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Savannah River Site

Statement of Basis / Proposed Plan for the P Area Operable Unit (PAOU) (U)

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Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm^2	centimeter square
CM	contaminant migration
CMS	Corrective Measures Study
COC	constituent of concern
CPT	cone penetrometer test
D&D	Deactivation and Decommissioning
DBCF	Disassembly Basin Cooling and Filtration System
dpm	disintegrations per minute
EAROD	Early Action Record of Decision
EARAIP	Early Action Remedial Action Implementation Plan
EE/CA	Engineering Evaluation/Cost Analysis
ESD	Explanation of Significant Difference
FDE	Facility Decommissioning Evaluation
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	foot
ft^2	foot square
gal	gallon
HCA	High Contamination Area
HHRA	human health risk assessment
HI	hazard index
IC	Institutional Controls
ISD	in situ decommissioning
km	kilometer
LLC	Limited Liability Company
LUC	land use control
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
m	meter
m^2	meter square
m^3	cubic meter
M&O	management and operation
MCL	maximum contaminant level
mi	mile
NBN	no building number
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
PAOU	P-Area Operable Unit
PCE	tetrachloroethylene
PP	Proposed Plan
PRGW	P-Reactor Groundwater
PSA	potential source area
PSL	process sewer line

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

PTSM	principal threat source material
RAO	remedial action objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goal
RGO	remedial goal option
RI	remedial investigation
ROD	Record of Decision
RPD	Radiological Protection Department
RSER	Removal Site Evaluation Report
SARA	Superfund Amendments Reauthorization Act
SB	Statement of Basis
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
sq	square
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SWMU	Solid Waste Management Unit
SVE	Soil Vapor Extraction
TBC	to be considered
TCE	trichloroethylene
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WSRC	Washington Savannah River Company (October 2005 – present)
WSRC	Westinghouse Savannah River Company (before October 2005)
yds^3	cubic yards

I. INTRODUCTION AND BACKGROUND

Introduction

This Statement of Basis/Proposed Plan (SB/PP) for the P-Area Operable Unit (PAOU) is being issued by the United States Department of Energy (USDOE), which functions as the lead agency for the Savannah River Site (SRS) remedial activities, with concurrence by the United States Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). The PAOU consists of multiple subunits, some of which were previously selected for early remedial actions or non-time critical (NTC) removal actions. The purpose of this SB/PP is to 1) describe the preferred remedy for the entire PAOU (i.e., land use controls [LUCs]) for any residual hazardous substances that remain at the PAOU after completion of the early remedial actions and the NTC removal actions, and 2) provide for public involvement in the decision-making process. Although the early remedial actions and the NTC removal actions will not be completed when this SB/PP is issued, they will be considered the final actions. The preferred remedy, to implement LUCs for the entire PAOU in order to prevent unrestricted land use, is based on the successful completion of the ongoing early remedial or removal activities to meet the remedial goals (RGs).

SRS occupies approximately 803 sq km (310 sq mi) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. The PAOU is located in P Area at the SRS in Barnwell County, South Carolina (Figure 1).

SRS manages certain waste materials that are regulated under the Resource Conservation and Recovery Act (RCRA), a comprehensive law requiring responsible management of hazardous waste. SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on September 30, 2003 (SC1 890 008 989). Module VIII of the Hazardous and Solid Waste Amendments portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units (SWMUs) subject to RCRA 3004(u). Two of the PAOU subunits, the P-Area Process Sewer Lines As Abandoned (PSLs) and the P-Area Ash Basin (Including Outfall P-007) (188-P) are SWMUs under RCRA Section 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 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 U.S.C. § 9620, USDOE has negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the USEPA and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements. The FFA lists the PAOU as a RCRA/CERCLA unit requiring further evaluation using 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.

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the proposed remedial alternatives. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.124 and Section 113 and 117 of CERCLA 42 U.S.C § 9613 and 9617. These requirements include the establishment of an Administrative Record File that documents the investigation and selection of remedial alternatives and allows for review and comment by the public regarding those alternatives (See Section II). The Administrative Record File must be established at or near the facility at issue. The *SRS FFA Community Involvement Plan* (WSRC 1996) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. 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.

SCHWMR R.61-79.124 requires that a brief description and response to all significant comments be made available to the public as part of the RCRA Administrative Record. Community involvement in consideration of this evaluation of alternatives for the PAOU is strongly encouraged. All submitted comments will be reviewed and considered. Following the public comment period, a Responsiveness Summary will be prepared to address issues raised during the public comment period. The Responsiveness Summary will be made available with the final RCRA permit modification in the Record of Decision (ROD) for the PAOU.

The final remedial decision will be made only after the public comment period has ended and all the comments have been received and considered. The final remedial decision under RCRA will be in the form of a final permit modification, which is made by SCDHEC. Selection of the remedial alternative that will satisfy the FFA requirements will be made by USDOE, in consultation with USEPA and SCDHEC. It is important to note that the final action(s) may be different from the preferred alternative discussed in this plan depending on new information or public comments. The alternative chosen will be protective of human health and the environment and comply with all federal and state laws.

Background

SRS is owned by the USDOE. The primary mission of SRS has been to produce tritium, plutonium, and other special nuclear materials for our nation's defense programs. Chemical and radioactive wastes are byproducts of nuclear material production processes. Additionally, hazardous substances, as defined by CERCLA, are currently present in the environment at SRS. Production of nuclear materials for the defense program was discontinued in 1988, though SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Management and operating (M&O) services are currently provided by Savannah River Nuclear Solutions, LLC (SRNS).

The PAOU is one of the area operable units (OUs) identified at SRS. In February 1954, P-Reactor

began operations with a mission of producing nuclear materials for the defense program. SRS reactors were both low pressure and low temperature reactors with heavy water cooling of the core. P-Reactor was placed in shutdown status in 1991. Reactor operations resulted in the generation of chemical and radioactive wastes.

The PAOU is comprised of the following subunits:

- Potential Release from the Reactor Cooling Water System (186/190-P);
- Potential Release from the P-Reactor Disassembly Basin (105-P);
- Process Sewer Lines As Abandoned (no building number [NBN]); Including the Spill on 03/15/79 of 5000 gallons of Contaminated Water; and various components of the PSLs including Process Water Storage Tank (106-P), Process Water Storage Basin (109-P); Cooling Water Effluent Sump (107-P/107-1P); outfalls; manholes, miscellaneous weirs and boxes; sumps, etc.;
- P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN);
- All Railroad Tracks within the P-Area Fence;
- High Contamination Area (HCA) associated with the Cask Car Railroad Tracks as Abandoned;
- P-Reactor Building (105-P) Complex and its Ancillary Structures including Engine House (108-1P), Engine House (108-2P) with Standby Pumphouse 191-P;
- P-Area Ash Basin (Including Outfall P-007) (188-P);
- Containment Tank within Emergency Cooling Water Retention Basin (904-86G);
- Pipe Fabrication Building (717-9P);
- Radiological Zone Storage Building (710-P);
- No. 2&5 Basin Deionizers Pad (105-1P);
- Potential Source Area (PSA) 1 – Emergency Cooling water Retention Basin (904-86G);
- PSA 2 – Area around the Cooling Water Effluent Sump (107-P/107-1P);
- PSA 3A – Area near the Northern end of the Reactor Building (105-P);
- PSA 3B – Area West of the Administrative/ Maintenance Slab;
- PSA 4 – Area East of the Reactor Building (105-P);
- PSA 5 – Two localized areas in the Southwestern part of P Area;
- Outfall P02; and
- Disposition of Water in the P-Reactor Disassembly Basin.

Groundwater is not considered part of the PAOU and will be addressed in the P-Reactor Groundwater (PRGW) OU.

Summary of Previous Regulatory Decisions

Regulatory decisions were made on select PAOU subunits. These decisions included early remedial

actions documented in an EAROD and ESD to the EAROD and NTC removal actions documented in three Removal Site Evaluation Reports (RSER)/ Engineering Evaluation / Cost Analyses (EE/CAs). The remaining subunits not selected for an early remedial action or NTC removal action were presented in the *RFI/RI with Baseline Risk Assessment (BRA) and Corrective Measures Study (CMS)/Feasibility Study (FS)* (SRNS 2008b) and are discussed further in this SB/PP. A description of the administrative pathway for each subunit is provided below and summarized in Figure 2 and Table 1.

