evaluated based on comments on the SB/PP received during the public comment period.

All of the alternatives have been evaluated against the seven CERCLA evaluation criteria that provide the basis for evaluating the alternatives and selecting a remedy (Tables 8 through 12). The purpose of this section is to identify key advantages and disadvantages of each alternative relative to one another and in relation to the two threshold criteria and five primary balancing criteria. Emphasis is placed on the two threshold criteria: Overall protection of human health and the environment and compliance with ARARs.

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Table 8. Comparative Analysis Summary for Building 313-M

Criterion	Alternative A-1	Alternative A-3	Alternative A-4
	No Action	Concrete Cap, Institutional Control	Passive Soil Vapor Extraction (SVE), Institutional Controls
Overall Protection of Human Health and the Environment			
Protection of Human Health	Not Protective	Protective; Provides a barrier to prevent human exposure	Protective; reduces future resident exposure to contaminants.
Protection of the Environment	Not Protective	Protective; Protects groundwater with a vapor barrier	Protective; Protects by treatment of VOCs to prevent contaminant migration
Effectiveness in Meeting Remediation Goal	Not Effective	Effective; barrier technology not very effective in reducing and VOCs to achieve RGOs	Effective; removal, disposal, treatment reduces VOCs to achieve RGOs
Compliance with ARARs			
Chemical-Specific	No action taken to meet chemical ARARs	Complies with protection of groundwater	Complies with protection of groundwater
Location-Specific	Not Applicable	Protective for migratory birds	Protective for migratory birds
Action-Specific	Not Applicable	Complies with land disturbance requirements	Complies with land disturbance requirements, air emission requirements, and hazardous waste management
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risks	Risk not reduced; vadose zone COC still pose risk to groundwater quality	Risks are reduced to acceptable levels by controlling exposure pathway and preventing impact to groundwater	Risks are reduced to acceptable levels by preventing impact to groundwater
Adequacy of Controls	Not Adequate	Adequate	Adequate
Permanence	Not Permanent	Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process	None	Not applicable	Passive SVE removes VOCs
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	Mobility is decreased with use of a barrier system	High - Contaminant mobility is reduced by treatment
Amount of Hazardous Materials Destroyed or Treated	None	Hazardous materials are not destroyed or treated	Would substantially reduce amount of VOCs in vadose zone
Degree to Which Treatment is Irreversible	No treatment	Reversible	Irreversible
Types and Quantities of Residuals Remaining after Treatment	None	VOC residuals remain	Minimal VOC residuals
Short-Term Effectiveness			
Risk to Remedial Workers	None	Minimal; limited land disturbance activities	Minimal; limited land disturbance activities
Risk to Community	None	None	None
Risks to Environment	None	Negligible	Negligible
Estimated Time Frame to Achieve RAOs	Not achieved	10 years	10 years
Implementability			
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward; materials, equipment, and labor are readily available	Straightforward; materials, equipment, and labor are readily available
Ability to Construct and Operate the Remedial Technology	Not Applicable	Readily implemented.	Readily implemented.
Ability to Obtain Permits/Approvals from Agencies	Readily implemented	Permits readily obtained	Permits readily obtained
Ability to Monitor Effectiveness of Remedy	Not Applicable	Readily monitored through inspections and groundwater sampling	Readily monitored through vacuum and flow measurements and sampling
Ease of Undertaking Additional Actions	Compatible	May not be compatible with simultaneous implementation of other actions	May not be compatible with simultaneous implementation of other actions
Time to Implement	0 months	3 months	4 months
Cost			
Total Estimated Capital Cost	**$0**	**$316,899**	**$119,635**
Total Estimated Present Worth O&M Cost	**$0**	**$235,255**	**$219,369**
Total Present-Worth Costs	**$0**	**$552,154**	**$339,005**

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Table 9. Comparative Analysis Summary for Building 321-M

Criterion	Alternative A-1	Alternative A-3	Alternative A-4
	No Action	Concrete Cap, Institutional Controls	Passive Soil Vapor Extraction (SVE), Institutional Controls
Overall Protection of Human Health and the Environment			
Protection of Human Health	Not Protective	Protective; Reduces contaminant impact to groundwater with a barrier	Protective; Reduces contaminant impact to groundwater by treatment
Protection of the Environment	Not Protective	Protective; Protects groundwater by providing a barrier to contaminant sources	Protective; Protects groundwater by depleting contaminant sources
Effectiveness in Meeting Remediation Goal	Not Effective	Not very effective in reducing VOCs to achieve RGOs	Effective; treatment reduces VOCs to achieve RGOs
Compliance with ARARs			
Chemical-Specific	No action taken to meet chemical ARARs	Complies with protection of groundwater	Complies with protection of groundwater
Location-Specific	Not Applicable	Protective for migratory birds	Protective for migratory birds
Action-Specific	Not Applicable	Complies with dust suppression management	Complies with air emission requirements, fugitive dust requirements, and hazardous waste management
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risks	Risk not reduced; vadose zone COC still pose risk to groundwater quality	Risks are reduced to acceptable levels by controlling exposure pathway and preventing impact to groundwater	Risks are reduced to acceptable levels by extracting VOCs and preventing impact to groundwater
Adequacy of Controls	Not Adequate	Adequate	Adequate
Permanence	Not Permanent	Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process	None	Barrier technology prevents migration of VOCs	Passive SVE for VOC removal
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	High-Contaminant mobility is reduced by a barrier	High - Contaminant mobility is reduced by treatment
Amount of Hazardous Materials Destroyed or Treated	None	Would not substantially reduce amount of VOCs in vadose zone	Would substantially reduce amount of VOCs in vadose zone
Degree to Which Treatment is Irreversible	No treatment	Reversible	Irreversible
Types and Quantities of Residuals Remaining after Treatment	None	VOC residuals would remain under the cover system	Minimal VOC residuals
Short-Term Effectiveness			
Risk to Remedial Workers	None	Minimal; limited land disturbance activities	Minimal; limited land disturbance activities
Risk to Community	None	None	None
Risks to Environment	None	Negligible	Negligible
Estimated Time Frame to Achieve RAOs	Not achieved	10 years	10 years
Implementability			
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward; materials, equipment, and labor are readily obtainable	Straightforward; materials, equipment, and labor are readily obtainable
Ability to Construct and Operate the Remedial Technology	Not Applicable	Readily implemented.	Readily implemented.
Ability to Obtain Permits/Approvals from Agencies	Readily implemented	Permits readily obtained	Permits readily obtained
Ability to Monitor Effectiveness of Remedy	Not Applicable	Readily monitored through sampling	Readily monitored through vacuum and flow measurements and sampling
Ease of Undertaking Additional Actions	Compatible	May not be compatible with simultaneous implementation of other actions	May not be compatible with simultaneous implementation of other actions
Time to Implement	0 months	3 months	4 months
Cost			
Total Estimated Capital Cost	**$0**	**$547,074**	**$932,938**
Total Estimated Present Worth O&M Cost	**$0**	**$235,255**	**$350,136**
Total Present-Worth Costs	**$0**	**$782,329**	**$1,283,074**

