
United States Department of Energy

Savannah River Site

**Record of Decision for Remedial Alternative Selection
for the 211-FB Pu-239 Release (081-F) Operable Unit (U)**

CERCLIS Number: 97

WSRC-RP-2005-4090

Revision 1

April 2006

**Prepared by:
Washington Savannah River Company LLC
Savannah River Site
Aiken, SC 29808**



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

DISCLAIMER

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

Printed in the United States of America

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

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

211-FB Pu-239 Release (081-F) Operable Unit (U)

CERCLIS Number: 97

**WSRC-RP-2005-4090
Revision 1**

April 2006

**Savannah River Site
Aiken, South Carolina**

Prepared by:

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

This page was intentionally left blank

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

211-FB Pu-239 Release Operable Unit (081-F)
Comprehensive Environmental Response, Compensation, and Liability Information System
(CERCLIS) Identification Number: 97
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 211-FB Pu-239 Release Operable Unit (OU) (081-F) is listed as a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

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 only medium associated with this OU is soil. The groundwater beneath 211-FB Pu-239 Release OU is being managed under the General Separations Area Western Groundwater OU.

Statement of Basis and Purpose

This decision document presents the selected remedy for the 211-FB Pu-239 Release OU, located in Aiken County, South Carolina. The remedy was chosen in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the Administrative Record File (ARF) for this site.

USEPA, SCDHEC and USDOE concur with the selected remedy.

Description of the Selected Remedy

The selected remedy for the 211-FB Pu-239 Release OU is No Action. The site poses no risk to human health and the environment based on unrestricted (residential) land use; therefore, no land use controls or other remedies are required. There are no human health, ecological or contaminant migration refined constituents of concern (RCOCs), and no principal threat source material (PTSM). The 211-FB Pu-239 Release OU is capable of supporting unrestricted (residential) use without any remedial actions; however, actual site use will remain industrial because of the physical location of the 211-FB Pu-239 Release OU within F Area.

Statutory Determinations

Because this remedy will not result in hazardous substances, pollutants or contaminants remaining on the site above levels that allow for unlimited use and unrestricted exposure, a five-year review will not be required for this remedial action.

Hazardous substances may have been released at the site; however, their concentrations do not pose a risk to human health and the environment based on unrestricted (residential) usage and unlimited exposure. Therefore, no remedial action is necessary to ensure protection of human health and the environment. Because the selected remedy for the 211-FB Pu-239 Release OU is No Action, a Certification Checklist is unnecessary.

ROD for the 211-FB Pu-239 Release OU (081-F) (U)
Savannah River Site
April 2006

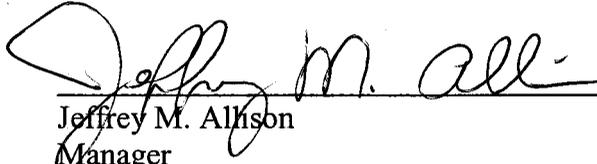
WSRC-RP-2005-4090

Rev. 1

Declaration iii of iv

7/10/06

Date

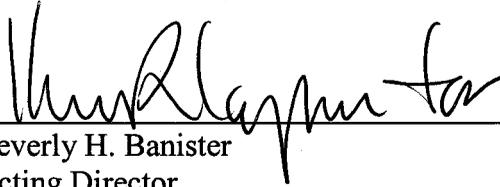


Jeffrey M. Allison
Manager

U. S. Department of Energy
Savannah River Operations Office

8/8/06

Date



Beverly H. Banister
Acting Director
Waste Management Division

U. S. Environmental Protection Agency - Region 4

9/5/06

Date



Robert W. King, Jr.
Deputy Commissioner
Environmental Quality Control

South Carolina Department of Health and Environmental Control

This page was intentionally left blank.

ROD for the 211-FB Pu-239 Release OU (081-F) (U)
Savannah River Site
April 2006

WSRC-RP-2005-4090
Rev. 1

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

211-FB Pu-239 Release (081-F) Operable Unit (U)

CERCLIS Number: 97

WSRC-RP-2005-4090
Rev. 1

April 2006

Savannah River Site
Aiken, South Carolina

Prepared By:

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

This page was intentionally left blank

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
LIST OF FIGURES	iv
LIST OF TABLES	iv
LIST OF APPENDICES	iv
LIST OF ACRONYMS AND ABBREVIATIONS	v
I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION.....	1
II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY	1
III. HIGHLIGHTS OF COMMUNITY PARTICIPATION.....	4
IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY.....	6
V. OPERABLE UNIT CHARACTERISTICS.....	7
VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES.....	15
VII. SUMMARY OF OPERABLE UNIT RISKS.....	17
VIII. EXPLANATION OF SIGNIFICANT CHANGES.....	19
IX. RESPONSIVENESS SUMMARY.....	19
X. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION.....	20
XI. REFERENCES.....	20

LIST OF FIGURES

FIGURE 1.	LOCATION OF THE 211-FB PU-239 RELEASE OU AT THE SRS	23
FIGURE 2.	LOCATION OF THE 211-FB PU-239 RELEASE OU IN F AREA	25
FIGURE 3.	VIEW OF THE 211-FB PU-239 RELEASE OU LOOKING WEST TOWARDS THE OU	27
FIGURE 4.	LAND USE MAP FOR F AREA.....	29
FIGURE 5.	CONCEPTUAL SITE MODEL FOR 211-FB PU-239 RELEASE OU	31
FIGURE 6.	SOIL SAMPLE LOCATIONS AT THE 211-FB PU-239 RELEASE OU	33
FIGURE 7.	PU-239 SAMPLE RESULTS THROUGH THE BURIAL AREA (DITCH B)	35
FIGURE 8.	CONTAMINANT MIGRATION CONCEPTUAL MODEL	37

LIST OF TABLES

TABLE 1.	SIGNIFICANT HISTORICAL EVENTS AT 211-FB PU-239 RELEASE OU	39
TABLE 2.	UNIT-SPECIFIC CONTAMINANT SCREENING	40
TABLE 3.	SUMMARY OF CONSTITUENT OF CONCERN SELECTION FOR 211-FB PU-239 RELEASE OU	41

LIST OF APPENDICES

APPENDIX A – RESPONSIVENESS SUMMARY.....	A-1
--	-----

LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
ARF	Administrative Record File
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	constituent of concern
COPC	constituent of potential concern
CSM	conceptual site model
D&D	decontamination and decommissioning
FFA	Federal Facility Agreement
ft	feet
GPR	ground penetrating radar
IOU	integrator operable unit
km	kilometer
LLC	Limited Liability Company
m	meter
MCL	maximum contaminant level
mi	mile
OU	operable unit
pCi/g	picocuries per gram
PRG	preliminary remedial goal
PTSM	principal threat source material
Pu-239	plutonium-239
RCOC	refined constituent of concern
RI	Remedial Investigation
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SCS	Soil Conservation Service
SRS	Savannah River Site
TAL	target analyte list
TCL	target compound list
TES	threatened, endangered, or sensitive
USC	unit-specific constituent
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VZCOMML	Vadose Zone Contaminant Migration Model Multi-Layer
WSRC	Washington Savannah River Company, LLC

This page was intentionally left blank

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

Unit Name, Location, and Brief Description

211-FB Pu-239 Release OU (081-F)

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: 97

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)

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

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 211-FB Plutonium-239 (Pu-239) Release Operable Unit (OU) (081-F) as a CERCLA unit requiring further evaluation. The 211-FB Pu-239 Release OU was evaluated through the CERCLA Remedial Investigation (RI) process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment (WSRC 2005b).

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.

On December 21, 1989, SRS was included on the National Priorities List. 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 South Carolina Department of Health and Environmental Control (SCDHEC) to coordinate remedial activities at SRS as one comprehensive strategy that fulfills these 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

The 211-FB Pu-239 Release OU (081-F) is located within the Fourmile Branch Watershed and integrator operable unit (IOU) on the southern boundary of F Area between the F-Area Retention Basin and the F-Area Tank Farm (Figures 1 and 2). The OU is the burial area for water and sludge that resulted from a release to the sanitary sewer in Building 221-F. Historic records (incident report included in the Site Evaluation Report [WSRC 1994]) indicate that a single release occurred on December 23, 1954, from Building 221-F (Canyon Building) as part of the start-up of the radioisotope separations process. Using a bucket, an operator drained a tank that contained liquid and Pu-239. An unknown number of buckets of liquid containing Pu-239 were dumped into the floor drain and toilet bowl in the men's room during this shift. The toilet bowl and surrounding floor as well as the primary settling tank (Building 607-1F) in the 200-F waste disposal plant were contaminated with plutonium. The water and sludge in the primary settling tank of the sewage treatment plant was removed and buried in a trench at the present location of the 211-FB Pu-239 Release OU. The sludge and contaminated soil media associated with the burial of this material in the trench are included in this OU.

Groundwater has not been impacted by Pu-239 or any other contaminant from this OU. The groundwater beneath the 211-FB Pu-239 Release OU is included in a separate OU, the General Separations Area Western Groundwater OU.

A Site Evaluation Report (WSRC 1994) was developed in 1994. The report concluded that the unit should be transferred to Appendix C of the FFA (FFA 1993) for further evaluation. Under USDOE Savannah River direction, a Pre-Work Plan characterization was performed in 2003 and 2004 to determine the nature and extent of contamination within the OU and define the burial area for the sludge and water containing Pu-239. In 2004, the FFA Core Team, comprised of USDOE, USEPA, and SCDHEC officials, agreed that a thorough and adequate characterization had been performed and was sufficient to make a remedial decision.