Based on the results of the RFI/RI/BRA/CMS/FS (SRNS 2008b), two subunits were determined to require No Further Action since it has been determined that these subunits pose no impact to human health (residential scenario) or the environment (Figure 3; Table 1). These subunits include the Containment Tank within the Emergency Cooling Water Retention Basin (904-86G) and the PSA-1 Emergency Cooling Water Retention Basin (904-86G). In addition, a third subunit, Outfall P02, was also determined to require No Further Action as documented in the Early Action Remedial Action Implementation Plan for the PAOU (EARAIP) (SRNS 2009a) and is discussed below. These subunits are located outside the P-Area fence line and would not be subject to LUCs for the PAOU.

In January 2009, an Early Action Record of Decision (EAROD) was issued that documents the selected early action remedies for the PSA-3A subunit (Soil Vapor Extraction [SVE] with Soil Fracturing and Chemical Oxidation Injection) and the PSA-3B subunit (SVE), the HCA associated with the P-Area Cask Car Railroad Tracks as Abandoned subunit (Excavation/Removal; Confirmatory Sampling), and the Outfall P02 subunit (Excavation/Removal; Confirmatory Sampling) (SRNS 2008a). Prior to implementation of the removal action, additional sampling confirmed that Outfall P02 posed no impact to human health (residential scenario) and the environment. The PAOU EARAIP (SRNS 2009a) documented that the removal action for Outfall P 02 was not needed and No Further Action for the Outfall P02 subunit was required (Figure 4; Table 1). Therefore, the final decision as to the location for waste disposition of the Outfall P02 soil will not be documented in the final PAOU ROD as originally stated in the EAROD.

An Explanation of Significant Difference (ESD) to the EAROD for the PAOU is planned for issuance in November 2009 (SRNS 2009b). The ESD documents the final end-state decision of in situ decommissioning (ISD) for the P-Reactor Building (105-P) Complex (RBC) (Figure 5; Table 1). Alternative R-2A (ISD with the Reactor Vessel grouted in place) was the selected remedial alternative for the RBC. This alternative includes the Process, the Purification, and the Assembly Areas of the RBC as well as the actuator tower remaining in place. The below-grade contents of the Disassembly Basin will be grouted to stabilize the contaminants. The above-grade structure of the Disassembly Basin will be demolished to grade-level after forced evaporation of the Disassembly Basin water has been completed. A sloped concrete cover will then be placed over the grouted Disassembly Basin. The remaining contaminated equipment in the above-grade structure of the RBC will be left in place. ICs

(i.e., LUCs) would also be implemented for an indefinite period of time to prevent direct human exposure. Figure 6 is a schematic drawing of the RBC with ISD applied.

A RSER/EE/CA is planned for public comment in November 2009 for the P-Area PSLs (SRNS 2009d). The preferred removal action is Alternative P-2 (Isolation Plugging of Reactor Building [105-P] PSLs and Drainage System; Grouting of Manholes, Diversion Boxes, and Process Tanks; Select Removal of Process Equipment External to the Reactor Building [105-P]; Sealing/Plugging of Outfalls, and ICs) (Figure 7; Table 1).

A RSER/EE/CA for the P Area Ash Basin (Including Outfall P-007) (188-P) (SRNS 2009c) is planned for public comment in December 2009. The preferred removal action is Alternative P-3 (Removal and Disposal of Cesium-137; Consolidate as Needed; Soil Cover; ICs) (Figure 8; Table 1).

II. COMMUNITY PARTICIPATION

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

USDOE
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

Hard copies of the SB/PP are available at the following locations:

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

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

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

SCDHEC
Bureau of Land and Waste Management
8911 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

SCDHEC – Region 5
Aiken Environmental Quality Control Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 641-7670

The public will be notified of the public comment period through mailings of 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* newspapers. The public comment period will also be announced on local radio stations.

USDOE will provide an opportunity for a public meeting during the public comment period if significant interest is expressed. The public will be notified of the date, the time, and the location. At the

meetings, the proposed action will be discussed, and questions about the action will be answered.

To request a public meeting during the public comment period, to obtain more information concerning this document, or to submit written comments, contact the following:

Paul Sauerborn
Savannah River Nuclear Solutions, LLC
Public Involvement
Savannah River Site
Building 730-1B
Aiken, South Carolina 29808
(803) 952-6658
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SCDHEC
Attn: Richard Haynes, P.E., Director
Division of Waste Management
Bureau of Land and Waste Management
2600 Bull Street
Columbia, South Carolina 29201
(803) 896-4000

Following the public comment period, a ROD will be signed, and a final decision for the SRS RCRA permit will be issued. The ROD and RCRA permit will detail the remedial alternatives chosen for this operable unit and include responses to oral and written comments received during the public comment period in the Responsiveness Summary.

The Facilities Disposition and Site Remediation Committee of the SRS Citizens Advisory Board (CAB) has met and reviewed the strategy for closure of P Area. This resulted in the CAB adopting recommendation #233 on May 23, 2006, which supported public involvement in the process to determine the P-Reactor Building (105-P) Complex end state at the PAOU. At their subsequent July 23-24, 2006 meeting, the CAB formally issued recommendation #248, which requested DOE to hold public workshops to discuss selection of the P-Reactor Building (105-P) end state. In response to this request, USDOE held two workshops for the Aiken area: the first on October 16, 2007, and the second on February 28, 2008. A third workshop was held on May 19, 2008 in Savannah, GA. These workshops were well publicized and included representatives from the USEPA Region 4 and SCDHEC. These workshops discussed ISD as the agreed to end state for the P-Reactor Building (105-P) Complex as documented in the EAROD (SRNS 2009a).

Future Land Use

The current land use for the PAOU is industrial with USDOE maintaining control of the land as long as necessary to keep the selected remedy fully protective of human health and the environment. 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. P Area has been identified in the SRS Land Use Controls Assurance Plan (LUCAP) as industrial (WSRC 1998). P-Reactor has been declared an excess facility by USDOE Defense Programs Office. An industrial land use scenario was selected as the BRA exposure scenario for the protection of human health and the environment (SRNS 2008b). One potential future use for this area that could be considered is by the U.S. Armed Forces for training purposes. The use by the U.S. Armed Forces for training purposes is consistent with industrial use, and the remediation goals established for industrial use are protective under this potential land use scenario as well.

III. OPERABLE UNIT BACKGROUND

P Area is located in south-central SRS (Figure 1). In February 1954, P-Reactor began operations. It was taken off-line for maintenance and safety upgrades in 1987, placed in warm standby in 1988, and placed in shutdown status in 1991. In 1993, P-Reactor was placed in cold shutdown with no capability of restart. The primary sources of radioactive contamination in P Area are activation products, fission products, and tritium, the majority of which were the consequence of P-Reactor operations. Currently, the P-Reactor Building (105-P), together with facilities within the P Area fence, is undergoing deactivation in preparation for ISD (SRNS 2009b). As previously mentioned groundwater is not part of the PAOU and will be addressed in the PRGW OU.

Twenty-four subunits were evaluated as part of the PAOU (Table 1). Of these, three subunits were determined to pose no risk to human health or the environment based on unrestricted land use. The remaining twenty one subunits will require land use controls as part of the selected remedy to prevent unrestricted land use. The subunits are discussed in more detail below and are categorized as either requiring no further action or requiring further action to be evaluated in this SB/PP.

PAOU Subunits Requiring No Further Action

The following subunits have been determined to require no further action. These subunits are located outside the P-Area fence line and were evaluated using both the industrial and residential land use scenario. It has been determined that these subunits pose no impact to human health (based on the more conservative residential land use) or the environment. The land use controls selected for the entire PAOU are not needed for these subunits as discussed in further detail below.