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Table 10. Comparative Analysis Summary for Building 320-M

Criterion	Alternative A-1	Alternative A-3	Alternative A-4
	No Action	Concrete Cap, Institutional Controls	Passive Soil Vapor Extraction (SVE), at MIPSL Tie-In, Institutional Controls
Overall Protection of Human Health and the Environment			
Protection of Human Health	Not Protective	Protective; Reduces contaminant impact to groundwater with a barrier	Protective; Reduces contaminant impact to groundwater by treatment
Protection of the Environment	Not Protective	Protective; Protects groundwater by providing a barrier to contaminant sources	Protective; Protects groundwater by depleting contaminant sources
Effectiveness in Meeting Remediation Goal	Not Effective	Not very effective in reducing VOCs to achieve RGOs	Effective; treatment reduces VOCs to achieve RGOs
Compliance with ARARs			
Chemical-Specific	No action taken to meet chemical ARARs	Complies with protection of groundwater	Complies with protection of groundwater
Location-Specific	Not Applicable	Protective for migratory birds	Protective for migratory birds
Action-Specific	Not Applicable	Complies with dust suppression management	Complies with air emission requirements, fugitive dust requirements, and hazardous waste management
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risks	Risk not reduced; vadose zone COC still pose risk to groundwater quality	Risks are reduced to acceptable levels by controlling exposure pathway and preventing impact to groundwater	Risks are reduced to acceptable levels by extracting VOCs and preventing impact to groundwater
Adequacy of Controls	Not Adequate	Adequate	Adequate
Permanence	Not Permanent	Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process	None	Barrier technology prevents migration of VOCs	Passive SVE for VOC removal
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	High-Contaminant mobility is reduced by a barrier	High - Contaminant mobility is reduced by treatment
Amount of Hazardous Materials Destroyed or Treated	None	Would not substantially reduce amount of VOCs in vadose zone	Would substantially reduce amount of VOCs in vadose zone
Degree to Which Treatment is Irreversible	No treatment	Reversible	Irreversible
Types and Quantities of Residuals Remaining after Treatment	None	VOC residuals would remain under the cover system	Minimal VOC residuals
Short-Term Effectiveness			
Risk to Remedial Workers	None	Minimal; limited land disturbance activities	Controlled through Work Plan
Risk to Community	None	None	None
Risks to Environment	None	Negligible	Negligible
Estimated Time Frame to Achieve RAOs	Not achieved	10 years	10 years
Implementability			
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward; materials, equipment, and labor are readily obtainable	Straightforward; materials, equipment, and labor are readily obtainable
Ability to Construct and Operate the Remedial Technology	Not Applicable	Readily implemented.	Readily implemented.
Ability to Obtain Permits/Approvals from Agencies	Readily implemented	Permits readily obtained	Permits readily obtained
Ability to Monitor Effectiveness of Remedy	Not Applicable	Readily monitored through sampling	Readily monitored through vacuum and flow measurements and sampling
Ease of Undertaking Additional Actions	Compatible	May not be compatible with simultaneous implementation of other actions	May not be compatible with simultaneous implementation of other actions
Time to Implement	0 months	3 months	4 months
Cost			
Total Estimated Capital Cost	**$0**	**$345,946**	**$110,484**
Total Estimated Present Worth O&M Cost	**$0**	**$235,255**	**$350,136**
Total Present-Worth Costs	**$0**	**$581,201**	**$460,620**

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Table 11. Comparative Analysis Summary for Buildings 322-M, 341-M, 341-1M, 341-8M, 305-A, 777-10A, 340-M, 324-M, 741-A, 740-A, 743-A

Criterion	Alternative 1	Alternative 2
	No Action	**Institutional Controls**
Overall Protection of Human Health and the Environment		
Protection of Human Health	Not Protective	Protective; Reduces future resident exposure to contaminants
Protection of the Environment	Not Protective	Protective; Limits access and work performed in the area
Effectiveness in Meeting Remediation Goal	Not Effective	Not Applicable
Compliance with ARARs		
Chemical-Specific	No action taken to meet chemical ARARs	Not Applicable
Location-Specific	Not Applicable	Not Applicable
Action-Specific	Not Applicable	Not Applicable
Long-Term Effectiveness and Permanence		
Magnitude of Residual Risks	Minimal volatile organic compound (VOC) risks	Minimal risks remain but are controlled to limit access and prevent exposure.
Adequacy of Controls	Not Adequate	Adequate
Permanence	Not Permanent	Permanent
Reduction of Toxicity, Mobility, or Volume Through Treatment		
Treatment Process	None	None
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	Not Applicable
Amount of Hazardous Materials Destroyed or Treated	None	Not Applicable
Degree to Which Treatment is Irreversible	No Treatment	Not Applicable
Types and Quantities of Residuals Remaining after Treatment	None	None
Short-Term Effectiveness		
Risk to Remedial Workers	None	None
Risk to Community	None	None
Risks to Environment	None	None
Estimated Time Frame to Achieve RAOs	Not Achieved	1 month
Implementability		
Availability of Materials, Equipment, and Skilled Labor	Not Applicable	Straightforward; materials are readily available
Ability to Construct and Operate the Remedial Technology	Not Applicable	Readily implemented
Ability to Obtain Permits/Approvals from Agencies	Readily implemented	Permits readily obtainable
Ease of Undertaking Additional Actions	Compatible	Compatible
Time to Implement	0 months	1 month
Cost		
Total Estimated Capital Cost	**$0**	**$106,920**
Total Estimated Present Worth Operations and Maintenance (O&M) Cost	**$0**	**$219,369**
Total Present – Worth Costs	**$0**	**$326,289**

Table 12. Comparative Analysis Summary for the MAOU Warranting Action

Building	Alternative	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	Overall Ranking (range 1 – 20)
313-M	A-1. No Action	No	NA	1	NA	1	5	$0	7
	A-3. Concrete Cap, Institutional Controls	Yes	Yes	5	3	4	5	$552,154	17
	A-4. Passive Soil Vapor Extraction, Institutional Controls	Yes	Yes	5	5	4	4	339,005	18
321-M	A-1. No Action	No	Na	1	NA	1	5	$0	7
	A-3. Concrete Cap, Institutional Controls	Yes	Yes	5	3	4	5	$782,329	17
	A-4. Passive Soil Vapor Extraction, Institutional Controls	Yes	Yes	5	5	4	4	$1,283,074	18
320-M	A-1. No Action	No	NA	1	NA	1	5	$0	7
	A-3. Concrete Cap, Institutional Controls	Yes	Yes	5	3	4	5	$581,201	17
	A-4. Passive Soil Vapor Extraction, at MIPSL tie-in, Institutional Controls	Yes	Yes	5	5	4	4	$460,620	18
322-M, 341-M, 341-1M, 341-8M, 305-A, 777-10A, 340-M, 324-M, 741-A, 740-A, 743-A	1. No Action	No	NA	1	NA	1	5	$0	7
	2. Institutional Controls	Yes	Yes	5	0	5	5	$326,289	15

NOTE: Numeric range 1 – 5, where 1 = worst and 5 = best; NA = Not Applicable

The following rationale was used to rank the first 6 of the 9 CERCLA FS criteria.