The OU was originally delineated by four concrete pylon markers with a metal placard on top of each pylon. The placards and pylons form the four corners of an area approximately 18.3 by 24.4 m (60 by 80 ft) and were intended to define the burial trench area for the contaminated residue. During characterization of the waste unit, the location of the sludge burial was found to be partly outside the pylon area. A continually modified investigative process was used in the characterization effort to locate the burial site for the plutonium-contaminated residue. Soil sampling was performed in three phases to ensure that the nature and extent of contamination was well-defined.

The ground surface is level with a dense cover of grass and weeds (Figure 3). The area north of the OU is highly industrialized. The F-Area Tank Farm is northwest of the OU, and the F-Area Retention Basin OU is directly east of the OU. Approximately 3.0 m (10 ft) of the OU is inside the F-Area security fence. The unit lies at a ground elevation of approximately 84.4 m (277 ft) above mean sea level. It is located within the Fourmile Branch watershed. There is a stormwater outfall 58 m (190 ft) from the southeast corner marker. The outfall drains south to a manmade ditch approximately 85 m (265 ft) south of the OU boundary.

The surface soils in the vicinity of the 211-FB Pu-239 Release OU are identified as Udorthents in the *Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina* (Soil Conservation Service [SCS] 1990). The surface soil is a clayey sand of the Upland Formation down to a depth of approximately 9.1 to 12.2 m (30 to 40 ft) where a contact zone of sub-angular clay quartz cobbles makes contact with the Tobacco Road Formation. The Tobacco Road Formation extends to an approximate depth of 27.4 to 30.5 m (90 to 100 ft).

The FRB monitoring well series around the F-Area Retention Basin is screened across the water table within the Tobacco Road Formation. The water table is at a depth of approximately 15 m (50 ft). The first semi-confining zone that impacts contaminant migration in the area is the Tan Clay. It is approximately 20.5 m (68 ft) below the surface. Although there are monitoring wells in the vicinity of the 211-FB Pu-239 Release OU, there are no wells that can be used as a drinking water source.

No critical or sensitive habitats are known to exist at or near the OU. A threatened, endangered or sensitive (TES) species survey of the 211-FB Pu-239 Release OU was not conducted; however, considering the small size of the unit and its proximity to an active industrial area, there is minimal potential for TES species to occur at the unit.

The *Savannah River Site Future Use Project Report, Stakeholder Recommendations for SRS Land and Facilities* (USDOE 1996) presents SRS stakeholders with preferred future land use recommendations. The report recommends that the 211-FB Pu-239 Release OU area be designated for future industrial use (Figure 4).

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires the public to be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA (42 United States Code Sections 9613 and 9617). These requirements include establishment of an Administrative Record File (ARF) that documents the investigation and selection of the remedial alternative for addressing the

soils at the 211-FB Pu-239 Release OU. The ARF must be established at or near the facility at issue.

The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969. Section 117(a) of CERCLA, as amended, requires notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action. The *Proposed Plan for the 211-FB Pu-239 Release Operable Unit (081-F)* (WSRC 2005a), a part of the ARF, highlights key aspects of the investigation and identifies the preferred action for addressing the 211-FB Pu-239 Release OU.

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

U.S. Department of Energy	Thomas Cooper Library
Public Reading Room	Government Documents Department
Gregg-Graniteville Library	University of South Carolina
University of South Carolina – Aiken	Columbia, South Carolina 29208
171 University Parkway	(803) 777-4866
Aiken, South Carolina 29801	
(803) 641-3465	

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 Proposed Plan public comment period began on November 22, 2005, and ended on January 5, 2006. A Responsiveness Summary, provided in Appendix A, addresses comments received during the public comment period.

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

Due to the complexity of multiple contaminant areas, the SRS is divided into integrator operable units (IOUs) for the purpose of managing a comprehensive cleanup strategy. Waste units within an IOU are evaluated and remediated individually.

The 211-FB Pu-239 Release OU is located within the Fourmile Branch IOU (Fourmile Branch Watershed, Figure 1) and is not considered a "source control" unit; i.e., the unit does not contain contaminated soil that could act as a source of future contamination to the groundwater through leaching. In addition to the 211-FB Pu-239 Release OU, there are many OUs within the Fourmile Branch Watershed. Upon disposition of all OUs within the watershed of the Fourmile Branch IOU, a final Record of Decision (ROD) for the Fourmile Branch IOU will be pursued.

Soils

The 211-FB Pu-239 Release OU poses no risk to human health or the environment under an unrestricted use scenario. No refined constituents of concern (RCOCs) have been identified for human health or ecological receptors at the 211-FB Pu-239 Release OU. Since no RCOCs are associated with the 211-FB Pu-239 Release OU, a No Action remedy is recommended for the unit. This means no action will be taken at the 211-FB Pu-239 Release OU, and this unit will remain in its present condition.

Groundwater

Results of the contaminant migration analysis indicate that groundwater has not been impacted by this OU. The groundwater beneath the 211-FB Pu-239 Release OU is not included in this unit. The groundwater is included in a separate OU, the General Separations Area Western OU.

V. OPERABLE UNIT CHARACTERISTICS

Conceptual Site Model for the 211-FB Pu-239 Release OU

The conceptual site model (CSM) for the 211-FB Pu-239 Release OU is presented in Figure 5. A CSM identifies known and suspected sources of contamination, types of contaminants and potentially affected media, known and potential routes of migration, and known and potential human and ecological receptors.

The primary source of contamination at the 211-FB Pu-239 Release OU was the water and sludge from the sewage treatment facility 607-1F. There are no other known contaminant sources within the OU. The plutonium was buried at a depth of 2.1 to 3.7 m (7 to 12 ft) below the present land surface.

If the primary source were to contact other media, secondary sources of contamination could be created through several release mechanisms. Typically, the potential secondary release mechanisms include release of volatile constituents from the soil (volatilization), generation of contaminated fugitive dust by wind or other surface soil disturbance, biotic uptake, bioturbation between surface and subsurface soils and infiltration/percolation/leaching to groundwater. Contact with contaminated environmental media creates pathways for both human and ecological receptors. These are assessed in the risk evaluation. The exposure media at this OU include ambient air (vapor and particulates), soil, and biota. Groundwater beneath the 211-FB Pu-239 Release OU will be evaluated under the General Separations Area Western Groundwater OU.

Human receptors evaluated for risk assessment purposes include the future industrial worker and hypothetical future on-unit resident. The general public is not considered to be a potential human receptor because the unit is located approximately 10.5 km (6.5 mi) from the nearest SRS boundary. Access by the general public has been prohibited by strict, long-term entry control procedures and site security inspections. The long distances and access restrictions make all pathways for the general public incomplete.

The proposed future land use for the OU is to remain industrial. Under future industrial use, potential human receptors are most likely industrial workers.

From an ecological perspective, the area lies within an industrial complex and is not conducive to use by wildlife as habitat. Any wildlife frequenting the area would occur on an occasional, transient basis only. The unit is very small in size and the overall habitat quality and diversity for the area is considered poor. The potential for ecological impacts at the community level is negligible based on the environmental setting. However, as a conservative measure, the ecological risk evaluation included the standard receptors for a terrestrial assessment: soil invertebrates (earthworm), herbivorous mammals (mouse), insectivorous mammals (shrew), omnivorous mammals (raccoon), insectivorous birds (robin) and carnivorous birds (hawk).

Media Assessment

Historic investigation and characterization activities at the OU have included radiation surveys, historic photo reviews, and ground penetrating radar (GPR). In addition, a continually modified investigative process was used to define the nature of contamination at the OU and to identify the location of the buried sludge from the sewage treatment facility. The continually modified investigative process is a characterization approach in which pieces of evidence are used to incrementally delineate the nature and extent of contamination at a waste site. Soil sampling was performed during three separate events (Phase I, Phase II and Phase III). The sequence of the characterization is presented in the table of historic events (Table 1).

Concrete pylons are present at each of the four corners of the unit. During the early stages of the investigation, it was assumed that these markers identified the location of the buried plutonium-contaminated sludge. As the investigation progressed, it became apparent that the location of the burial trench was not completely within the pylon area. Therefore, it is recognized that the pylons do not precisely identify the OU boundary, and the contamination in the burial trench further defines the OU.

The RI Report (WSRC 2005b) contains detailed information and analytical data for all of the investigations conducted and samples collected in the media assessment of the 211-FB Pu-239 Release OU. This document is available in the ARF (see Section II of this document).

Radiation Survey

A radiation survey was performed at the area in 1991. The results of the survey are presented in the 1994 Site Evaluation Report (WSRC 1994). The survey indicates that the OU and the area around it do not have elevated radiation levels compared to the background area. Shallow soil samples were tested for gross alpha with no detections above background. Air monitoring was also performed to determine the presence of fission products or plutonium: no detections were indicated.

Historic Photo Review

A historic photo review is provided in the RI Report (WSRC 2005b). Because of security concerns, F Area was blanked out of aerial photographs. For this reason, early photographic evidence supporting the identification of the burial of the sludge is vague. The photo review begins in November of 1954, a month before the plutonium release on December 23, 1954. Subsequent photos show that the area around the OU was disturbed, but there is no clear view of a trench.

The November 1954 photo provided evidence to support a continually modified investigative approach to sampling. The historic drainage features were targeted for sampling since they could have provided an open excavation for the burial of material. One drainage ditch observed on the 1954 photograph crossed the northeast corner of the pylon boundary from the center of the northern boundary diagonally to the top third of the eastern boundary of the OU. The ditch was backfilled when the area was regraded, which was sometime after the sludge containing plutonium was buried.

Ground Penetrating Radar

A GPR survey was performed in July 2003 within the original OU boundary delineated by the pylons prior to soil sampling to identify any buried utilities. No anomalies were identified during the GPR survey, and the disturbed zone in the soil was thought to be about 3.0 m (10 ft) deep. The strategy for the first phase of soil sampling was based on interpretation from this survey; soil samples were collected in the disturbed zone and in the interval below the disturbed zone. This GPR survey was general in nature, and no printouts are available.