Potential Source Area 1 – Emergency Cooling Water Retention Basin (904-86G)

PSA 1 is primarily associated with the Emergency Cooling Water Retention Basin (904-86G) (Figure 4). It is a 190 million L (50 million gal) earthen basin that was constructed during the 1960's as part of the emergency cooling water system. The basin was designed to contain contaminated water that would accumulate in the event of a loss-of-cooling or loss-of-circulation accident. The basin never received discharges from an emergency event.

Based on the results of the human health risk assessment (SRNS 2008b), there are no human health refined constituents of concern (RCOCs) in the surface soils for a future industrial worker or a future resident at the PSA-1 Emergency Cooling Water Retention Basin. Therefore, No Further Action was determined for this subunit (Table 1).

Slab Associated with Containment Tank within the 904-86G (Emergency Cooling Water Retention Basin)

The Containment Tank was located inside of the Emergency Cooling Water Retention Basin (904-86G) (SRNS 2008b) (Figure 3). The tank was constructed in 1979 and had a capacity of 500,000 gallons.

The tank received water from building drains, manholes, sump pumps, or storage tanks located within the P-Reactor Building (105-P). In the mid-

1980's, the tank received process sewer back-up from P-Reactor Building (105-P) during a high rain event. The facility was demolished and removed to foundation and all interfacing utilities were isolated, disconnected, and plugged (WSRC 2007d). There are no spills associated with the tank and there are no instances where the tank overflowed onto the surrounding basin soils.

Radiological samples taken per the Facility Decommissioning Evaluation (FDE) indicated that the tank met the unconditional release criteria (removal surface contamination is less than 20 dpm/100 cm^2 alpha, 200 dpm/100 cm^2 beta/gamma, and 10,000 dpm/100 cm^2 tritium) (WSRC 2006). Additionally, the concrete slab was surveyed as a best practice. The survey demonstrated that the concrete slab also met the unconditional release criteria.

Because the surveys of the slab met unconditional release criteria and the human health risk assessment for PSA 1 resulted in no HH RCOCs in the surface soils for a future industrial worker or a future resident, No Further Action was determined for this subunit (SRNS 2008b) (Table 1).

Outfall P02

Outfall P02 is a stormwater outfall located to the northeast of the PAOU and is a tributary to PAR Pond (Figure 4). It is approximately 0.07 hectares (0.16 acres) in area. Previous sampling indicated the presence of radionuclides in the upper section of Outfall P02. Based on these results, soil excavation/ removal was planned as an early action. Confirmatory sampling was conducted at Outfall P02 in 2008 and is documented in the *Early Action Remedial Action Implementation Plan* (EARAIP) (SRNS 2009a). Using the results of the 2008 confirmatory sampling, a supplemental risk assessment was performed for Outfall P02 to evaluate exposure risk to a residential receptor. Based on this evaluation, it was determined that no exposure risk exists for the residential scenario. Therefore, no remedial action is required for the Outfall P02. Both the confirmatory sampling and no further action determination occurred prior to commencing the planned early action excavation activities.

PAOU Subunits Requiring Further Action

The following discussions pertain to the PAOU subunits that will require further action:

Potential Release from Reactor Cooling Water System (186/190-P)

The P-Area Reactor Cooling Water System comprises the P-Area Reactor Cooling Water Reservoir (186-P) and the P-Area Cooling Water Pump House (190-P) (Figure 3). The P-Reactor Cooling Water Reservoir, commonly referred to as the concrete lakes or the cooling water basin, is a large, reinforced concrete basin. The structure has been decommissioned and deactivated. The footprint of the reservoir is 17,652 m^2 (190,000 ft^2) and, when full, the basins hold 94,635 m^3 (25 million gallons) total. The basin depth is approximately 9 m (30 ft), of which approximately 6 m (20 ft) is below grade.

When operational, the basins were filled with cooling water from PAR Pond or makeup water from the Savannah River. From the reservoir, the water was

pumped to the non-contact heat exchangers in the P-Reactor Building (105-P). These heat exchangers sometimes leaked minute quantities of radioactively contaminated heavy water (deuterium oxide) to the cooling water.

During normal operation and cold weather, some of the water was recycled back to the Cooling Water Reservoir (186-P) to maintain water temperature. Investigation of surface and subsurface soil around the Reactor Cooling Water System (186/190-P) determined the presence of inorganic and radionuclide constituents (SRNS 2008b), but at naturally-occurring levels.

The presence of VOCs in the groundwater is not attributed to the Cooling Water Reservoir System (186/190-P), but rather to upgradient sources (PSAs 3A/3B).

As determined in the RFI/RI/BRA/CMS/FS, the Potential Release from Reactor Cooling Water System (186/190-P) was determined to have no problems warranting action under the industrial land use scenario. However, the Potential Release from Reactor Cooling Water System (186/190-P) subunit will be managed with the land use controls selected for the entire PAOU to prevent unrestricted use. (SRNS 2008b) (Table 1).

Potential Release from the P-Area Disassembly Basin (105-P)

The P-Area Disassembly Basin is a concrete-lined basin that ranges in depth from 5.2 m (17 ft) below grade to 9.1 m (30 ft below grade (Figure 3). The full-pool capacity of the basin is 18,250 m^3 (4.82 million gal); currently, the basin is 85% full, containing approximately 15,520 m^3 (4.1 million gal) of water and miscellaneous contaminated scrap (chains, buckets, hangers, lights, plastic, hand tools, etc.) (WSRC 2005b).

The disassembly basin is divided into several discrete but contiguous areas used for different fuel handling processes, including storage, cooling, disassembly, and preparation for transport (WSRC 2005a). The tritium contamination in the disassembly basin water and sludge was from the small amounts of moderator that were transferred with the fuel, targets, and other components when discharged from the reactor. The other radionuclide contamination within the disassembly basin water and sludge is from the corrosion of the irradiated and activated components that were stored in the basin.

Soil sampling was conducted to discern the nature and extent of metal and radionuclide contamination at the Disassembly Basin. Analysis of the data indicates that inorganics and radionuclides that were detected in subsurface soils are naturally-occurring. Radionuclides which were typical of reactor operations were not detected in the subsurface soils around the Disassembly Basin.

As discussed in the RFI/RI/BRA/CMS/FS, the Potential Release from the P-Area Disassembly Basin (105-P) was determined to have no problems warranting action under the industrial land use scenario. (SRNS 2008b) (Table 1). However, the Potential Release from the P-Area Disassembly Basin (105-P) subunit will be managed with the land use

controls selected for the entire PAOU to prevent unrestricted use.

P-Area Process Sewer Lines As Abandoned

The PSLs consist of 4.7 km (2.9 mi) of underground lines of various sizes and configuration throughout the P Area (Figure 7). The process lines were constructed of carbon steel. These lines, in some cases, were joined to concrete stormwater lines. In addition, underground tanks (including 106-P and 109-P), outfalls, manholes, miscellaneous weirs and boxes associated with the PSLs are included with this subunit for closure (Figure 7). Subsurface soils were sampled around and below the PSLs and at the Spill on 03/15/79 of 500 Gallons of Contaminated Water, NBN. No contamination was found exterior to the PSLs.

Based on process knowledge and investigations conducted at C- and R-Area PSLs, radionuclides are present in the lines. The contamination (i.e., cesium-137 and cobalt-60) is fixed to the metal matrix of the PSLs and does not pose an immediate threat to the environment. Due to the difficulty in accessing the lines and investigations conducted at other reactor areas, the Core Team agreed, in November 2008, that there is a potential for principal threat source material (PTSM) may be fixed within the pore spaces of the concrete or trapped in the rust and scale in these lines. Therefore, there is a potential risk for exposure to PSL contamination if the lines are physically breached and exposed at the surface.

A RSER/EE/CA for the P-Area PSLs (SRNS 2009d) is planned for public comment in November 2009. The preferred removal action is Alternative P-2 (Isolation Plugging of Reactor Building [105-P] PSLs and Drainage System; Grouting of Manholes, Diversion Boxes, and Process Tanks; Select Removal of Process Equipment External to the Reactor Building [105-P]; Sealing/Plugging of Outfalls, and ICs) (Table 1).