For the ranking of (1) Overall Protection of Human Health and the Environment, and (2) Compliance with ARARs, the alternatives were simply ranked with a Yes or a No. If the alternative would satisfy the criteria, a Yes is indicated; however, if an alternative would not satisfy the criteria, a No is designated. In instances where a criteria is not addressed an NA is designated. Numerically, an NA is equivalent to a ranking of 0.

For criteria (3) Long-term Effectiveness and Permanence, the alternatives were ranked on the basis of the magnitude of residual risk, adequacy, and the reliability of controls used to manage remaining wastes after the response objectives have been achieved. For the MAOU, all of the alternatives with the exception of the No Action alternative are equivalently ranked a 5 because they offer the highest degree of long-term effectiveness and permanence.

For criteria (4) Reduction of Toxicity, Mobility, or Volume through Treatment, alternative 2 for all the MAOU facilities under evaluation are given the highest ranking 5 because SVE actively reduces toxicity, mobility, and volume through treatment. Alternative 3, cover systems, are given a moderate score of 3 because the alternative does not actively treat the contaminants.

For criteria (5), Short-term Effectiveness, the No Action alternative was given a low ranking of 1 when considering protection of remedial workers, members of the community, and environment during the implementation of the remedial action, and time to achieve RAO/RGOs. Alternatives 2 and 3 for each of the MAOU facilities were equivalently ranked at 4 when accounting the short-term effectiveness factors indicated earlier.

For criteria (6) Implementability, the SVE alternative A-4 is ranked at 4 when considering the technical and administrative feasibility of implementation as well as the availability of necessary equipment and services. Concrete capping is more easily implemented and is ranked with a 5.

However, key tradeoffs between alternatives are identified through a comparative evaluation against the five primary balancing criteria: long-term effectiveness and permanent reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The five primary balancing criteria were assigned subjective values to aid in performing the comparative analyses. The final two modifying criteria – state or support agency acceptance and community acceptance – will be evaluated following the comment period for the SB/PP.

Alternatives Addressing VOC-Contaminated Media

Overall Protection of Human Health and the Environment

With the exception of Alternative A-1, all alternatives are protective of human health and the environment. Alternative A-4 offers the most protection by addressing VOC contamination with passive SVE treatment with Baroball™ technology to prevent contaminant migration. Alternative A-3 is a less aggressive alternative that addresses the VOC contamination with concrete cover systems to prevent water infiltration and minimize contaminant migration. Both Alternatives A-3 and A-4 equally and sufficiently include IC measures for the manholes and remnant areas to limit site access and use.

Compliance with ARARs

Chemical-Specific ARARs. With the exception of Alternative A-1, all of the alternatives will comply with protection of groundwater ARARs. Alternative A-4 would be the most effective for complying with the chemical ARARS followed by Alternative A-3.

Location-Specific ARARs. With the exception of Alternative A-1, all of the alternatives will comply with protection of migratory birds.

Action-Specific ARARs. With the exception of Alternative A-1, all of the alternatives would comply with their pertinent ARARs. Both Alternatives A-3 and A-4 would meet

air emission requirements, fugitive dust requirements, and hazardous waste management requirements.

Long-Term Effectiveness and Permanence

Alternative A-4 offers the greatest degree of risk reduction, long-term effectiveness, and permanence since the migration of VOC contaminants to the groundwater is prevented with SVE treatment. Alternative A-3 has the next highest level of effectiveness and permanence because a concrete cap system would only act as a barrier system and not be as proactive in treating VOC contamination. Alternative A-1 has no long-term effectiveness or permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative A-4 provides the greatest reduction in toxicity, mobility, and volume through treatment with SVE. Alternative A-3 does not treat the contaminants but offers a barrier system to minimize infiltration and thus contaminant mobility. Alternative A-1 involves no treatment.

Short-Term Effectiveness

Alternative A-4 provides the most risk to remedial workers and environment since it involves setup of SVE well networks. Additionally, at 321-M, earthwork and placement of a geosynthetic cover pose more risk to workers and the environment. Because of the location of MAOU within SRS, there are negligible risks to surrounding communities. Alternative A-3 provides a lesser amount of risk to the remedial workers and environment than Alternative A-4 because it involves placement of concrete cover systems. No remedial activities are associated with Alternative A-1; therefore, no risks to remedial workers, the environment, or community exist.

Implementability

Equipment, materials, and skilled labor are readily available to support all of the alternatives. Alternative A-4 has the most complexity due to its constructability of SVE well network and earthwork at 321-M. Alternative A-3 is the most easily implemented due to simple cover system configurations. No implementation is associated with Alternative 1.

Cost

Alternative 1, no action, is the least expensive of all the three alternatives to implement. Tables 8 through 11 depict the comparative analysis summary of the alternatives. A cost summary of the other alternatives per building is provided in Table 12, which depicts the comparative ranking of the alternatives.

MAOU Remnant Areas

For the purpose of evaluating the No Action Alternative and Institutional Controls alternative, it is recognized that ICs would offer sufficient overall protection of human health and the environment, control the minimal residual risk, and provide adequate controls. Additionally, ICs would have no risks to the remedial workers, community, and environment, and be easily implemented with a nominal cost.

XI. THE SELECTED REMEDY

Detailed Description of the Selected Remedy

Following the early actions, VOC contamination that poses a contamination migration threat will remain in the vadose zone soils at the 313-M, 321-M, and 320-M locations. The selected remedy for the final remedial action is:

Passive Soil Vapor and Extraction and Institutional Controls

Vadose zone remediation using SVE reduces and removes the VOC source and is typically performed to manage the release of VOCs to groundwater. For example, the groundwater may be contaminated with VOCs above the MCL or the concentrations within the vadose zone are elevated enough to threaten groundwater. SVE is expected to improve groundwater conditions by reducing the further migration of VOCs to groundwater. SVE is a common technology that is implemented to manage the release of VOCs from sources in the vadose zone to prevent impact to groundwater. SVE removes the VOC from the soil by evacuating the soil gas from the contaminated soil. The pressure gradient created by the vacuum causes the soil-gas to flow through the soil pore spaces toward the wells. This remedy has two beneficial aspects. The first is that the remedy focuses on the VOC contamination that has been mobilized and is in the form of soil gas. By removing the soil gas, there is a relatively immediate impact on groundwater since the source of contamination to the groundwater has been cut off. The second benefit is that SVE is a treatment technology that over time reduces the mass of contamination in the subsurface.

This second aspect of the remedy is a key to meeting the RGs that were established for this remediation. The final RG is a model derived number, and as such does not definitively establish when the threat to groundwater has been mitigated. Every attempt will be made to meet the established RGs as finalized following public comment. The effect of VOC soil contamination on the groundwater depends on multiple factors, including both concentration and mobility. Thus recognized, RGs may not be the sole indicator used to determine when degradation to groundwater has been halted and/or the threat to groundwater has been eliminated. Additional data and information may be used by the Core Team to establish these conditions. SRS believes that it is important to review all the monitoring data, including VOC concentrations in soil, soil-gas extracted by the SVE system, and groundwater concentrations when determining the effectiveness of a particular SVE technology in achieving RAOs.