The first phase of soil sampling (described in the next section) indicated that the depth of the disturbed soil was less than 3.0 m (10 ft) in the locations that were sampled. This suggested that a higher resolution GPR survey would be necessary to delineate the disturbed soil depth. Therefore, a second GPR survey with greater resolution was conducted in October 2003 as part of the Phase II sampling effort. The area surveyed extended outside the pylon boundary. The results of the survey are documented in the RI Report (WSRC 2005b).

Several subsurface features were identified with the higher resolution GPR survey, including two pipelines outside the pylon boundary. One of the pipelines runs southwest of the OU from the Tank Farm area toward the stormwater outfall. The other pipeline runs parallel to the eastern OU boundary from the north in F Area to the stormwater outfall.

Soil Sampling: Phase I

At the 211-FB Pu-239 Release OU, a general assumption was made at the onset of characterization that the plutonium would be uniformly buried within the pylon boundary. This assumption was based on the homogeneous pattern of disturbed soil from the initial GPR and the precise placement of boundary markers. Based on that assumption, five sample locations were uniformly spaced within the OU (Figure 6). The initial GPR estimated the depth of disturbed soil from 1.5 m to 3.0 m (5 to 10 ft) below

ground surface (bgs); samples were obtained from the disturbed zone and at least one interval below the disturbed zone.

Based on the volume estimate of the sludge in the sewage treatment facility, it was uncertain whether plutonium would be detectable if it were spread over the full area of the OU. To determine the magnitude of plutonium anticipated during the remainder of the characterization for radiological monitoring, an initial soil core was collected from the center of the OU and tested at the Savannah River National Laboratory. No plutonium was detected in this initial soil core. Soil cores were collected in clear plastic tubes to 3.9 m (13 ft) bgs with a Geoprobe drill rig. Three of the five sample locations inside the pylon boundary (FPS-05, FPS-06, and FPS-07) were subject to a full suite analysis. Cores from locations FPS-04 and FPS-08 were held in a sealed B-12 container on the unit and sampled at a later date for gross alpha, non-volatile beta, and plutonium.

The initial sampling strategy included contingent locations on each side of the original OU boundary as defined by the pylons to bound any contamination within the OU boundary. Two (FPS-09 and FPS-11) of these four contingent locations were sampled (Figure 6). Another location (FPS-11C) was cored within an area that appeared to have been disturbed by excavation. Soil cores were collected from locations FPS-09, FPS-11, FPS-11B and FPS-11C, then stored in a B-12 container on the unit for field screening and geologic description. All of the soil cores were radiologically screened in the field for beta and gamma activity to determine if there was measurable radioactivity within the core that would require special protection when the clear plastic tubes were opened. Field instruments did not detect any radioactivity above background in any soil cores.

In summary, several locations were sampled and/or cored in the Phase I sampling effort. Pu-239 was not detected in any of the soil samples and the suspected burial area was not identified. It was recognized that additional investigative work was needed after field instruments did not detect radioactivity above background levels and "trench-like" disturbed features were not observed in the soil cores collected within the pylon area. This led to Phase II of the investigation.

Soil Sampling: Phase II

In October 2003, a high resolution GPR investigation performed at the beginning of the Phase II sampling event helped to locate the sludge burial area. An historic photograph of the area taken one month before the release occurred revealed a ditch, later shown to be backfilled, running through the northeast corner of the OU boundary (Figure 6). This feature is designated as "Ditch A." It measures approximately 24 by 4.6 m (79 by 15 ft). The high resolution GPR survey revealed a shallow disturbed soil along Ditch A and an area of deeper disturbed soil in the southeast corner of the OU, referred to as "Ditch B." Ditch B did not exist when the November 1954 photograph was taken. It measures approximately 10.7 by 5.2 m (35 by 17 ft). The location where Pu-239 was later identified (FPS-11C) coincides with the disturbed soil area (Ditch B) that shows up on the GPR survey.

Since no Pu-239 was identified during the initial sampling event, the strategy was revised to search the entire area using closely spaced locations that were selected randomly within the pylon boundary. For this second sampling event, a random sampling strategy focusing on Pu-239, gross alpha, and non-volatile beta with low detection limits was developed to locate the buried sludge containing plutonium. The sample design locations were selected to identify a 1.8-m (6-ft) diameter area since any excavation would have to be at least that wide to bury the water and sludge from the sewage treatment facility. A statistically based software tool (Visual Sample Plan) was used to plan and locate sampling points so that an appropriate number of samples could be collected to cover the OU. The previously sampled locations and the cores stored at the unit were included in the sample design coverage. Seven additional sample locations were added: FPS- 20, 21, 22, 23, 24, 25, and 11C (Figure 6). The core from FPS-11C had been stored from the previous field activity.

In summary, analytical results from this phase of investigation only identified Pu-239 at location FPS-11C in the 2.1- to 3.0-m (7- to 10-ft) interval (0.517 pCi/g). All other

intervals, including the 3.0- to 4.0-m (10- to 13-ft) interval, were nondetects (WSRC 2005b).

Soil Sampling: Phase III

The Phase III sampling began in February 2004. This phase of characterization builds on the discovery of buried ditches (A and B Ditches) using the aerial photographs and GPR surveys. The sampling strategy in this phase of the investigation used transects of multiple soil cores to field-verify the GPR and photographic evidence. The sample locations were arranged in transects or lines of boreholes spaced approximately 0.9 m (3 ft) apart across the area where the ditches had been identified (Figure 6). The transect lines were approximately 3.0 m (10 ft) apart. Transects B through H and Z covered the Ditch A area. Transects I through N₂ covered the Ditch B area. The ditches were not well defined with the GPR survey so the soil cores were collected in clear plastic tubes to allow the geologist to interpret the depth to undisturbed soil.

Observations from the soil cores indicate that the soil disturbance in Ditch A was approximately 0.75 m (2.5 ft) deep and Ditch B was 3.5 m (11.5 ft) deep, with the greatest depth at 4 m (13 ft). Subsequent soil samples were collected from the deepest part of Ditch A at locations FPS-26, FPS-27, and FPS-30. The FPS-9 Phase II location was also re-sampled within Ditch A; the sample was collected across the observed contact between disturbed and undisturbed soil from the 0.3- to 0.9-m (1 to 3 ft) interval. Ditch B sample locations FPS-28 and FPS-29 were sampled in a 2-ft interval within the disturbed soil, above the observed contact zone with the undisturbed soil. The FPS-11C Phase II location was also re-sampled within Ditch B; the sample was collected across the observed contact between disturbed and undisturbed soil from the 3.0- to 3.6-m (10- to 12-ft) interval. Samples from FPS-26, FPS-27, FPS-28, FPS-29, and FPS-30 were analyzed for Pu-239, gross alpha, and non-volatile beta. A full suite analysis was performed for the FPS-09 and FPS-11C samples. Analytical results from this phase of the investigation only identified Pu-239 at location FPS-11C in the 3.0 to 3.6 m (10 to 12 ft) interval at a concentration of 1.71 pCi/g.

Media Assessment Results

The findings of the 211-FB Pu-239 Release OU investigation and assessment are documented in the RI Report (WSRC 2005b) and summarized in the following paragraphs. A summary of the results for all the analytes detected is provided in Table 2. Two pesticides, 15 organics, 18 inorganics, and 11 radionuclides were identified as unit-specific contaminants (USCs) based on a comparison of unit maximum constituent concentration to site-specific background concentration. Results of more detailed evaluations indicate that none of these constituents present a problem warranting action from either a human health, ecological or contaminant migration perspective (i.e., no RCOCs were identified).

Analytical results indicate that location FPS-11C is the only location with measurable Pu-239. This location was sampled and tested for Pu-239, gross alpha, and non-volatile beta during the Phase II event. FPS-11C was sampled again in Phase III to collect additional soil for full suite analysis. Samples collected at FPS-11C during the Phase II event were collected from the 2.1- to 3.0-m (7- to 10-ft) and 3.0- to 4.0-m (10- to 13-ft) intervals. Pu-239 results at the 2.1- to 3.0-m (7- to 10-ft) interval were 0.517 pCi/g. At 3.0 to 4.0 m (10 to 13 ft), the Pu-239 was below the detection limit. At the 3.0- to 3.6-m (10- to 12-ft) interval (Phase III sampling event), the Pu-239 was measured at 1.71 pCi/g. Figure 7 presents the results of Pu-239 data at sample location FPS-11C.

In conclusion, the location of the water and sludge burial was found using a combination of radiological surveys, historic photographs, GPR, soil borings, and soil sampling and analysis. However, the location of the burial was not completely within the boundary originally delineated by the concrete pylons. The volume and activity of the sludge was uncertain prior to characterization efforts. The detections of very low concentrations of Pu-239 (maximum activity of 1.71 pCi/g) within the trench confirm the presence of the dispositioned sludge at low concentrations. The maximum activity of the Pu-239 is below the residential preliminary remediation goal (PRG) of 2.8 pCi/g. Additionally, Pu-239 is highly immobile in soil and will not impact groundwater.

Site-Specific Factors

No site-specific factors requiring special consideration that might affect the No Action remedial decision for the 211-FB Pu-239 Release OU are present at the site.