Based on the likelihood for PTSM in the P-Area PSLs, a removal action will be conducted to eliminate exposure to access points in the lines and prevent water flow through the lines. Following the removal action, radioactive contaminants will be left in place. LUCs will be required to prevent exposure if the PSLs are physically breached and exposed at the surface.

P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN)

The P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN) is an area south of the Disassembly Basin that extends from the western reactor fence line back to the end of a railroad spur. Radiological material from the reactor was transferred into metal casks inside the Reactor Building (105-P) (Figure 3). The casks were loaded onto railroad cars inside the building and were routinely parked in various P Area locations while awaiting transfer to the Separation Areas (F/H Areas). When the railroad cars were exposed to rain, radiological materials could have been washed from the outside of the casks onto the ground surface, thus possibly contaminating the railroad tracks with radiological constituents from reactor operations.

Soil sampling was conducted to discern the nature and extent of metal and radionuclide contamination

at the P-Area Reactor Area Cask Car Railroad Tracks As Abandoned. Analysis of the data indicates that at the Cask Car Railroad Tracks inorganics and radionuclides that were detected are naturally-occurring.

As discussed in the RFI/RI/BRA/CMS/FS, the P-Area Reactor Area Cask Car Railroad Tracks As Abandoned was determined to have no problems warranting action under the industrial land use scenario. (SRNS 2008b) (Tables 1 and 2). The P-Area Reactor Area Cask Car Railroad Tracks As Abandoned subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

All P-Area Cask Car Railroad Tracks within the P-Area Fence

All railroad tracks, cross ties, and up to 1.8 m (6 ft) on either side of the railroad tracks remaining within the P Area facility fence were surveyed by SRS Radiological Protection Department (RPD) personnel to determine areas of radioactivity that may be present above background levels. In addition, remnants of the railroad tracks that led to the coal burning powerhouse were also surveyed. This section of railroad track and cross ties was removed in the mid-1990s and consolidated within the southern section of P Area.

As an outcome of the survey, no radiological contamination was found on or near the P-Area Cask Car Rail Road Tracks within the P-Area fence (except for the HCA associated with the Cask Car Railroad Tracks which will be discussed in the next section). However, because of its location within the P Area fence, the Cask Car Railroad Tracks will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

High Contamination Area Associated with the P-Area Cask Car Railroad Tracks

During reactor operations, the irradiated fuel and target assemblies were loaded underwater into lined casks in the Disassembly Basin. These casks were then transported by rail to the separations areas for chemical processing. Inevitably some leakage (water contaminated with radionuclides – mostly cesium-137 [+D]) occurred, which resulted in a release of radioactive contaminants along the railroad tracks to the southeast of the P-Reactor Building (105-P) (Figure 4). Total cumulative carcinogenic risk to an industrial worker is 5.6E-03 (Table 2).

In January 2009, an EAROD was issued that documents the selected early action remedy for the HCA associated with the Cask Car Railroad Tracks (Excavation/Removal; Confirmatory Sampling (SRNS 2008a) (Figure 4; Table 1). Following the early remedial action (soil removal to 1 pCi/g cesium-137), the HCA associated with the Cask Car Railroad Tracks subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

P-Reactor Building (105-P) Complex (Including Engine House [108-1P], Engine House [108-2P] with Standby Pumphouse [191-P]

The P-Reactor Building (105-P) Complex (RBC), in its entirety, is subdivided into three components based on total curie inventory, risk, and future remedial action(s). For clarification, the RBC, as a

whole, contains all three components which were integral to reactor operations (Figure 5). The three components are as follows:

- Reactor Vessel;
- Disassembly Basin
- P-Reactor Building (105-P) and its ancillary structures (including the Engine Houses [108-1P/ 108-2P] and the Standby Pumphouse [191-P]).

Additional information pertaining to components of the RBC, the sampling results, and the curie estimates can be found in the ESD to the EAROD for the PAOU (SRNS 2009a). The risks associated with the RBC are shown in Table 2.

As stated in the ESD to the EAROD (SRNS 2009a), Alternative R-2A (ISD with the Reactor Vessel grouted in place) was the selected remedial alternative for the P-Reactor Building (105-P) Complex (Figure 6). This alternative includes the Process, the Purification, and the Assembly Areas of the RBC as well as the actuator tower remaining in place. The below-grade contents of the Disassembly Basin will be grouted to stabilize the contaminants. The above-grade structure of the Disassembly Basin will be demolished to grade-level after forced evaporation of the Disassembly Basin water has been completed. A sloped concrete cover will then be placed over the grouted Disassembly Basin. The remaining contaminated equipment in the above-grade structure of the RBC will be left in place.

Following the early remedial action, radioactive contaminants will be left in place. LUCs will be required to prevent exposure to contaminants located within the RBC. Therefore, LUCs will be required for as long as necessary to keep the selected remedy fully protective of human health and the environment.

P-Area Ash Basin (Including Outfall P-007 Outfall)

Each reactor at SRS utilized a coal-fired powerhouse to generate steam and electricity, with coal ash produced as a result of boiler operations. In P Area, this ash was disposed within the P-Area Ash Basin (188-P) via a sluice line. The ash basin is located outside the southeastern perimeter of P Area. The P-Area Ash Basin (188-P) is an unlined, earthen containment basin that received sluice from 1951 to 1991. During the years of 1973 to 1974, significant amounts of ash within the basin were removed and placed around the perimeter of the basin and to the north along the access road that led to the basin (Figure 8), including in the vicinity of Outfall P-007. Ash covers approximately 9.71 hectares (24 acres). An estimate of approximately 157,498 m3 (206,000 yds3) of ash is determined to be present both inside and outside of the basin. The P-Area Ash Basin (188-P) operated under Industrial Wastewater Permit #7292.

The Outfall P-007 is located north of the P-Area Ash Basin (188-P) (Figure 8). Because the possible source of contamination in the Outfall P-007 is from process line discharges that originated from the P-Reactor Disassembly Basin, the Outfall P-007 was evaluated independent of the P-Area Ash Basin (188-P). Gamma overflight data indicated a localized area of elevated gamma activities. Sampling performed in 2006 and 2008 confirmed the presence of elevated

activities of cesium-137 (+D) and cobalt-60. Figure 8 shows the extent of the contamination at Outfall P-007 as it relates to the ash deposits from the P-Area Ash Basin (188-P). Including the extent of ash present, Outfall P-007 is approximately 2.83 hectares (7 acres) in size. Human health COCs and risks for both the P-Area Ash Basin and the Outfall P-007 are shown in Table 2.

A RSER/EE/CA for the P Area Ash Basin (Including Outfall P-007) (188-P) (SRNS 2009c) is planned for public comment in December 2009. The preferred removal action is Alternative P-3 (Removal and Disposal of Cesium-137; Consolidate as Needed; Soil Cover; Institution Controls). Following the removal action, radioactive and hazardous contaminants will be left in place under a soil cover. LUCs will be required to prevent disturbance of the cover and potential exposure to the contaminants.

Slab Associated with 717-9P Pipe Fabrication Building

The Pipe Fabrication Shop Building (717-9P) was located southwest of P-Reactor Building (105-P) (Figure 3). It was constructed in 1987 to support the renovation of systems within the P-Reactor Building (105-P), including storing construction materials and industrial products. It was constructed of a wooden frame on a concrete slab with corrugated aluminum siding and roof. The building footprint was approximately 177 m^2 (1,263 ft^2).

The building was decommissioned and demolished to the foundation slab (WSRC 2007a). The FDE identified both an oil stain and a radiological hot spot on the slab. The oil stain on the building foundation slab was cleaned with Biosolve® and the hot spot was scabbled twice.

Final verification sampling was performed on the building slab to identify residual contamination. Only naturally-occurring radionuclides (lead-212, lead-214, potassium-40, and thallium-208) were detected in the concrete samples collected. No unit-related radionuclides were detected.