ICs will be implemented throughout the MAOU and remnant facilities as outlined in Table 13.

The selected alternative was selected because it effectively uses treatment to curtail contaminant migration of VOCs.

The alternative provides the best balance of tradeoffs between alternatives because contaminant toxicity, mobility, and volume is reduced. Additionally, less VOC residual contamination remains at the site. ICs are readily implementable and do not increase worker risk. Based upon the information currently available, the lead agency believes that the selected alternative provides the best balance of tradeoffs with respect to the evaluation criteria.

USDOE expects the selected alternative to satisfy the statutory requirements in CERCLA Section 121(b) to (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected alternative can change in response to public comment or new information.

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Table 13. Land Use Controls for the MAOU

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas[a]
1. Property Record Notices[b]	Provide notice to anyone searching records about the existence and location of contaminated areas.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
2. Property record restrictions[c]: A. Land Use B. Groundwater	Restrict use of property by imposing limitations. Prohibit the use of groundwater.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Drafted and implemented by USDOE upon any transfer of affected areas. Recorded by USDOE in accordance with state law at County Register of Deeds office.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
3. Other Notices[d]	Provide notice to city &/or county about the existence and location of waste disposal and residual contamination areas for zoning/planning purposes.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Notice recorded by USDOE in accordance with state laws at County Register of Deeds office if the property or any portion thereof is ever transferred to non-federal ownership.	All waste management areas and other areas where hazardous substances are left in place at levels requiring land use and/or groundwater restrictions.
4. Site Use Program[e]	Provide notice to worker/developer (i.e., permit requestor) on extent of contamination and prohibit or limit excavation/penetration activity.	As long as property remains under USDOE control	Implemented by DOE and site contractors Initiated by permit request	Remediation systems, all waste management areas, and areas where levels requiring land use and / or groundwater restrictions.
5. Physical Access Controls[f] (e.g., fences, gates, portals)	Control and restrict access to workers and the public to prevent unauthorized access.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Controls maintained by USDOE.	At select locations throughout SRS.

Table 13. Land Use Controls for the MAOU *(Continued/End)*

Type of Control	Purpose of Control	Duration	Implementation	Affected Areas
6. Warning Signs[g]	Provide notice or warning to prevent unauthorized uses.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Signage maintained by USDOE.	At select locations throughout SRS
7. Security Surveillance Measures	Control and monitor access by workers/public.	Until the concentrations of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use.	Established and maintained by USDOE Necessity of patrols evaluated upon completion of remedial actions.	Patrol of selected area throughout SRS, as necessary.

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

ICs will be implemented by:

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

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

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

The deed shall also include deed restrictions precluding residential use of the property. The deed shall expressly prohibit activities inconsistent with the RGs and objectives in this ROD upon any and all transfers. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for the deed restrictions will be done through an amended ROD with USEPA and SCDHEC review and approval.

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

The selected remedy for the MAOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions for an indefinite period of time. As agreed on March 30, 2000, among the USDOE, USEPA, and SCDHEC, SRS is implementing a Land Use Control and Assurance Plan (LUCAP) to ensure that the Land Use Controls (LUCs) required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific LUCIP referenced in this ROD will provide details and specific measures required to implement and maintain the LUCs selected as part of this remedy. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs selected under this ROD. The LUCIP, developed as part of this action, will be submitted concurrently with the CMI/RAIP, as required in the FFA for review and approval by USEPA and SCDHEC. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA and the SRS FFA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the unit. The LUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. The deed shall expressly prohibit activities inconsistent with the RGs and objectives in this ROD upon any and all transfers. The LUCs shall be maintained until the concentration of hazardous substances associated with the unit have been reduced to levels that allow for unlimited exposure and unrestricted use. Approval by USEPA and SCDHEC is required for any modification or termination of the ICs.

USDOE has recommended that residential use of SRS land be controlled; therefore, future residential use and potential residential water usage will be restricted to ensure long-term protectiveness. Land use controls, including ICs, will restrict the MAOU to future industrial use and will prohibit residential use of the area. Unauthorized excavation

will also be prohibited and the waste unit will remain undisturbed. Land use controls selected as part of this action will be maintained for as long as they are necessary and termination of any land use controls will be subject to CERCLA requirements for documenting changes in remedial actions.

The LUC objectives necessary to ensure the protectiveness of the selected remedy are

- restrict worker access and prevent unauthorized contact, removal or excavation of contaminated media
- prevent access through manholes and pipelines
- prohibit the development and use of property for residential housing, elementary schools, child care facilities and playgrounds
- maintain the integrity of any current or future remedial or monitoring system such as SVE systems or groundwater monitoring wells
- prevent access to or use of the groundwater until cleanup levels are met (under the RCRA program)

Cost Estimate for the Selected Remedy

Passive Soil Vapor Extraction and Institutional Controls

Total Capital Cost: $1,269,977

Present-Worth O&M Cost: $1,139,010

Total Present-Worth Cost: $2,408,987

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during

the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record File, an explanation of significant difference (ESD), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

A detailed cost estimate is presented in Appendix B of this document.

Estimated Outcomes of Selected Remedy

The expected condition after the selected alternative is implemented is that the ICs will prevent access by human receptors, and that SVE will prevent future leaching of CM COCs to groundwater above MCLs. The groundwater will be remediated as specified in the SRS RCRA Part B Permit and addressed by the requirements of the M Area and Metallurgical Laboratory Hazardous Waste Management Facilities Groundwater Monitoring and Corrective Action agreement. The MAOU would be available for SRS use as an industrial area with land use restrictions.

Waste Disposal and Transport

The waste streams generated during the remedial action may include: condensate from SVE units, well drilling material (typically described as non-aqueous fluids), personal protective equipment (PPE)/job control waste (JCW), failed equipment (e.g., SVE system components), rinse and wash solutions, and decontamination liquids. Each of these waste streams has been previously dispositioned during the characterization phase of the MAOU.

- All unused environmental samples may be returned to the waste site, within the Area of Contamination. This only includes samples that have had no preservatives added.

- Decontamination solutions and rinsates from cleaning items intended for reuse or recycle (e.g., field sampling tools, equipment, or personal protective equipment) may

be discharged to the ground surface at an area which will not runoff or cause erosion. This method for handling decontamination solutions does not require an engineering evaluation to determine a waste disposal strategy. Decontamination wash and rinse solutions typically include laboratory grade soap and deionized water, and laboratory grade isopropyl alcohol for residual organic compound stripping and tool drying. Any residual isopropyl alcohol must be containerized and combined with the soapy wash water before the solution is discharged to the ground surface, to avoid discharging an ignitable hazardous solution.

- Environmental sampling boreholes may be abandoned by backfilling with native soil. This is regardless of the level of contamination. The soil will be placed in the borehole in the reverse order as removed, to maintain the original stratigraphy. Environmental media and/or secondary waste will be determined to no longer contain listed hazardous waste by direct comparison to the Investigation-Derived Waste Management Plan (WSRC 2007c) HBLs for soil and groundwater.