Contaminant Transport Analysis

The contaminant migration of unit-related constituents was evaluated to determine if there is any potential for contaminants to reach the groundwater. The contaminants evaluated in this assessment are the USCs identified in Table 3. Two pesticides, 15 organics, 18 inorganics and 11 radionuclides were identified as USCs based on a comparison of unit maximum constituent concentration to site-specific background concentration. The vadose zone contaminant migration conceptual model used for the analysis of contaminant fate and transport is presented in Figure 8. The analysis was based on lithological information, groundwater levels, and geotechnical data. The results of the migration model reveal that the concentrations of constituents detected in the 211-FB Pu-239 Release OU soils will not exceed their maximum contaminant levels (MCLs) or PRGs within the 1,000-year modeling period. The MCL is the maximum concentration of a substance allowed in water that is delivered to any user of a public water supply as required by the Safe Drinking Water Act. The evaluation identified no contaminant migration RCOCs (Table 3). Therefore, the 211-FB Pu-239 Release OU soils do not pose a migration threat to groundwater.

VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

Current Land Use

Currently, the 211-FB Pu-239 Release OU is an inactive waste unit. It is located on the southern boundary of F Area between the F-Area Retention Basin and the F-Area Tank Farms. Access to SRS is controlled by USDOE, and access to the 211-FB Pu-239 Release OU is restricted within the SRS boundaries.

The potential receptor for exposure to constituents associated with the 211-FB Pu-239 Release OU is the current on-unit worker who comes to the area on an infrequent or occasional basis. On-unit workers are defined as SRS employees who work at or near the vicinity of the waste unit under current land use conditions. An on-unit worker may be a researcher, environmental sampler, or other SRS personnel who work in close proximity to the unit.

Future Land Use

According to the *Savannah River Site Future Use Project Report, Stakeholder Recommendations for SRS Land and Facilities* (USDOE 1996), residential uses of SRS land should be prohibited. The SRS FFA Implementation Plan (WSRC 1996) designates the preferred land use for the 211-FB Pu-239 Release OU as industrial. The potential receptor for exposure to constituents associated with the 211-FB Pu-239 Release OU is the future industrial worker.

Groundwater Uses/Surface Water Uses

This OU is not contributing any contamination to the groundwater. Groundwater beneath the 211-FB Pu-239 Release OU is not used for any type of human consumption. Furthermore, the groundwater associated with the 211-FB Pu-239 Release OU has been separated from the OU and placed in the General Separations Area Western OU. Future use of the groundwater will be addressed by the General Separations Area Western OU ROD. The groundwater that flows beneath the 211-FB Pu-239 Release OU is discharged to the Fourmile Branch watershed.

There are no distinct surface water features on the unit and no drainage or surface runoff features that indicate that the surface runoff is being used for irrigation or any other beneficial uses.

VII. SUMMARY OF OPERABLE UNIT RISKS

Baseline Risk Assessment

As a component of the CERCLA process, a risk evaluation was performed and included in the RI Report (WSRC 2005b). The evaluation estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminant and exposure pathways that need to be addressed by the remedial action. The evaluation includes the human health and ecological risk evaluations as well as an assessment of the potential for contaminants to migrate to groundwater. A summary of the constituent of concern (COC) identification process is provided in Table 3; the results of the risk evaluations are summarized in the following paragraphs.

Summary of the Human Health Risk Assessment

The 211-FB Pu-239 OU is located in F Area with both a current and future land use designation of industrial. The human health risk assessment evaluated both the industrial worker and unrestricted (residential) scenarios. The residential scenario was evaluated since it is the most conservative approach for the risk assessment. The screening process identified arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-c,d)pyrene as human health constituents of potential concern (COPCs). Further quantitative evaluation identified arsenic (residential risk = $1.0E-05$; industrial worker risk = $2.5E-06$) and benzo(a)pyrene (residential risk = $1.7E-06$) as human health COCs. Following an uncertainty analysis, no constituents were identified as human health RCOCs for either the residential or industrial scenario at the 211-FB Pu-239 Release OU. The evaluation concluded that there are no problems warranting action from a human health risk perspective for either the unrestricted (residential) or the industrial land use scenarios.

Summary of the Ecological Risk Assessment

The purpose of the ecological component of the risk assessment is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of

exposure to unit-related constituents based on a lines-of-evidence approach. Although the overall habitat quality and diversity for the area is poor and the potential for ecological impacts at the community level is considered negligible based on the environmental setting, the quantitative evaluation conservatively included standard terrestrial receptors. The initial screening process identified aluminum, arsenic, chromium, lead, manganese, zinc, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-c,d)pyrene, and pyrene as ecological COPCs. More detailed risk calculations for these constituents and an uncertainty (lines-of-evidence) analysis did not identify any ecological COCs. The evaluation concluded that there are no problems warranting action from an ecological risk perspective.

Summary of the Fate and Transport Analysis

A fate and transport analysis was performed to identify contaminant migration RCOCs. Two pesticides, 15 organics, 18 inorganics, and 11 radionuclides were identified as USCs and evaluated in the contaminant migration analysis. The Vadose Zone Contaminant Migration Model Multi-Layer (VZCOMML) conceptual model used for the analysis of contaminant fate and transport is presented in Figure 8. A constituent is defined as a contaminant migration RCOC if leachability modeling predicts the constituent will leach to groundwater and exceed MCLs (or PRGs) within 1,000 years. The results of the contaminant migration conceptual model reveal that the concentrations of the constituents detected in the 211-FB Pu-239 Release OU soils will not exceed their MCLs (or PRGs) within the 1,000 year modeling period. Therefore, no contaminant migration RCOCs are associated with the 211-FB Pu-239 Release OU. The evaluation concluded that there are no problems warranting action from a contaminant migration to groundwater perspective.

Discussion of Principal Threat Source Material

The concept of principal threat source material (PTSM) developed by USEPA (USEPA 1991) was applied to USCs. Wastes that generally will be considered PTSM include

liquids, mobile source material, and highly toxic source materials. No PTSM associated with 211-FB Pu-239 Release OU was identified based on toxicity or mobility.

Conclusion

There are no hazardous substances from the 211-FB Pu-239 Release OU that would present a current or potential future threat to public health, welfare, or the environment (Table 3). The CSM is provided in Figure 5.

- There are no human health RCOCs in soil.
- There are no ecological RCOCs in soil.
- There are no contaminant migration RCOCs in soil.
- There are no applicable or relevant and appropriate requirements (ARARs) or PTSM RCOCs in soil.

The site poses no risk to human health and the environment based on unrestricted land use; therefore, no land use controls or other remedies are required. The land use will remain industrial as described in the most current USDOE future land use report (WSRC 1999) since the OU is located within F Area, which is designated as an industrial use zone.

VIII. EXPLANATION OF SIGNIFICANT CHANGES

The remedy selected in this ROD does not contain any significant changes from the preferred alternative presented in the Proposed Plan (WSRC 2005a). Responses to comments received during the public comment period are provided in Appendix A.

IX. RESPONSIVENESS SUMMARY

Two inquiries were received during the public comment period on the Proposed Plan as described in Section III Highlights of Community Participation of this document. The comments dealt with the composition of the buried sludge and a request for more

information than published in the SRS Environmental Bulletin announcement. SRS responded to the questions by providing additional information on the composition of the material and providing information that was not included in the Environmental Bulletin. These questions were satisfactorily addressed and did not impact the remedial decision for this waste unit. The remedy selected in this ROD does not contain any significant changes from the preferred alternatives presented in the Proposed Plan. The Responsiveness Summary is included in Appendix A of this document.

X. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

No remedial action will be performed at the 211-FB Pu-239 Release OU; therefore, a schedule for post-ROD cleanup activities is not provided.

XI. REFERENCES

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

SCS, 1990. *Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina*, Soil Conservation Service, United States Department of Agriculture, Savannah River Site, Aiken, SC

USDOE, 1994. *Public Involvement, A Plan for the Savannah River Site*, Savannah River Operations Office, Aiken, SC

USDOE, 1996. *SRS Future Use Project Report, Stakeholder Preferred Recommendations for SRS Land Use Facilities*, United States Department of Energy, Savannah River Operations Office, Aiken, SC

USEPA, 1991. *A Guide to Principal Threat and Low Level Threat Waste*, United States Environmental Protection Agency, Office of Emergency and Remedial Response, Superfund Publication 9380.3-06FS, Washington D.C.

WSRC, 1994. *Site Evaluation Report for the Spill on 12/23/54 (U)*, WSRC-RP-93-571, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Rev. 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005a. *Proposed Plan for the 211-FB Pu-239 Release Operable Unit (081-F) (U)*, WSRC-RP-2005-4009, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005b. *Remedial Investigation Report for the 211-FB Pu-239 Release Operable Unit (081-F) (U)*, WSRC-RP-2004-4112, Rev. 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