As discussed in the RFI/RI/BRA/CMS/FS, the Slab Associated with 717-9P Pipe Fabrication Building was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The Slab Associated with 717-9P Pipe Fabrication Building subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Slab Associated with 710-P Radiological Zone Storage Building

Radiological Zone Storage Building (710-P) was an 11.9 m^2 (128 ft^2), single-story structure. The building was a steel-framed structure with corrugated asbestos panels as siding and roofing. It was constructed on a concrete slab with no floor drains, sumps, or secondary containment structures. The building served as a storage area for contaminated laundry and waste bags.

The FDE noted areas of split paint and an area, in the approximate center of the structure's slab, as having internal/fixed contamination. The facility was decommissioned and demolished to the foundation slab.

The slab was scabbled to address the painted areas and radiological hot spot. Radiological survey performed after scabbling did not indicate the presence of radioactivity (WSRC 2007b).

Samples were collected as part of final verification. Tritium and lead-212 were the only radionuclides detected. However, lead-212 is present in the natural material used in making concrete and is unit-related.

As discussed in the RFI/RI/BRA/CMS/FS, the Slab Associated with 710-P Radiological Zone Storage Building was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The Slab Associated with 710-P Radiological Zone Storage Building subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P)

The No. 2&5 Basin Deionizers Pad (105-1P), located next to P-Reactor Building (105-P), began operating in 1963 as a 186 m^2 (2,000 ft^2) curbed concrete slab with electrical and piping connections for connecting portable filtration/deionization trailers to the Disassembly Basin Cooling and Filtration System (DBCF) for periodic decontamination of the basin water (Figure 3).

Two sumps were operated during Building 105-1P's operation history. The slab was sloped to a process drain which was approximately three inches below grade. In 1984, the "collection sump" was filled in with grout and a new sump and pump were installed. During deactivation in the late 1990's, the sump pump was removed, and a metal cover was placed over the new sump and covered with two inches of concrete.

The concrete foundation was radiologically contaminated due to disassembly basin water leaks from trailers and piping connections.

The facility was decommissioned and demolished to the concrete slab. Fixative coatings applied during the initial deactivation in the late 1990's were removed to allow surveys and decontamination of the foundation concrete. Several long thin cracks that were previously covered by a fixative coating were visible. During decommissioning of the slab, the slab was scabbled and the cracks were heavily scabbled to the extent that the cracks are no longer open. The new sump was uncovered and all remaining equipment (float valve and electrical connection), sludge, and water were removed from the bottom of the sump. No cracks or holes were present in the sump bottom following visual inspection (WSRC 2007c).

Subsequent to scabbling the slab, radiological surveys were conducted and did not indicate the presence of radiological contamination on the slab (WSRC 2007c).

A concrete sample was collected from the original sump by drilling through the grout fill to the bottom of the sump. Two unit-related radionuclides (cesium-137 and tritium) and two metals (barium, chromium) were detected in the sample. Upon completion of the sampling, the drill hole was regrouted.

Radiological survey of the new sump indicated radioactive contamination (WSRC 2007c). Three radionuclides (cesium-137, cobalt-60, and tritium) and three metals (arsenic, barium, and chromium) were detected in the new sump. Upon completion of the sampling, the new sump was grouted to surface.

As discussed in the RFI/RI/BRA/CMS/FS, the Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P) was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P) subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Potential Source Area 2 – Area around the Cooling Water Effluent Sumps (107-P/107-1P)

PSA 2 is located in the area around the Cooling Water Effluent Sumps (107-P/107-1P) which received cooling water effluent discharges from the P-Reactor Building (105-P) (Figure 4). PSA 2 was identified due to the presence of elevated gross alpha and nonvolatile beta activities in the groundwater from previous groundwater investigations. Sampling results taken as part of PAOU characterization at the PSA 2 indicate that there was no release of material to subsurface soils or the groundwater from the Cooling Water Effluent Sumps.

As discussed in the RFI/RI/BRA/CMS/FS, the PSA 2 was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The PSA 2 subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Potential Source Area 3A – Area near the Northern End of the Reactor Building (105-P)

PSA 3A is located north of the Reactor Building (105-P) (Figure 4). The highest VOC concentrations (trichloroethylene [TCE]) are exhibited in an area outside the northern end of the Reactor Building (105-P). Releases within PSA 3A have resulted in subsurface soil contamination and are contributing to the existing VOC groundwater plume.

In January 2009, an EAROD was issued that documents the selected early remedial action for PSA-3A (SVE with Soil Fracturing and Chemical Oxidation Injection) (SRNS 2008a) (Figure 4; Table 1), to reduce TCE to 0.53 mg/kg in the vadose zone. Following the early remedial action, the PSA 3A subunit will be managed with the land use controls selected for the entire PAOU to prevent unrestricted use.

Potential Source Area 3B – Area West of the Administrative/Maintenance Slab

PSA 3B is located west of the Administrative/ Maintenance slab (704-P) (Figure 4). The highest VOC concentrations (tetrachloroethylene [PCE]) are exhibited in an area west of the Administrative/ Maintenance slab. Releases from PSA 3B have resulted in subsurface soil contamination which is contributing to the existing VOC groundwater plume.

In January 2009, an EAROD was issued that documents the selected early remedial action for PSA-3B (SVE) (SRNS 2008a) (Figure 4; Table 1), to

reduce PCE to 0.53 mg/kg in the vadose zone. Following the early remedial action, the PSA 3B subunit will be managed with the land use controls selected for the entire PAOU to prevent unrestricted use.

Potential Source Area 4 – Area East of the Reactor Building (105-P)

PSA 4 is located in an area on the eastern side of the P-Reactor Building (105-P) (Figure 4). PSA 4 was identified due to the presence of elevated TCE/tritium in the groundwater from previous groundwater investigations. Sampling results taken as part of PAOU characterization at the PSA 4 did not indicate a source(s) of VOCs in the subsurface.

As discussed in the RFI/RI/BRA/CMS/FS, the PSA 4 was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The PSA 4 subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Potential Source Area 5 – Two Localized Areas in the Southwestern Part of P Area

PSA 5 focuses on two small areas in the southwestern part of P Area (Figure 4). Previous groundwater investigation had identified potential VOC contamination in the groundwater of these two localized areas, but the source of the contamination, if any, had not been identified. Based on process knowledge and historical data, there is no indication of surficial release of VOCs in this area. Sampling results taken as part of PAOU characterization at the PSA 5 did not indicate a source(s) of VOCs in the subsurface.

As discussed in the RFI/RI/BRA/CMS/FS, the PSA 5 was determined to have no problems warranting action under the industrial land use scenario (SRNS 2008b) (Table 1). The PSA 5 subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Disposition of Water in the P-Reactor Disassembly Basin

The P-Reactor Disassembly Basin is a concrete basin inside the P-Reactor Building (105-P) building comprised of seven interconnected sections and currently has 15.9 million L (4.2 million gal) of water. The basin also contains contaminated sediments and reactor activated metal components.

The selected removal action for the Disassembly Basin is Alternative 3 – Forced Evaporation. Additionally, 1.4 million L (380,000 gal) of water from the R-Reactor Disassembly Basin will need to be transported to the P-Reactor Disassembly Basin in order to achieve closure of the R-Reactor Disassembly Basin. Following the removal action, the P-Reactor Disassembly Basin subunit is included as part of the ISD decision for the RBC, as documented in the ESD to the EAROD (SRNS 2009a).

IV. SCOPE AND ROLE OF RESPONSE ACTION

The USDOE, the owner of SRS, developed a new completion strategy in 2003 for environmental restoration at SRS. The new strategy accelerates the cleanup completion and results in accelerated risk reduction to workers, the public, and the environment. SCDHEC and USEPA, which serve as

the regulatory agencies, support the accelerated cleanup.

A key component of the plan is to implement an area-by-area remediation strategy. Through the coordinated sequencing of environmental restoration and decommissioning activities, environmental cleanup can be completed for the entire areas of SRS. In addressing whole areas, individual units will be consolidated to form an Area OU to take advantage of characterization data, risk assessments, decommissioning documents and integrated solution to affect economies of scale and reduce administrative requirements. In 2005, the Core Team (representatives from USDOE, USEPA and SCDHEC) convened and agreed that using the Area OU strategy to manage surface units at the PAOU was appropriate.