- Environmental media that contains RCRA-listed waste is subject to applicable RCRA requirements until determined to no longer contain hazardous waste. Environmental media and/or secondary waste will be determined to no longer contain listed hazardous waste by direct comparison to the HBLs for soil and groundwater. The HBLs for soil are based on the lower of (1) the USEPA Region 9 Preliminary Remediation Goals (PRGs) for the residential exposure scenario or (2) the RCRA toxicity characteristic level (due to the 20-fold dilution factor inherent in the toxic characteristic leaching procedure (TCLP) analysis of solids, the RCRA TCLP values are multiplied by 20). Due to the analytical method limitations, groundwater (as defined by South Carolina Regulation 61-68) HBLs are based on the higher of (1) MCLs, or (2) USEPA RCRA (SW-846) analytical minimum detection levels (MDLs).

XII. STATUTORY DETERMINATIONS

Based on the unit RFI/RI/BRA report, the MAOU poses a threat to human health and the environment. Therefore, Alternative A-4, Passive Soil Vapor Extraction and Institutional Controls, has been selected as the remedy for the MAOU. The MAOU is located in an area of historically heavy industrial and nuclear land use, and future industrial land use is anticipated.

This alternative was selected because it effectively treats contaminant migration to groundwater. Alternative A-4 is protective of human health and the environment and complies with ARARs. It provides the best balance of tradeoffs between alternatives because contaminant mobility and volume is reduced through treatment, and SVE is a readily implementable technology. Passive SVE will be implemented to address contaminant migration to groundwater along the MAOU.

The selected alternative satisfies the statutory requirements in CERCLA Section 121(b) to (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected alternative satisfies the preference for treatment as a principal element of the remedy.

The SRS RCRA permit will be revised to reflect selection of the final remedy using the procedures under 40 CFR Part 270 and SCHWMR R.61-79.264;270.

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

XIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy/remedies selected in this ROD do not contain any significant changes from the preferred alternative(s) presented in the SB/PP.

XIV. RESPONSIVENESS SUMMARY

The Responsiveness Summary serves the dual purposes of (1) presenting stakeholder concerns about the site and preferences regarding the remedial alternatives, and (2) explaining how those concerns were addressed and how the preferences were factored into the remedy selection process. The Responsiveness Summary is included as Appendix A of this document.

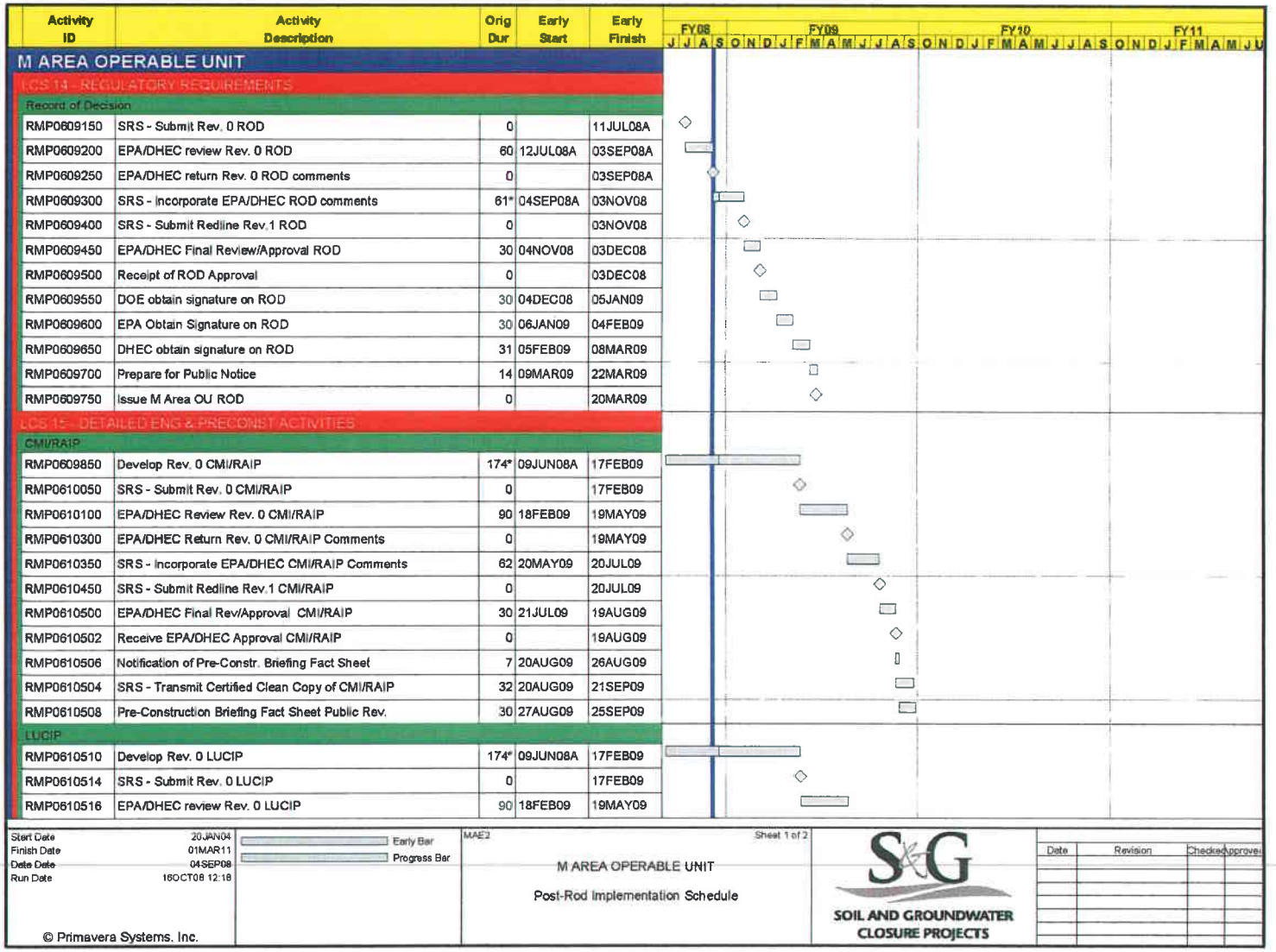
XV. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

A detailed schedule for the ROD and post-ROD activities is shown in Figure 12.

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

- SRS submittal of Revision 0 CMI/RAIP and Revision 0 LUCIP is scheduled for February 17, 2009.
- USEPA and SCDHEC will receive 90 calendar days for review of the Revision 0 CMI/RAIP and Revision 0 LUCIP.
- The SRS revision of the CMI/RAIP and LUCIP will be completed 60 calendar days after receipt of all regulatory comments on each of the documents.
- USEPA and SCDHEC will receive 30 days for final review and approval of the CMI/RAIP and LUCIP.
- The projected Remedial Action start date is September 30, 2009.

- The Revision 0 Post-Construction Report will be submitted to USEPA and SCDHEC after completion of the remedial action in accordance with the implementation schedule in the approved MAOU CMI/RAIP.



Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
M AREA OPERABLE UNIT				
LCS 14 - REGULATORY REQUIREMENTS				
Record of Decision				
RMP0609150	SRS - Submit Rev. 0 ROD	0		11JUL08A
RMP0609200	EPA/DHEC review Rev. 0 ROD	60	12JUL08A	03SEP08A
RMP0609250	EPA/DHEC return Rev. 0 ROD comments	0		03SEP08A
RMP0609300	SRS - Incorporate EPA/DHEC ROD comments	61*	04SEP08A	03NOV08
RMP0609400	SRS - Submit Redline Rev.1 ROD	0		03NOV08
RMP0609450	EPA/DHEC Final Review/Approval ROD	30	04NOV08	03DEC08
RMP0609500	Receipt of ROD Approval	0		03DEC08
RMP0609550	DOE obtain signature on ROD	30	04DEC08	05JAN09
RMP0609600	EPA Obtain Signature on ROD	30	06JAN09	04FEB09
RMP0609650	DHEC obtain signature on ROD	31	05FEB09	08MAR09
RMP0609700	Prepare for Public Notice	14	09MAR09	22MAR09
RMP0609750	Issue M Area OU ROD	0		20MAR09
LCS 15 - DETAILED ENG & PRECONST ACTIVITIES				
CMI/RAIP				
RMP0609850	Develop Rev. 0 CMI/RAIP	174*	09JUN08A	17FEB09
RMP0610050	SRS - Submit Rev. 0 CMI/RAIP	0		17FEB09
RMP0610100	EPA/DHEC Review Rev. 0 CMI/RAIP	90	18FEB09	19MAY09
RMP0610300	EPA/DHEC Return Rev. 0 CMI/RAIP Comments	0		19MAY09
RMP0610350	SRS - Incorporate EPA/DHEC CMI/RAIP Comments	62	20MAY09	20JUL09
RMP0610450	SRS - Submit Redline Rev.1 CMI/RAIP	0		20JUL09
RMP0610500	EPA/DHEC Final Rev/Approval CMI/RAIP	30	21JUL09	19AUG09
RMP0610502	Receive EPA/DHEC Approval CMI/RAIP	0		19AUG09
RMP0610506	Notification of Pre-Constr. Briefing Fact Sheet	7	20AUG09	26AUG09
RMP0610504	SRS - Transmit Certified Clean Copy of CMI/RAIP	32	20AUG09	21SEP09
RMP0610508	Pre-Construction Briefing Fact Sheet Public Rev.	30	27AUG09	25SEP09
LUCIP				
RMP0610510	Develop Rev. 0 LUCIP	174*	09JUN08A	17FEB09
RMP0610514	SRS - Submit Rev. 0 LUCIP	0		17FEB09
RMP0610516	EPA/DHEC review Rev. 0 LUCIP	90	18FEB09	19MAY09

Figure 12. Post-ROD Schedule

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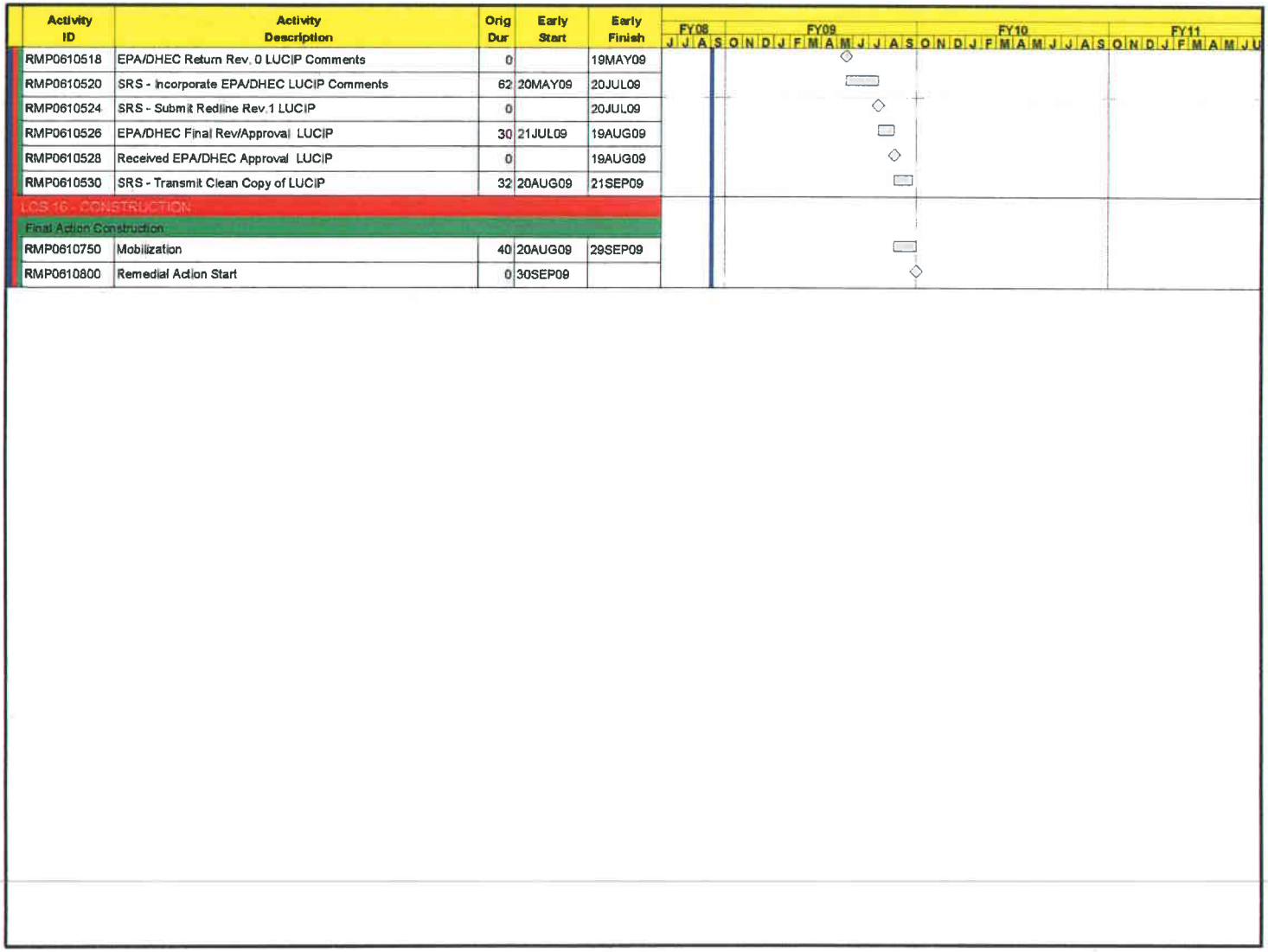

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
RMP0610518	EPA/DHEC Return Rev. 0 LUCIP Comments	0		19MAY09
RMP0610520	SRS - Incorporate EPA/DHEC LUCIP Comments	62	20MAY09	20JUL09
RMP0610524	SRS - Submit Redline Rev.1 LUCIP	0		20JUL09
RMP0610526	EPA/DHEC Final Rev/Approval LUCIP	30	21JUL09	19AUG09
RMP0610528	Received EPA/DHEC Approval LUCIP	0		19AUG09
RMP0610530	SRS - Transmit Clean Copy of LUCIP	32	20AUG09	21SEP09
LCS 16 - CONSTRUCTION				
Final Action Construction				
RMP0610750	Mobilization	40	20AUG09	29SEP09
RMP0610800	Remedial Action Start	0	30SEP09	

Sheet 2 of 2

Figure 12. Post-ROD Schedule *(Continued)*

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XVI. REFERENCES

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APPENDIX A

RESPONSIVENESS SUMMARY

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Responsiveness Summary

The 45-day public comment period for the SB/PP for the MAOU began on May 13, 2008, and ended on June 26, 2008. No comments were received from the public.