This page was intentionally left blank

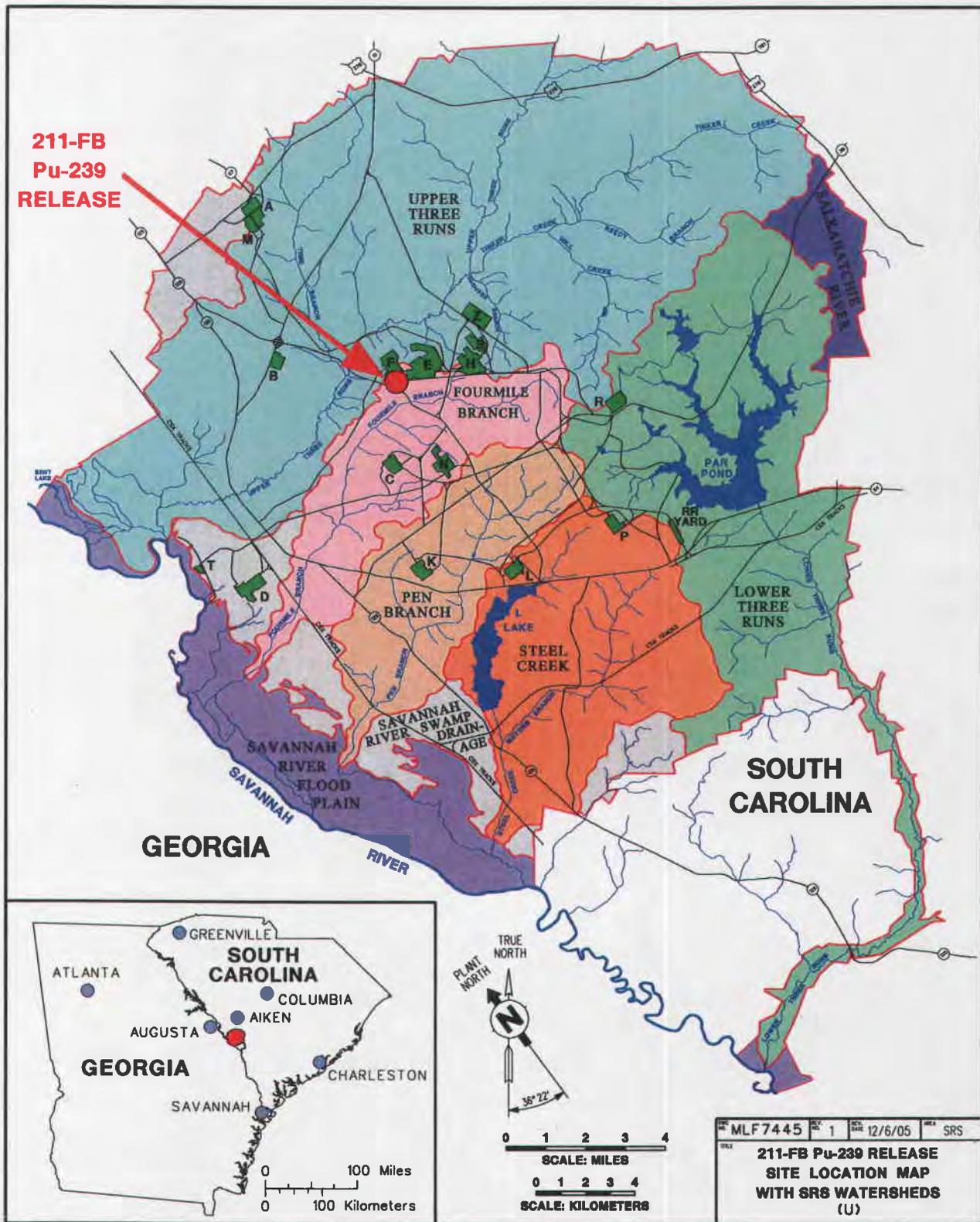


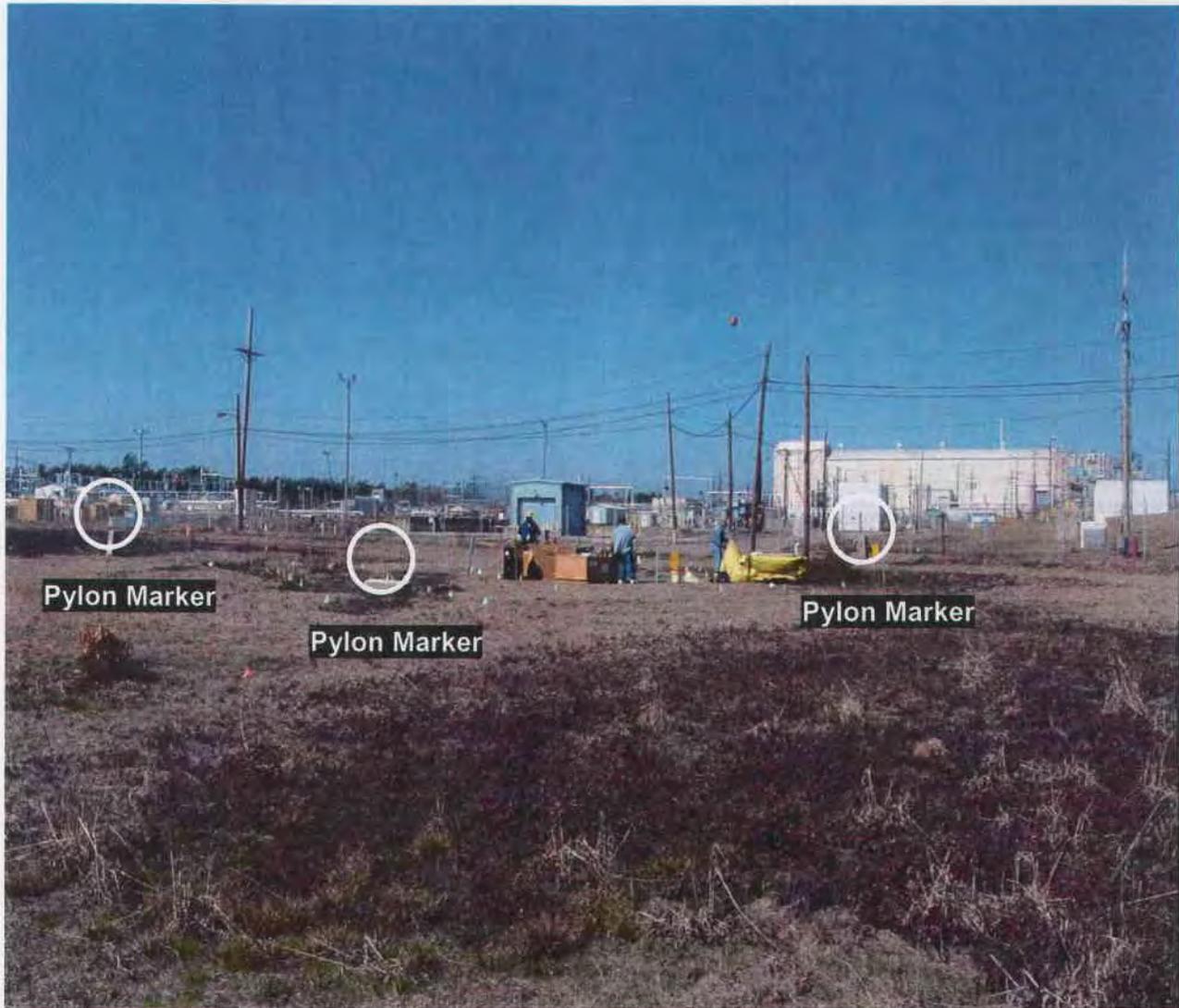
Figure 1. Location of the 211-FB Pu-239 Release OU at the SRS

This page intentionally left blank



Figure 2. Location of the 211-FB Pu-239 Release OU in F Area

This page intentionally left blank



Note: The fourth pylon is not visible in the photograph.