As part of the Area OU remedial strategy, the facilities in the former P-Area industrial area (including the P-Area Ash Basin [188-P]) were consolidated to form a single OU, the PAOU. SRS has revised the FFA (FFA 1993) to indicate D&D facilities and Area OUs. This information is listed in the FFA under Appendix C.4, "D&D Facilities (or Remnants) that may Warrant Action"; Appendix C.5, "Area Operable Units"; and Appendix K, "D&D Facilities List." Appendix K of the FFA consists of Appendix K.1, "D&D Facilities to be Decommissioned," and Appendix K.2, "D&D Facilities (or Remnants) that Require No Further Evaluation."

In 2008, the Core Team convened and agreed to accelerate clean up of certain PAOU subunits using an early remedial action approach. The early remedial actions for the PSA 3A, the PSA 3B, and the HCA associated with the Cask Car Railroad Tracks will achieve final cleanup goals. Only LUCs will be required to prevent unrestricted use and land disturbances.

In 2009, the USDOE decided to proceed with removal actions to support accelerated remediation of the P-Area PSLs and the P-Area Ash Basin (including Outfall P-007) under the American Recovery and Reinvestment Act of 2009. The removal actions for these subunits will achieve final clean up goals. Only LUCs (e.g., ICs) will be required to prevent unrestricted use and land disturbances (Figure 9).

Therefore, the PAOU will be addressed with a combination of early remedial actions, removal actions, and a final action.

The purpose of the SB/PP is to propose and document the following for the PAOU subunits:

- LUCs after completion of the removal action for the PSLs to meet RGs;
- LUCs after completion of the removal action for the P-Area Ash Basin (including Outfall P-007) (188-P) to meet RGs;
- LUCs after completion of the early remedial action for the P-Reactor Building (105-P) Complex:
- LUCs after completion of the early remedial actions at the PSAs 3A/3B, and the HCA

associated with the Cask Car Railroad Tracks to meet RGs;

- Document that no further actions are required for the three subunits that have been determined to pose no threat to human health (residential and industrial) or the environment (Table 1). Due to their location outside of the P-Area fence line, LUCs are not warranted;
- LUCs for the entire PAOU will include the ten subunits designated in Table 1 that were not included in the early remedial actions or removal actions decisions but are located within the P-Area fence line.

V. SUMMARY OF SITE RISKS

This section identifies the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial actions. Additional information pertaining to the risk assessment can be found in the RFI/RI/BRA/ CMS/FS (SRNS 2008b), the ESD for the EAROD (SRNS 2009b), the EAROD (SRNS 2008a), the EARAIP (SRNS 2009a), the RSER/EECA for the PSLs (SRNS 2009c), and the RSER/EECA for the P-Area Ash Basin (including Outfall P-007) (188-P) (SRNS 2009d).

Summary of Human Health Risk Assessment

A summary of the risks for each subunit is provided below, including the expected residual risk after the early remedial actions or removal actions are completed. Baseline risks for each subunit are included in Table 2.

The future industrial worker scenario was chosen to document the analysis of the potential for adverse human health effects at the PAOU (SRNS 2008b). This analysis is a standard USEPA scenario which addresses risks to workers who are exposed to unit contaminants within an industrial setting. The future industrial worker is an adult who hypothetically works on unit for the majority of time. An area is considered to pose adverse health effects to a future industrial worker if the cumulative risk from all constituents of concern (COCs) exceeds a carcinogenic threshold greater than 1E-06 or a noncarcinogenic Hazard Index (HI) greater than 1.

For PSA 1, the Containment Tank within the Emergency Cooling Water Retention Basin (904-86G) and Outfall P02, the residential land use scenario was considered because these subunits were outside the P Area fence line. Soil data was evaluated against residential risk criteria to determine if theses subunits could be identified as unrestricted release.

The human health risk assessment (HHRA) conservatively assumed that currently there are no access or exposure controls in place at the PAOU. The routes of exposure for soils considered incidental ingestion, inhalation, and external exposure pathways; however, the exposure scenario for concrete structures considered the inhalation pathway incomplete. Additionally, the routes of exposure for the Disassembly Basin (sediment media) included incidental ingestion, inhalation, and external radiation.

As determined in the RFI/RI/BRA/CMS/FS, various subunits were determined to have no problems warranting action under the industrial land use scenario. However, these subunit will be managed with the land use controls selected for the entire PAOU to prevent unrestricted use. (SRNS 2008b) (Table 1).

The results of the HHRA for the PAOU subunits are shown in Table 2. Subunits for which RCOCs were determined for the human health risk assessment are: HCA Associated with the Cask Car Railroad Tracks, P-Reactor Building (105-P) Complex, and P-Area Ash Basin (including Outfall P-007).

Based on the likelihood for human health risks to exceed 1E-03 in the P-Area PSLs, a removal action will be conducted to eliminate exposure to access points in the lines and prevent water flow through the lines. Following the removal action, radioactive contaminants will be left in place. LUCs will be required to prevent exposure if the PSLs are physically breached and exposed at the surface.

Due to human health risk determined at the HCA associated with the Cask Car Railroad Tracks (Table 2), an early remedial action will be conducted to eliminate exposure to radionuclide contaminants. Following the early remedial action (soil removal to 1 pCi/g cesium-137), the HCA associated with the Cask Car Railroad Tracks subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

Because of the below-grade contamination and the above-grade contaminated equipment remaining in place at the RBC, an early remedial action will be conducted to eliminate exposure to radionuclide contaminants. Following the early remedial action, radioactive contaminants will be left in place. LUCs will be required to prevent exposure to contaminants located within the RBC. Therefore, LUCs will be required for as long as necessary to keep the selected remedy fully protective of human health and the environment.

Based on radioactive and hazardous contaminants being left in place under a soil cover for the P-Area Ash Basin (including Outfall P-007), a removal action will be conducted to prevent disturbance of the cover and potential exposure to the contaminants. Following the removal action, LUCs will be required to prevent disturbance of the cover and potential exposure to the contaminants.

Summary of PTSM Evaluation

PTSM are materials that include or contain hazardous substances, pollutants, or contaminants that act as a reservoir for migration to groundwater, surface water, or air and act as a source of direct exposure.

At SRS, source material is considered to be PTSM if the cumulative risk exceeds one of the following threshold criteria:

- Carcinogens – greater than 1E-03 industrial worker risk; or
- Non-carcinogens – industrial worker HI greater than 10.

The results of the PTSM evaluation for the PAOU subunits are shown in Table 2. Subunits for which RCOCs were determined for the PTSM evaluation

are: HCA Associated with the Cask Car Railroad Tracks, and P-Reactor Building (105-P) Complex. Early remedial actions have been developed (SRNS 2009a) that will address the PTSM in these subunits.

Summary of Ecological Risk Assessment

Ecological risk is associated with the potential for harmful effects to ecological systems resulting from exposure to an environmental stressor. A stressor is any physical, chemical, or biological entity that can induce an adverse response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact.

An ecological risk assessment was conducted on the P-Area Ash Basin (188-P), the Outfall P-007, the Potential Release from P-Reactor Cooling Water System (186/190-P), and the PSA 1 – Emergency Cooling Water Retention Basin. The remaining PAOU subunits were determined not to require an ecological risk evaluation due to lack of habitat (industrial setting) and/or conceptual model considerations (e.g., contamination at depth).

The results of the ecological risk assessment for the PAOU subunits are shown in Table 2. There were no ecological COCs identified for any of the PAOU subunits.

Summary of Contaminant Fate and Transport

Contaminant migration (CM) modeling conducted for P-Reactor Building (105-P) Complex evaluated the impact to groundwater greater than a regulatory threshold (i.e., MCL) by determining CM COCs (SRNS 2008b).