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APPENDIX B

SELECTED REMEDY DETAILED COST ESTIMATE

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Table B.1 313-M Alternative A-4

Passive SVE, Institutional Controls
M Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Baroball Well (2 in well @ 35 ft)	1	ea	$3,000	$3,000	
Plug Manhole Inverts and Grout Manholes	12	ea	$2,000	$24,000	
Institutional Controls					
Posting of Warning Signs	4	ea	$50	$200	
Land Use Control Implementation Plan	1	ea	$5,000	$5,000	
Deed Restrictions	1	ea	$5,000	$5,000	
Subtotal - Direct Capital Cost				$37,200	*
Mobilization/Demobilization	30%	of subtotal direct capital		$11,160	*
Site Preparation/Site Restoration	30%	of subtotal direct capital		$11,160	*
Total Direct Capital Cost	(sum of * items)			**$59,520**	
Indirect Capital Costs					
Engineering & Design	20%	of direct capital		$11,904	
Project/Construction Management	25%	of direct capital		$14,880	
Health & Safety	6%	of direct capital		$3,571	
Overhead	30%	of direct capital		$17,856	
Contingency	20%	of direct capital		$11,904	
Total Indirect Capital Cost				**$60,115**	
Total Estimated Capital Cost				**$119,635**	
Direct O&M Costs	3.9% discount rate for costs > 30 years duration[1]				
Annual Costs (Existing System during Post-ROD Design & Const)	2 years O&M			*Years 2008 - 2009*	
Access Controls	1	ea	$500	$500	
Subtotal - Annual Costs				$500	
Present Worth Annual Costs (2.1% Discount Rate)				$969	
Annual Costs (Institutional Controls)	10 years O&M			*Years 2010 - 2019*	
Access Controls	1	ea	$500	$500	
Annual Inspections / Maintenance	1	ea	$5,000	$5,000	
Subtotal - Annual Costs				$5,500	
Present Worth Annual Costs (3.2% Discount Rate)				$43,605	
Five Year Costs	3				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$31,070	
Total Present Worth Direct O&M Cost				**$75,645**	
Indirect O&M Costs					
Project/Admin Management	124%	of direct O&M		$93,799	
Health & Safety	21%	of direct O&M		$15,885	
Overhead	30%	of direct O&M		$22,693	
Contingency	15%	of direct O&M		$11,347	
Total Present Worth Indirect O&M Cost				**$143,725**	
Total Estimated Present Worth O&M Cost				**$219,369**	
TOTAL ESTIMATED COST				**$339,005**	

1. Interest rate for costs with duration <30 years (i.e., before 2034) is based on SRS' 16 April 2002 Technical Memorandum.

Table B.2 321-M Alternative A-4

Passive SVE of Stockpiled Soils, Institutional Controls
M Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Prep Infiltration Control Barrier Location					
Excavate Area / Stockpile Soil / Prep Area to Accept Early Actions Soils	1375	bcy	$8	$11,000	
Stockpiled Soil From Early Actions (320-M & 321-M)					
Excavate Stockpiled Soils	1100	lcy	$8	$8,800	
Transport Stockpiled Soils From 320-M and 321-M	1100	lcy	$17	$18,700	
Place / Contour Stockpiled Soils (Machine)	1100	lcy	$11	$12,100	
Place / Contour Stockpiled Soils - Baroball Wells / Perforated Pipe (Hand)	275	lcy	$25	$6,875	
Fab / Install Perforated PVC Pipe (lower level & upper level) - Tie-in to Passive SVE	3000	lf	$11	$33,000	
Infiltration Control Barrier					
Infiltration Barrier - Geosynthetic Clay Layer (GCL) Sealed at Baroball Wells	16500	sf	$4	$66,000	
Equipment Decontamination (Allowance)	1	lt	$5,000	$5,000	
Backfill With Common Fill One Foot Over GCL	667	lcy	$31	$20,677	
Vegetative Layer (1.5 ft Common Fill + 0.5 ft Topsoil)	1334	lcy	$35	$46,690	
Backfill Constituent / Inplace Density Testing	6	ea	$250	$1,500	
Baroball Well (2 in well @ 35 ft)	16	ea	$3,000	$48,000	
Plug Manhole Inverts and Grout Manholes	12	ea	$2,000	$24,000	
Institutional Controls					
Posting of Warning Signs	4	ea	$50	$200	
Land Use Control Implementation Plan	1	ea	$5,000	$5,000	
Deed Restrictions	1	ea	$5,000	$5,000	
Subtotal - Direct Capital Cost				$312,542	*
Mobilization/Demobilization	25% of subtotal direct capital			$78,136	*
Site Preparation/Site Restoration	25% of subtotal direct capital			$78,136	*
Total Direct Capital Cost	(sum of * items)			**$468,813**	
Indirect Capital Costs					
Engineering & Design	18% of direct capital			$84,386	
Project/Construction Management	25% of direct capital			$117,203	
Health & Safety	6% of direct capital			$28,129	
Overhead	30% of direct capital			$140,644	
Contingency	20% of direct capital			$93,763	
Total Indirect Capital Cost				**$464,125**	
Total Estimated Capital Cost				**$932,938**	
Direct O&M Costs	3.9% discount rate for costs > 30 years duration[1]				
Annual Costs (Existing System during Post-ROD Design & Const)	2 years O&M			*Years 2008 - 2009*	
Access Controls	1	ea	$500	$500	
Subtotal - Annual Costs				$500	
Present Worth Annual Costs (2.1% Discount Rate)				$969	
Annual Costs (Passive Soil Vapor Extraction Operation - Baroballs)	10 years O&M			*Years 2010 - 2019*	
Access Controls	1	ea	$500	$500	
Annual Inspections	1	ea	$5,000	$5,000	
Performance Analysis Report	1	ea	$10,000	$10,000	
Subtotal - Annual Costs				$15,500	
Present Worth Annual Costs (3.2% Discount Rate)				$122,888	
Five Year Costs	3				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$31,070	
Total Present Worth Direct O&M Cost				**$154,927**	
Indirect O&M Costs					
Project/Admin Management	71% of direct O&M			$109,998	
Health & Safety	10% of direct O&M			$15,493	
Overhead	30% of direct O&M			$46,478	
Contingency	15% of direct O&M			$23,239	
Total Present Worth Indirect O&M Cost				**$195,208**	
Total Estimated Present Worth O&M Cost				**$350,136**	
TOTAL ESTIMATED COST				**$1,283,074**	