Figure 3. View of the 211-FB Pu-239 Release OU Looking West towards the OU

This page intentionally left blank

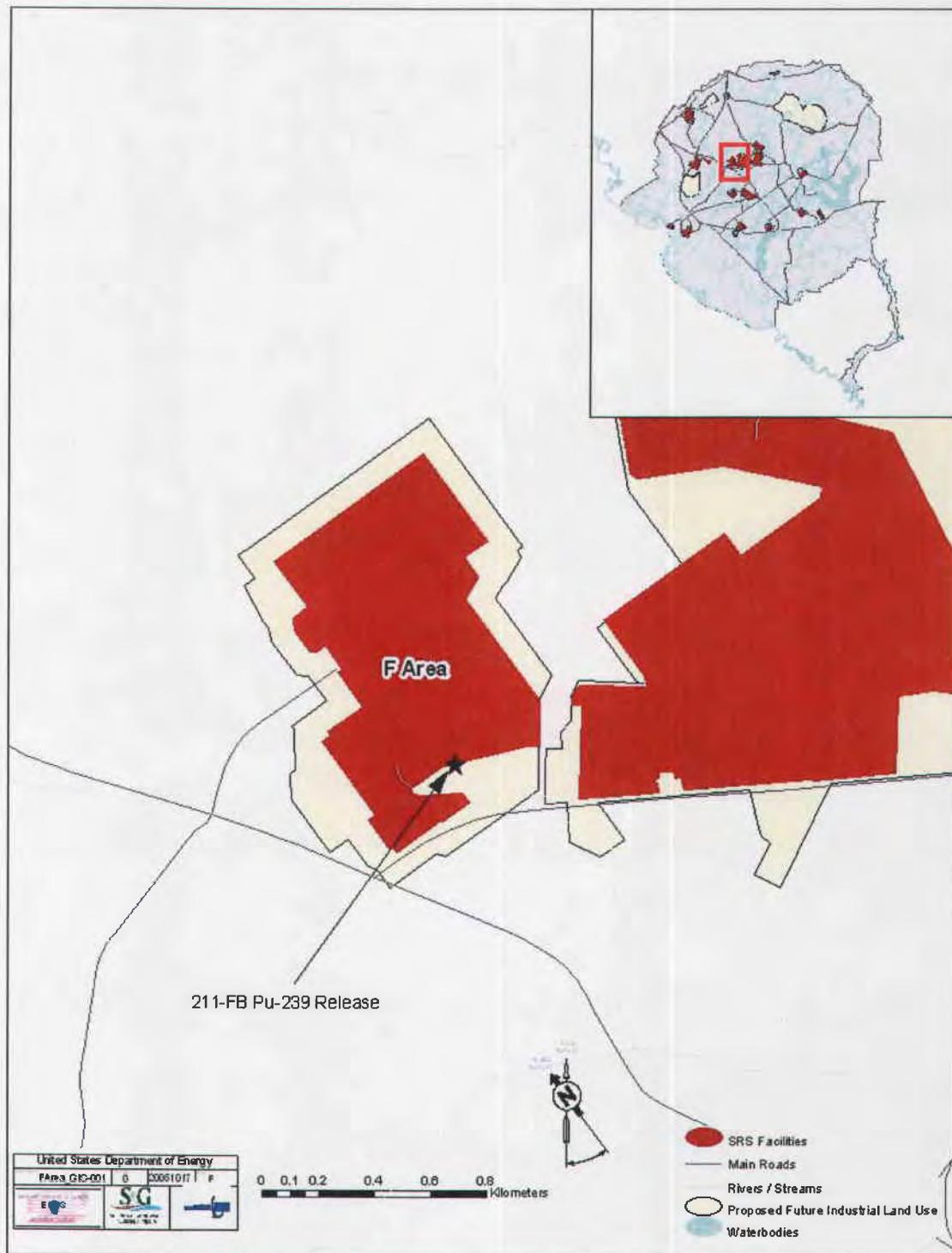


Figure 4. Land Use Map for F Area

This page intentionally left blank

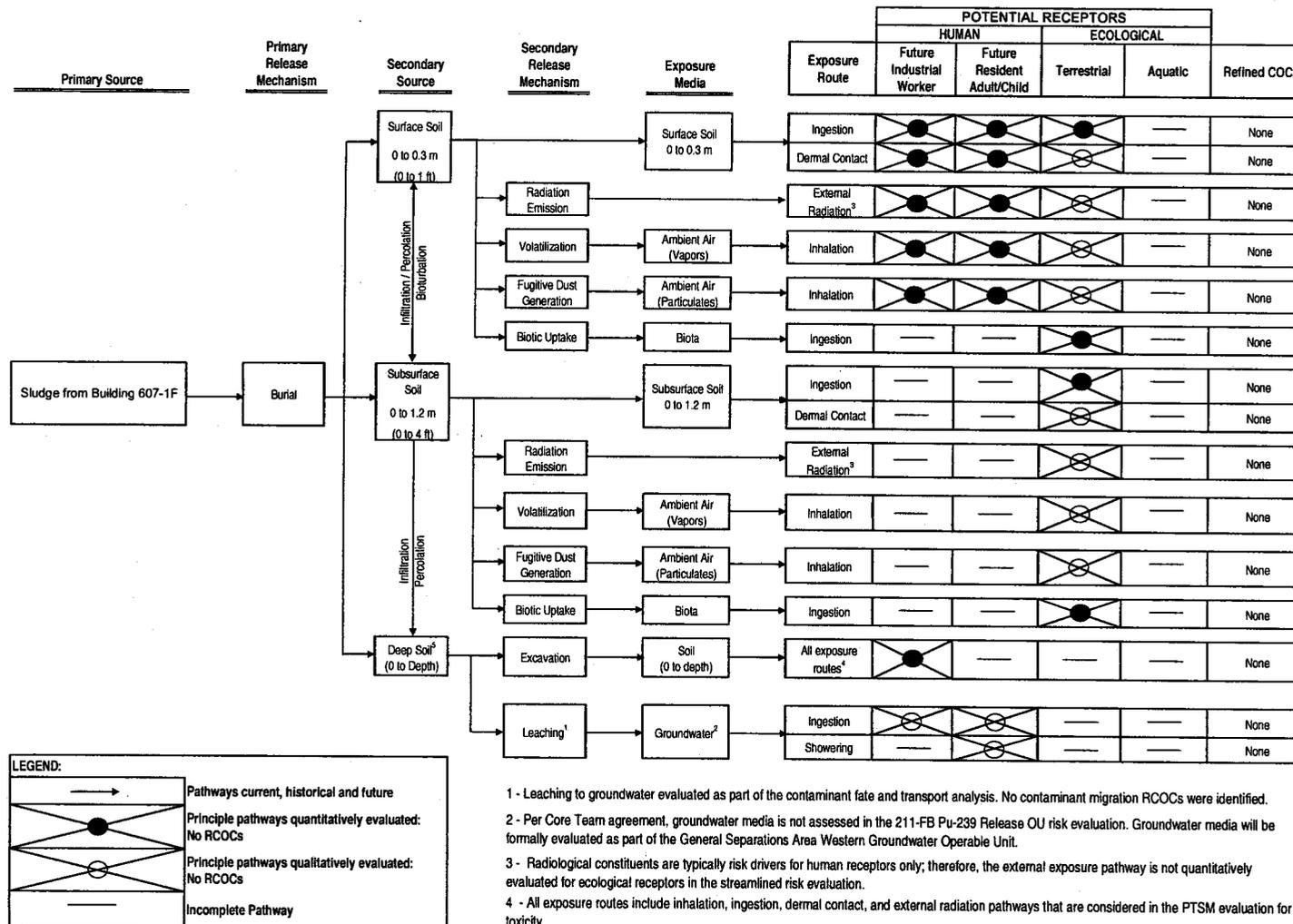


Figure 5. Conceptual Site Model for 211-FB Pu-239 Release OU

This page intentionally left blank

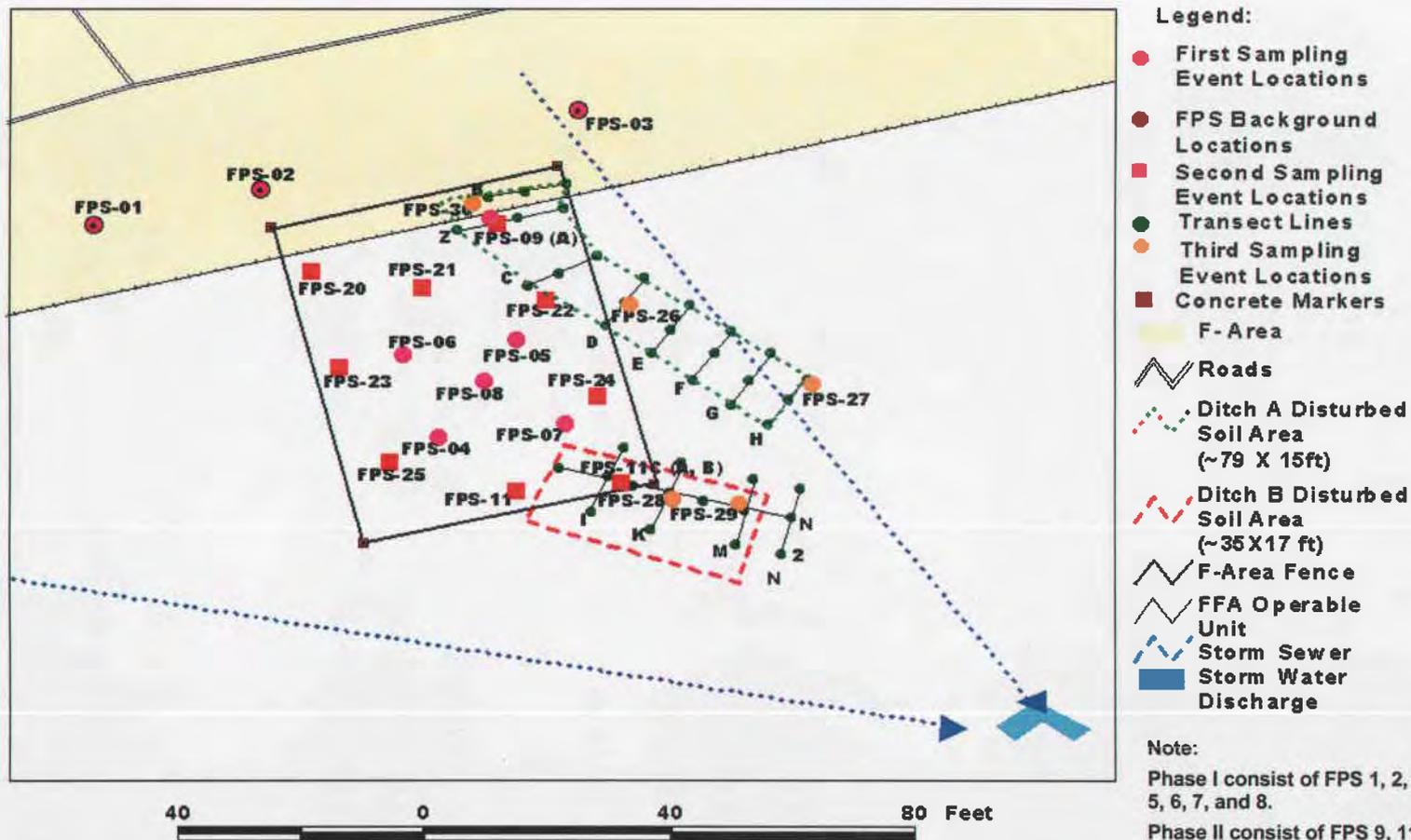
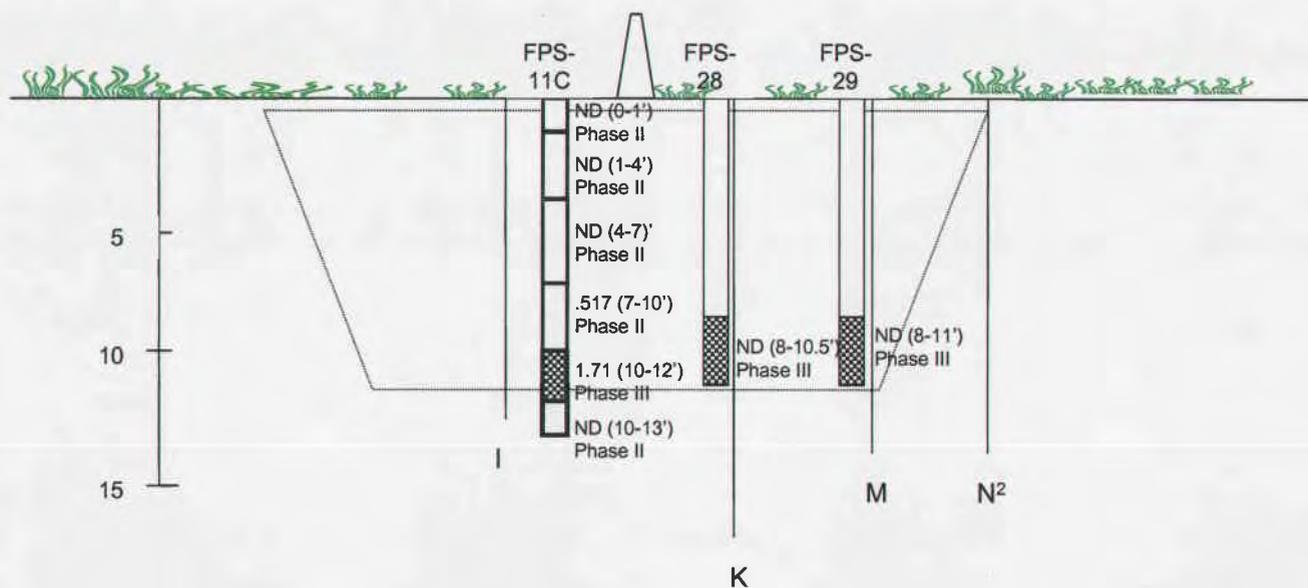


Figure 6. Soil Sample Locations at the 211-FB Pu-239 Release OU

This page intentionally left blank



Note: Results of Pu-239/240 analysis are in pCi/g.