The results of the CM evaluation for the PAOU subunits are shown in Table 2. Subunits for which RCOCs were determined for the CM evaluation are: P-Reactor Building (105-P) Complex, and PSAs 3A/3B. Early remedial actions have been developed (SRNS 2009a) that will address the CM COCs in these subunits.

Site Risks - Conclusion

Overall, the subunits identified herein warrant a final action as part of this SB/PP. If these subunits are not addressed by the Preferred Alternative (Section IX) radioactive or hazardous substances from these subunits may present a potential threat to public health. Three subunits were identified as requiring No Further Action since it has been determined that these subunits pose no impact to human health (residential and industrial) or the environment (SRNS 2008b) (Table 1). Additionally, various subunits identified in Table 1 pose no threat to human health or the environment under the industrial land use scenario. These subunits will remain as part of the PAOU due to their location within the industrial zone of P Area and will be managed with LUCs for the PAOU to prevent unrestricted use (Figure 9).

VI. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOAL OPTIONS

Remedial Action Objectives

Remedial action objectives (RAOs) are media- or unit-specific objectives for protecting human and the environmental receptors from exposure to

contaminated media. RAOs describe what the cleanup will 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 PAOU subunits warranting final action:

- Eliminate or control all routes of exposure to residual radioactive or chemical contamination posing industrial risks exceeding 1E-06 in media or structures associated with the P-Reactor Building (105-P) Complex, the P-Area PSLs, and the P-Area Ash Basins (including Outfall P-007); and
- Prevent exposure of potential contamination in media or structures to a residential receptor associated with the following subunits:
  - Potential Release from the Reactor Cooling Water System (186/190-P);
  - Potential Release from the P-Reactor Disassembly Basin (105-P);
  - P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN);
  - All Railroad Tracks within the P-Area Fence;
  - Pipe Fabrication Building (717-9P);
  - Radiological Zone Storage Building (710-P);
  - No. 2&5 Basin Deionizers Pad (105-1P);
  - PSA 2 – Area around the Cooling Water Effluent Sump (107-P/107-1P);
  - PSA 4 – Area East of the Reactor Building (105-P); and
  - PSA 5 – Two localized areas in the Southwestern part of P Area.

Remedial Goal Options

Remedial Goal Options (RGOs) represent the preliminary media-specific goals and serve as a standard by which to measure whether a selected remedial action has met its RAO. RGOs can be qualitative statements or numerical values often expressed as concentrations in soils and groundwater, or actions (installation of engineered barriers, placement of caps and covers, etc.) that achieve the RAO. RGOs become finalized as remedial goals after public comment and approval of the SB/PP and are documented in the ROD. Final remedial goals will be monitored to determine when the remedial action is complete.

The RGs identified in the early remedial action and removal action decision documents (SRNS 2008a, SRNS 2009a, SRNS 2009c, SRNS 2009d) will be met as the actions are completed. Specific RGOs are not developed for the final action since the preferred alternative (LUCs) serves to break the exposure pathway to any contamination left in place as part of the early remedial actions or removal actions.

Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirement (ARARs) are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a

CERCLA site. 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.

Three categories of ARARs were defined to clarify how to identify and comply with environmental requirements. They 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 the characteristics of the unit.
- Chemical-specific ARARs are media-specific concentration limits promulgated under federal or state law. The National Oil and Hazardous Substances Pollution Contingency Plan more commonly called the National Contingency Plan (NCP) requires the development of health-based, site-specific levels for chemicals where such limits do not exist and where there is a concern with their potential health or environmental effects.

ARARs for the early remedial actions and the NTC removal actions were previously identified in the respective EAROD, ESD, or RSER/EE/CA documents. The chemical- and action-specific ARARs identified for the alternatives evaluated in this SB/PP for the PAOU are shown in Table 4.

VII. SUMMARY OF REMEDIAL ALTERNATIVES

This section presents and summarizes the remedial alternatives for the final remedy for PAOU. Under CERCLA, it is desirable when practical to offer a range of diverse alternatives to compare during the detailed analysis to arrive at the most effective cost-efficient remedial action. 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. For PAOU, these alternatives were previously evaluated in the early remedial actions or removal action decision documents (SRNS 2008b, SRNS 2008a, SRNS 2009b, SRNS 2009a, SRNS 2009d, and SRNS 2009c). For the final action at PAOU, the LUC alternative was developed that involves little or no treatment yet provides protection to human health and the environment by preventing or controlling exposure to the contaminants through institutional controls. As required by the NCP, the No Action alternative is provided as a baseline for comparison.

Remedial Alternatives for the P-Area Operable Unit

Two remedial alternatives were developed for the PAOU and are discussed below. These alternatives are based on the site conditions that remain following successful completion of the removal/remedial actions to meet RGs.

Alternative PAOU-1 – No Action

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 at the PAOU. This alternative would leave the PAOU in its current condition with no additional controls. This alternative does not include five-year remedy reviews.

Alternative PAOU-2: Land Use Controls

Total Present Worth Cost $1,580,323

Under this alternative, LUCs (i.e., institutional controls) would be implemented after completion of the removal/remedial actions (Figure 9). No additional active remedial action is needed after completion of the early remedial actions and removal actions. Implementation of this alternative would require both near- and long-term actions.

For the near-term, signs would be posted to indicate that the area was used for disposal of waste material. In addition, existing SRS access controls would be used to maintain the use of the PAOU consistent with its intended use. A perimeter fence will not be constructed around the PAOU because removal/remedial actions and land use restrictions are sufficient to isolate the contaminants from human exposure. Surface soils will not pose a potential threat to a current on-unit worker at the PAOU once removal/remedial actions have been completed to meet RGs.

Periodic inspections would be conducted and maintenance would be performed to help ensure that no the removal/remedial actions are in satisfactory condition. Maintenance, as needed, would consist primarily of mowing, cap and roof repair, subsidence repairs, etc. Minor drainage modification may be conducted as needed to prevent ponding and to promote surface water runoff. Although groundwater is not part of the PAOU, periodic (every five years) groundwater monitoring would be conducted to confirm that contaminants are not reaching the groundwater.

VIII. EVALUATION 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. Potential alternatives that address the PAOU are individually evaluated in detail against CERCLA requirements. A comparative analysis is then conducted for the corrective measures/remedial alternatives.

In this section, the alternatives formulated and retained are evaluated in detail against CERCLA requirements. The statutory requirements that guide the evaluation of remedial alternatives in a CERCLA 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; and
- 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 Proposed Plan. Evaluation criteria categories and the nine evaluation criteria are listed and explained below.

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 institutional controls. Each alternative is examined as to whether it creates any unacceptable short-term risks to human health.

2. Compliance with ARARs - Remedial actions under CERCLA must attain all ARARs. ARARs are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically addresses 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.

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 contaminated media that remain 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/RGOs. 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. The cost estimates are included for comparison only and are not intended to forecast actual budgetary expenditures. The actual costs of the project depends 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. Real interest rates on U.S. Treasury notes and bonds of specific maturity were used to estimate the present-worth costs. 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.

Modifying Criteria

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

*8. **State or support agency acceptance*** - The preferred alternative should be acceptable to the SCDHEC and USEPA. Approval of the ROD will constitute approval of the selected alternative by the regulatory agencies.

*9. **Community Acceptance*** - The concerns of the community should also be considered in presenting alternatives that would be acceptable to the community. Community acceptance is evaluated based on comments on the SB/PP received during the public comment period. These comments are considered in the final remedy selection for the ROD.

The first seven criteria are used to evaluate the alternatives based on human health and environmental protection, cost and feasibility issues. The preferred alternative is further evaluated under the state acceptance and community acceptance criteria, based on comments during the public review period.

Comparative Analysis of P-Area Operable Unit Alternatives

A comparative analysis summary and ranking of the PAOU alternatives is shown in Table 3. The

following two alternatives were developed for consideration:

- Alternative PAOU-1 - No Action; and
- Alternative PAOU-2 - Land Use Controls.

1. Overall Protection of Human Health and the Environment - Alternative PAOU-2 is protective of human health (industrial workers and residents) by preventing the exposure of potentially contaminated soils through LUCs (i.e. ICs); Alternative PAOU-1 is not protective of human health since no controls are in place to prevent the potential exposure to contaminated soils and structures. Alternative PAOU-2 would achieve RAOs.