1. Interest rate for costs with duration <30 years (i.e., before 2034) is based on SRS' 16 April 2002 Technical Memorandum.
(ERTEC-52002-0001)

Table B.3 320-M Alternative A-4

Passive SVE at MIPSL Tie-in and Institutional Controls
M Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Baroball Well (2 in well @ 35 ft)	1	ea	$3,000	$3,000	
Plug Manhole Inverts and Grout Manholes	12	ea	$2,000	$24,000	
Institutional Controls					
Posting of Warning Signs	4	ea	$50	$200	
Land Use Control Implementation Plan	1	ea	$5,000	$5,000	
Deed Restrictions	1	ea	$5,000	$5,000	
Subtotal - Direct Capital Cost				$37,200	*
Mobilization/Demobilization	25%	of subtotal direct capital		$9,300	*
Site Preparation/Site Restoration	25%	of subtotal direct capital		$9,300	*
Total Direct Capital Cost	(sum of * items)			**$55,800**	
Indirect Capital Costs					
Engineering & Design	18%	of direct capital		$10,044	
Project/Construction Management	25%	of direct capital		$13,950	
Health & Safety	5%	of direct capital		$2,790	
Overhead	30%	of direct capital		$16,740	
Contingency	20%	of direct capital		$11,160	
Total Indirect Capital Cost				**$54,684**	
Total Estimated Capital Cost				**$110,484**	
Direct O&M Costs	3.9% discount rate for costs > 30 years duration[1]				
Annual Costs (Existing System during Post-ROD Design & Const)	2 years O&M			*Years 2008 - 2009*	
Access Controls	1	ea	$500	$500	
Subtotal - Annual Costs				$500	
Present Worth Annual Costs (2.1% Discount Rate)				$969	
Annual Costs (Passive Soil Vapor Extraction Operation - Baroballs)	10 years O&M			*Years 2009 - 2019*	
Access Controls	1	ea	$500	$500	
Annual Inspections / Maintenance	1	ea	$5,000	$5,000	
Performance Analysis Report	1	ea	$10,000	$10,000	
Subtotal - Annual Costs				$15,500	
Present Worth Annual Costs (3.2% Discount Rate)				$122,888	
Five Year Costs	3				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$31,070	
Total Present Worth Direct O&M Cost				**$154,927**	
Indirect O&M Costs					
Project/Admin Management	71%	of direct O&M		$109,998	
Health & Safety	10%	of direct O&M		$15,493	
Overhead	30%	of direct O&M		$46,478	
Contingency	15%	of direct O&M		$23,239	
Total Present Worth Indirect O&M Cost				**$195,208**	
Total Estimated Present Worth O&M Cost				**$350,136**	
TOTAL ESTIMATED COST				**$460,620**	

1. Interest rate for costs with duration <30 years (i.e., before 2034) is based on SRS' 16 April 2002 Technical Memorandum.

Table B.4

322-M, 341-M, 341-1M, 341-8M, 305-A, 777-10A, 340-M, 324-M, 741-A, 740-A, 743-A
Alternative 2

Institutional Controls
M Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Plug Manhole Inverts and Grout Manholes	12	ea	$2,000	$24,000	
Institutional Controls					
Posting of Warning Signs	40	ea	$50	$2,000	
Land Use Control Implementation Plan	1	ea	$5,000	$5,000	
Deed Restrictions	1	ea	$5,000	$5,000	
Subtotal - Direct Capital Cost				$36,000	*
Mobilization/Demobilization	25%	of subtotal direct capital		$9,000	*
Site Preparation/Site Restoration	25%	of subtotal direct capital		$9,000	*
Total Direct Capital Cost	(sum of * items)			**$54,000**	
Indirect Capital Costs					
Engineering & Design	18%	of direct capital		$9,720	
Project/Construction Management	25%	of direct capital		$13,500	
Health & Safety	5%	of direct capital		$2,700	
Overhead	30%	of direct capital		$16,200	
Contingency	20%	of direct capital		$10,800	
Total Indirect Capital Cost				**$52,920**	
Total Estimated Capital Cost				**$106,920**	
Direct O&M Costs	3.9% discount rate for costs > 30 years duration[1]				
Annual Costs (Existing System during Post-ROD Design & Const)	2 years O&M			*Years 2008 - 2009*	
Access Controls	1	ea	$500	$500	
Subtotal - Annual Costs				$500	
Present Worth Annual Costs (2.1% Discount Rate)				$969	
Annual Costs (Institutional Controls)	10 years O&M			*Years 2009 - 2019*	
Access Controls	1	ea	$500	$500	
Annual Inspections / Maintenance	1	ea	$5,000	$5,000	
Subtotal - Annual Costs				$5,500	
Present Worth Annual Costs (3.2% Discount Rate)				$43,605	
Five Year Costs	3				
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$15,000	
Present Worth Five Year Costs				$31,070	
Total Present Worth Direct O&M Cost				**$75,645**	
Indirect O&M Costs					
Project/Admin Management	124%	of direct O&M		$93,799	
Health & Safety	21%	of direct O&M		$15,885	
Overhead	30%	of direct O&M		$22,693	
Contingency	15%	of direct O&M		$11,347	
Total Present Worth Indirect O&M Cost				**$143,725**	
Total Estimated Present Worth O&M Cost				**$219,369**	
TOTAL ESTIMATED COST				**$326,289**	

1. Interest rate for costs with duration <30 years (i.e., before 2034) is based on SRS' 16 April 2002 Technical Memorandum.

WESTINGHOUSE SAVANNAH RIVER COMPANY
Environmental Restoration Engineering and Technology

TECHNICAL MEMORANDUM

April 16, 2002 ERTEC-2002-00011

TO: DISTRIBUTION

FROM: T. F. GAUGHAN

REVISED DISCOUNT FACTORS FOR USE IN COST ESTIMATES FOR THE CORRECTIVE MEASURES STUDY/FEASIBILITY STUDY

Initiator: T. E. Rehder
Keywords: Discount factor, CMS/FS, cost estimates

Currently, the present value cost estimates of alternatives in the Corrective Measures Study/Feasibility Study (CMS/FS) documents are calculated using a discount factor of 7%. USEPA has requested that the discount factors used in the CMS/FS cost estimates should be the "Real Interest Rates on Treasury Notes and Bonds of Specified Maturities" as presented in OMB Circular No. A-94, Appendix C (Revised February 2002). Therefore, all CMS/FS Revision 0 documents prepared after April 1, 2002 shall use the following discount factors for present value cost estimations:

Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)				
3-Year	5-Year	7-Year	10-Year	30-Year
2.1	2.8	3.0	3.1	3.9

Analyses with terms different from those presented in the table may use linear interpolation. For example, a four-year item can be evaluated with a rate equal to the average of the three-year and the five-year rates. Items with durations longer than 30 years may use the 30-year rate.

Procedure Impact? ____y ___x___n
Procedure Number: N/A

Approved J. M. Clark

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