ND = Non Detect

Numbers in parenthesis represent sampling interval in feet.

Figure 7. Pu-239 Sample Results through the Burial Area (Ditch B)

This page intentionally left blank

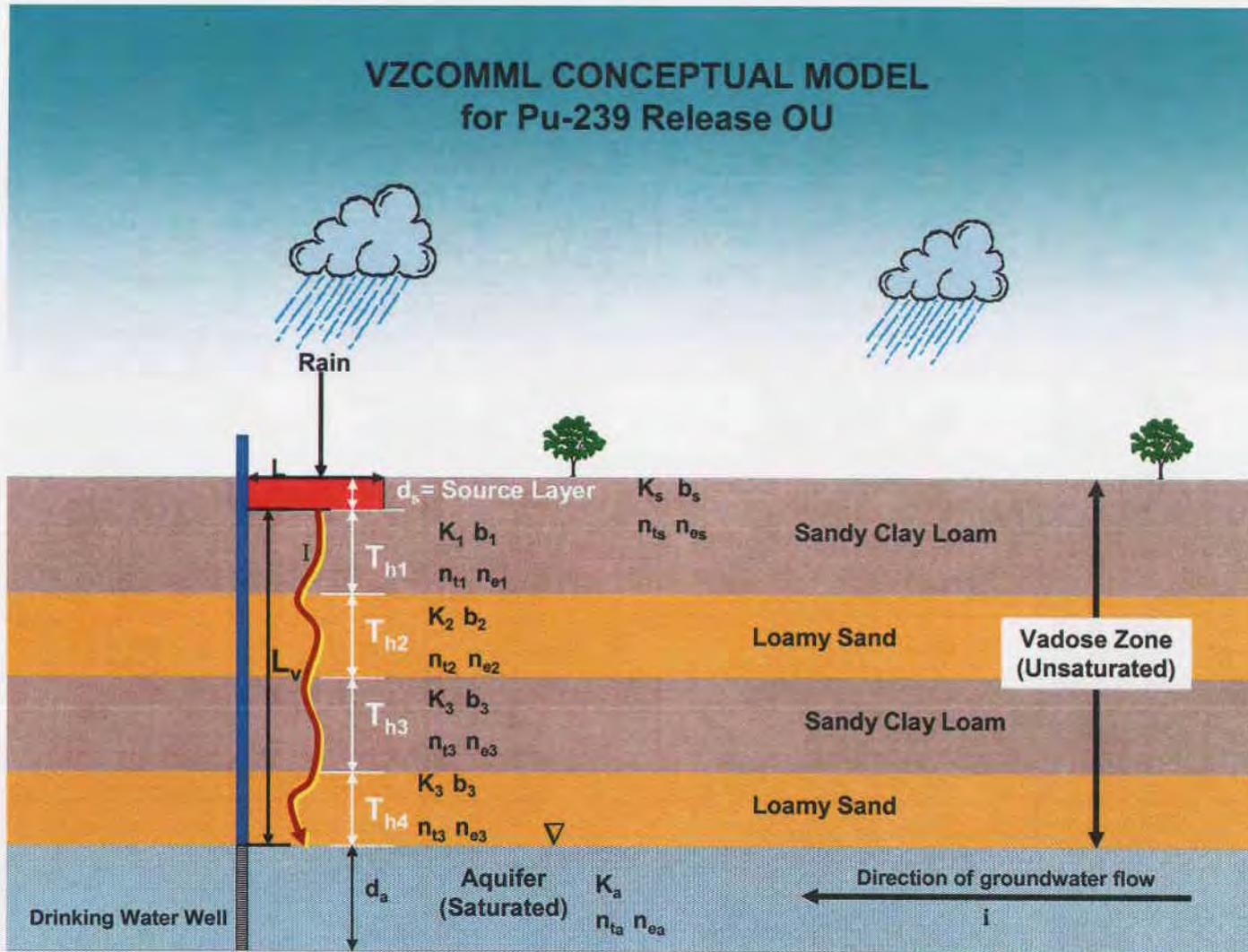


Figure 8. Contaminant Migration Conceptual Model

This page intentionally left blank

Table 1. Significant Historical Events at 211-FB Pu-239 Release OU

Date	Event
December 23, 1954	Pu-239 was disposed of in the sanitary sewer system from F-area separations process and contaminated the sewer and sewage treatment facility 607-1F. Sludge from 607-1F was disposed of within the OU boundary.
1973	The incident was documented in the spill report summary, estimating the volume and concentration of Pu-239.
1991	Radiological survey performed; results indicate that the OU and the area around it do not have elevated radiation levels compared to the background area.
1994	A Site Evaluation Report was developed (WSRC 1994).
July 30, 2003	A general GPR survey was performed to identify subsurface utility interferences and determine the depth of disturbed soil within the OU.
August 7, 2003 Phase I	Initial pre-characterization was performed at five locations down to 4 m (13 ft) to determine the nature of contamination within the OU boundary and three background locations down to 16 m (53 ft) upgradient of the OU. Geoprobe cores were collected at all locations with target analyte list (TAL)/target compound list (TCL) analytes, and full speciated radiological analysis was performed on three of the five on-unit soil core locations and on all background intervals to the water table.
October 14 -15, 2003 Phase II	High definition GPR was performed in the area around 211-FB Pu-239 Release OU. The survey indicated that the surface soil had been uniformly regraded to an undefined depth (geologic descriptions indicate disturbance to 1.2 m (4 ft)). Two pipelines and two ditches were identified by GPR.
November 17, 2003 Phase II	There was uncertainty that Pu-239 would be detected within the OU following the initial analysis so a hot spot random sampling design was developed to locate any Pu-239 within the boundaries of the OU. This included eight additional locations with soil samples analyzed for gross alpha, non-volatile beta, and Pu-239. Locations FPS-9 and FPS-11C were biased toward linear features with subsurface disturbances identified in the GPR survey. Pu-239 was only detected in location FPS-11C.
February 11, 2004 Phase III	The sample design was revised to define the extent of Pu-239 in the backfilled disturbed areas by performing geologic transects including 68 boreholes across the subsurface disturbance features followed by five samples with Pu-239 analysis from the center. Full suite analysis was performed at two locations (FPS-09 and FPS-11C) in the deepest interval within each of the subsurface disturbed features. Results indicate that Pu-239 is only present in the southeast corner of the OU (FPS-11C).

Table 2. Unit-Specific Contaminant Screening

Analyte	Units	Proportion Detected	Proportion "J" Detected	Arithmetic Mean	Minimum Detect	Maximum Detect	2x Average Background	USC?
Pesticides/PCBs								
AROCOR 1254	mg/kg	1/17	1/17	0.00183	0.00424	0.00424	0.00516	No
DDE	mg/kg	1/17	1/17	0.000113	0.000489	0.000489	0.000288	Yes
DDT	mg/kg	1/17	1/17	0.000213	0.00122	0.00122	0.000494	Yes
Radionuclides								
ACTINIUM-228	pCi/g	28/28	1/28	1.42	0.589	2.18	2.02	Yes
AMERICIUM-241	pCi/g	1/17	1/17	0.0825	0.11	0.11	ND	Yes
BISMUTH-214	pCi/g	29/29	0/29	0.646	0.2	1.04	1.286	No
CARBON-14	pCi/g	1/5	1/5	0.519	0.499	0.499	1.034	No
CESIUM-137	pCi/g	3/29	1/29	0.0542	0.162	0.616	0.15	Yes
GROSS ALPHA	pCi/g	72/72	63/72	9.4	3.75	17.3	14.66	N/A
LEAD-212	pCi/g	27/27	0/27	1.42	0.487	2.39	2.34	Yes
LEAD-214	pCi/g	29/29	1/29	0.736	0.15	1.22	1.498	No
NONVOLATILE BETA	pCi/g	70/71	70/71	4.05	1.55	8.98	4.72	N/A
PLUTONIUM-239/240	pCi/g	2/76	0/76	0.12	0.517	1.71	ND	Yes
POTASSIUM-40	pCi/g	27/29	13/29	1.13	0.304	1.83	1.992	No
RADIUM-226	pCi/g	17/17	0/17	0.737	0.418	1.04	1.286	No
RADIUM-228	pCi/g	17/17	0/17	1.51	1.06	2.18	2.02	Yes
THALLIUM-208	pCi/g	24/28	2/28	0.486	0.148	1.129	0.71	Yes
THORIUM-228	pCi/g	17/17	4/17	1.62	0.706	2.78	2.12	Yes
THORIUM-230	pCi/g	11/17	5/17	0.922	0.915	2.28	1.194	Yes
THORIUM-232	pCi/g	17/17	1/17	1.56	0.876	2.09	1.692	Yes
URANIUM-233/234	pCi/g	17/17	13/17	0.746	0.428	1.33	1.274	Yes
URANIUM-238	pCi/g	16/17	13/17	0.607	0.325	0.958	1.072	No
TAL Inorganics								
ALUMINUM	mg/kg	17/17	5/17	9660	4660	18200	10760	Yes
ARSENIC	mg/kg	12/17	11/17	3.95	2.55	8.58	3.3	Yes
BARIUM	mg/kg	14/17	7/17	15.2	3.57	56	24.4	Yes
BERYLLIUM	mg/kg	3/17	3/17	0.19	0.834	0.981	0.144	Yes
CALCIUM	mg/kg	13/17	9/17	151	23.6	592	448	Yes
CHROMIUM	mg/kg	17/17	7/17	30.1	9.09	53.8	33.2	Yes
COBALT	mg/kg	1/17	1/17	0.184	1.84	1.84	0.522	Yes
COPPER	mg/kg	13/17	13/17	2.57	1.64	6.37	6.26	Yes
CYANIDE	mg/kg	2/17	2/17	0.108	0.156	0.51	0.21	Yes
IRON	mg/kg	17/17	0/17	26600	7780	53200	32000	Yes
LEAD	mg/kg	16/17	7/17	6.98	5.15	11	9.16	Yes
MAGNESIUM	mg/kg	15/17	15/17	100	37.4	208	100.6	Yes
MANGANESE	mg/kg	17/17	9/17	63.9	11.8	265	129.8	Yes
MERCURY	mg/kg	13/17	8/17	0.0177	0.0113	0.0369	0.0266	Yes
NICKEL	mg/kg	6/17	6/17	0.984	1.78	4.48	3.4	Yes
POTASSIUM	mg/kg	11/17	7/17	68.3	38.3	308	66	Yes
VANADIUM	mg/kg	17/17	15/17	59.6	17.9	111	74.6	Yes
ZINC	mg/kg	17/17	11/17	35.1	3.25	90.9	47.4	Yes
TCL Semivolatiles								
BENZO (G,H,I)PERYLENE	mg/kg	1/17	1/17	0.0184	0.0793	0.0793	ND	Yes
BENZO(A)ANTHRACENE	mg/kg	1/17	1/17	0.016	0.0785	0.0785	ND	Yes
BENZO(A)PYRENE	mg/kg	1/17	1/17	0.0214	0.103	0.103	ND	Yes
BENZO(B)FLUORANTHENE	mg/kg	2/17	2/17	0.0214	0.0283	0.174	0.0234	Yes
BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	mg/kg	1/17	0/17	0.0616	0.291	0.291	0.1012	Yes
CHRYSENE	mg/kg	1/17	1/17	0.0169	0.0785	0.0785	ND	Yes
FLUORANTHENE	mg/kg	2/17	2/17	0.0251	0.0353	0.179	0.0316	Yes
INDENO (1,2,3-CD)PYRENE	mg/kg	1/17	1/17	0.0192	0.0819	0.0819	ND	Yes
PYRENE	mg/kg	1/17	1/17	0.0207	0.138	0.138	0.029	Yes
TCL Volatiles								
1,1-DICHLOROETHYLENE	mg/kg	15/17	11/17	0.000724	0.000314	0.00168	0.00146	Yes
2-HEXANONE	mg/kg	1/17	1/17	0.000584	0.00257	0.00257	ND	Yes
ACETONE	mg/kg	5/17	2/17	0.0119	0.00413	0.135	ND	Yes
DICHLOROMETHANE (METHYLENE)	mg/kg	11/17	8/17	0.00527	0.00155	0.017	0.01382	Yes
METHYL ETHYL KETONE	mg/kg	3/17	0/17	0.00637	0.00574	0.0416	ND	Yes
TETRACHLOROETHYLENE (PCE)	mg/kg	15/17	0/17	0.00234	0.00149	0.00375	0.00077	Yes
Abbreviations	ND=Non Detect N/A=Not Applicable							

Table 3. Summary of Constituent of Concern Selection for 211-FB Pu-239 Release OU

Detected Analyte	USC	ARAR	PTSM ¹	Contaminant Migration		Human Health		Ecological		Refined
		COC	COC	COPC	COC	COPC	COC	COPC	COC	COC ²
		(None)	(None)	(None)	(None)				(None)	(None)
Inorganics										
Aluminum	X							X		
Arsenic	X					X	X	X		
Barium	X									
Beryllium	X									
Calcium	X									
Chromium	X							X		
Cobalt	X									
Copper	X									
Cyanide	X									
Iron	X									
Lead	X							X		
Magnesium	X									
Manganese	X							X		
Mercury	X									
Nickel	X									
Potassium	X									
Vanadium	X									
Zinc	X							X		

Table 3. Summary of Constituent of Concern Selection for 211-FB Pu-239 Release OU (Continued)

Detected Analyte	USC	ARAR	PTSM ¹	Contaminant Migration		Human Health		Ecological		Refined
		COC	COC	COPC	COC	COPC	COC	COPC	COC	COC ²
Semi-Volatile Organics										
Benzo(g,h,i)perylene	X							X		
Benzo(a)anthracene	X					X				
Benzo(a)pyrene	X					X	X	X		
Benzo(b)fluoranthene	X					X		X		
Bis(2-ethylhexyl)phthalate	X									
Chrysene	X					X		X		
Fluoranthene	X							X		
Indeno(1,2,3-cd)pyrene	X					X		X		
Pyrene	X							X		
Volatile Organics										
Acetone	X									
1,1-Dichloroethylene	X									
Dichloromethane	X									
2-Hexanone	X									
Methyl ethyl ketone	X									
Tetrachloroethylene	X									

Table 3. Summary of Constituent of Concern Selection for 211-FB Pu-239 Release OU (Continued)

Detected Analyte	USC	ARAR COC	PTSM ¹ COC	Contaminant Migration		Human Health		Ecological		Refined COC ²
				COPC	COC	COPC	COC	COPC	COC	
Pesticides/PCBs										
Aroclor-1254										
DDE	X									
DDT	X									
Radionuclides										
Actinium-228	X									
Americium-241	X									
Bismuth-212										
Carbon-14										
Cesium-137	X									
Lead-212	X									
Lead-214										
Plutonium-239/240	X									
Potassium-40										
Radium-226										
Radium-228	X									
Thallium-208	X									
Thorium-228	X									
Thorium-230	X									
Thorium-232	X									
Uranium 233/234	X									
Uranium-238										

¹ PTSM includes evaluations based on both toxicity and mobility

² RCOCs are COCs retained following the uncertainty analysis that require further remedial action

This page was intentionally left blank

APPENDIX A – RESPONSIVENESS SUMMARY

The public comment period for the Proposed Plan for the 211-FB Pu-239 Release OU began on November 22, 2005, and ended on January 5, 2006. Two inquiries were received during the public comment period. SRS responses to the comments are provided below.

1. Comment received on 11/22/05 from Perry Holcomb. "Please find out for me the composition of the buried 'sludge', mentioned in this EB, is" (reference Environmental Bulletin - Volume 16, Number 25).

SRS response: *The 211-FB Pu-239 Release OU was formed by burial of plutonium contaminated sanitary sludge in 1954. Specifically, an operator drained a small tank in the F Area separations facility on December 23, 1954, between 7:00 and 7:30 a.m., by dumping pail(s) of plutonium-contaminated water into a toilet (it is believed that this must have been the mode of operation prior to startup of the facility). The plutonium-contaminated water became mixed with the sanitary sewage at the sewage treatment plant. The contaminated contents of the treatment plant were eventually dispositioned in a trench that was excavated just south of the F-Area fence.*

The vast majority of the sludge contents was sewage. There is not a good understanding of the exact volumes of sewage involved because the documentation is not very detailed in that sense. It was reported that there was less than 20 mCi of Pu-239 involved in the release. Upon characterization of the sludge burial site, very little plutonium was found (maximum of approximately 1.7 pCi/g in the soil).

Not much that one could identify as organic sludge was found at the burial site. A full suite of analytes was run on the zone containing the maximum Pu-239; the only significant RCOC was Pu-239. Because of these findings, it is believed that the sewage consisted mostly of water. Also, it is useful to recognize that the detection capability in 1954 was somewhat limited and the "less than 20 mCi" was obviously very much an overestimate.

The maximum Pu-239 activity in the soil was detected at 10 to 12 feet below surface. Given the depth of burial and the fact that the maximum activity is less than the residential preliminary remediation goal (PRG), SRS is of the opinion that this waste unit requires no future action.

2. Comment received on 11/30/05 from Ernest Vitalini. "I have some concerns about the OU in F Area as mentioned in the Environmental Bulletin. Since an unknown number of buckets (concentration also not known?) were dumped down the drain and 200-F was contaminated, the buried sludge could still be a source of contamination and should not be considered as posing no risk to the public/environment unless there is more information known about this sludge that has not yet been made available to the public."

SRS Response. *Actually there is more information that was not included in the Environmental Bulletin, but is part of the Proposed Plan that is advertised by the bulletin. It is true that it is not known if more than one pail of contaminated water was discharged to the sewage treatment plant, but there is information on the radiological activity associated with the release in 1954. From that information, it is known that the concentration of the contamination in the sludge would be very low, just not how low. After performing a characterization of the burial site for the sludge, it was determined that the concentration of the plutonium was less than preliminary remedial goals (PRG) for residential exposure. In addition, plutonium is known to be very immobile in SRS soils (soils have high cation exchange capacity) and this circumstance eliminates the potential for plutonium to migrate any significant distance vertically.*