2. Compliance with ARARs - ARARs are associated with this proposed action (Table 4). Alternative PAOU-1 does not meet the chemical-specific ARARs since there are no controls are in place to prevent the potential exposure to contaminated soils and structures; PAOU-2 does meet these criteria.

3. Long-Term Effectiveness and Permanence – The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation. Alternative PAOU-2 is protective and provides long-term effectiveness and permanence as long as land use controls criteria are met. Alternative PAOU-1 does not provide long-term effectiveness and permanence since there are no controls in place to prevent the potential exposure to contaminated soils and structures.

4. Reduction of Toxicity, Mobility, or Volume through Treatment - Both Alternatives PAOU-1 and PAOU-2 do not provide reduction of toxicity, mobility, or volume. This criteria was addressed by the early remedial/removal actions for the specific subunits, as described in the EAROD (SRNS 2008a), the ESD to the EAROD (SRNS 2009b), the EARAIP (SRNS 2009a), the RSER/EE/CA for the PSLs (SRNS 2009c), and the RSER/EE/CA for the P-Area Ash Basin (including Outfall P-007) (SRNS 2009d).

5. Short-Term Effectiveness – The remedial alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts on workers, potential environmental impacts and the time until protection is achieved. Alternative PAOU-2 achieves RAOs in a short period of time with essentially no risk to workers and the public. Alternative PAOU-1 does not provide short-term effectiveness since there are no controls in place to prevent the potential exposure to contaminated soils and structures.

6. Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative, including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations, administrative feasibility (regulatory requirements), and availability of services and materials. Both Alternative PAOU-1 and PAOU-2 are easily implementable.

7. Cost - Alternative PAOU-1 is the least expensive ($0), as compared with Alternative PAOU-2

($1,580,323). Detailed alternative costs are provided in Tables 5 and 6. Five-year remedy reviews for 200 years are included for Alternative PAOU-2.

IX. PREFERRED ALTERNATIVES

The preferred alternatives for the PAOU subunits are described below. However, USEPA, in consultation with SCDHEC, may modify the preferred alternative or choose another response action presented in the SB/PP based on new information or public comments.

P-Area Operable Unit

The preferred remedial action for the PAOU is Alternative PAOU-2 - Land Use Controls. This remedy meets the RAOs and the threshold criteria, provides overall protection of human health and the environment, and complies with ARARs. The remedy is effective in the long-term based on preventing human exposure to radioactive and hazardous contaminants that remain. Present worth cost estimates for Alternative PAOU-2 is $1,580,323.

LUCs (ICs) for PAOU will be implemented by:

- Providing access controls for 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.
- Providing access controls against 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.
- Notifying the USEPA and SCDHEC in advance of any changes in land use or excavation of waste.

In the long-term, if the property is ever transferred to nonfederal ownership, the US 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 remedial goals and objectives in the 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 preferred remedy for the PAOU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions as long as necessary to keep the selected remedy fully protective of human health and the environment. As agreed on March 30, 2000, among the USDOE, the USEPA, and the SCDHEC, SRS is implementing a LUCAP to ensure that LUCs required by numerous remedial decisions at SRS are properly maintained and periodically verified. The unit-specific LUCIP that will be referenced in the ROD for this PAOU will provide details and specific measures required for the LUCs selected as part of this preferred remedy. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs described in this SB/PP. Upon final approval, the LUCIP will be appended to the LUCAP and is considered incorporated by reference into the PAOU ROD, establishing LUC implementation and maintenance requirements enforceable under CERCLA. The approved LUCIP will establish implementation, monitoring, maintenance, reporting, and enforcement requirements for the PAOU. The LUCIP will remain in effect unless and until modifications are approved as needed to be protective of human health and the environment. 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. LUCs, including institutional controls, will restrict the PAOU 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. LUCs selected as part of this action will be maintained for as long as necessary to keep the selected remedy fully protective of human health and the environment and termination of any land use controls will be subject to CERCLA requirements for documenting changes in remedial actions.

Under Alternative PAOU-2, LUCs (i.e., institutional controls) would be implemented after completion of the removal/remedial actions. Figure 9 provides an illustration of the LUC boundary for the PAOU. No additional active remedial action is needed after completion of the early remedial actions and removal actions. Implementation of this alternative would require both near- and long-term actions.

For the near-term, signs would be posted to indicate that the area was used for disposal of waste material. In addition, existing SRS access controls would be used to maintain the use of the PAOU consistent with its intended use. A perimeter fence will not be constructed around the PAOU because removal/remedial actions and land use restrictions are sufficient to isolate the contaminants from human exposure. Surface soils will not pose a potential threat to a current on-unit worker at the PAOU once removal/remedial actions have been completed to meet RGs.

Periodic inspections would be conducted and maintenance would be performed to help ensure that no the removal/remedial actions are in satisfactory condition. Maintenance, as needed, would consist primarily of mowing, cap and roof repair, subsidence repairs, etc. Minor drainage modification may be conducted as needed to prevent ponding and to promote surface water runoff. Although groundwater is not part of the PAOU, periodic (every five years) groundwater monitoring would be conducted to confirm that contaminants are not reaching the groundwater.

Based on information currently available, the lead agency believes the preferred alternative, Alternative PAOU-2 - Land Use Controls provide the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. The USDOE expects the preferred 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; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element to the extent practicable.

Because the final remedial action will consist of LUCs, an RAIP will not be submitted for the PAOU. Approval of the LUCIP would constitute remedial action start.

X. POST-ROD SCHEDULE

An implementation schedule is provided as Figure 10 showing the ROD submittal date, post-ROD document submittals, and remedial action start date.

XI. REFERENCES

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

USDOE, 1996. *Savannah River Site Future Use Project Report*, Stakeholder-Preferred Recommend-ations for SRS Land and Facilities, USDOE Savannah River Operations Office.

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SRNS, 2009b. *Explanation of Significant Difference for the Revision 1.1 Early Action Record of Decision*

for the P-Area Operable Unit (U), SRNS-RP-2009-00704, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2009c. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the P-Area Ash Basin (Including Outfall P-007) (188-P) and the R-Area Ash Basin (188-R) (U)*, SRNS-RP-2009-01064, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2009d. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the P-Area Process Sewer Lines As Abandoned (NBN) Subunit for the P-Area Operable Unit (U)*, SRNS-RP-2009-01046, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

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WSRC, 2005a, *Deactivation Project Plan 105-P Disassembly Basin,* G-PMP-P-00001. Rev.0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2005b, *P Reactor Basin Inventory,* CBU-SDD-2005-000286, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2006, *Facility Decommissioning Evaluation - Containment Tank Inside Retention Basin, 904-86G,* G-FDE-G-00008, Rev.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2007a, *Decommissioning Project Final Report – Building 717-9P, Pipe Fabrication Shop*, V-PCOR-P-00042, Rev.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2007b, *Decommissioning Project Final Report – RZ Storage Facility, Building 710-P*, V-PCOR-P-00051, Rev.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

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WSRC, 2007d, *Decommissioning Project Final Report – Building 904-86G, Containment Tank Inside Retention Basin*, V-PCOR-G-00014, Rev.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

XII. GLOSSARY

Administrative Record File: A file that is maintained and contains all information used to make a decision on the selection of a response action under the Comprehensive Environmental Response, Compensation and Liability Act. This file is to be available for public review, and a copy is to be established at or near the Site, usually at one of the

information repositories. Also a duplicate file is held in a central location, such as a regional or state office.

Applicable, or Relevant and Appropriate Requirements (ARARs): Refers to the federal and state requirements that a selected remedy will attain. These requirements may vary from site to site.

Baseline Risk Assessment (BRA): Analysis of the potential adverse health effects (current or future) caused by hazardous substance release from a site in the absence of any actions to control or mitigate these releases.

Characterization: The compilation of all available data about the waste units to determine the rate and extent of contaminant migration resulting form the waste site, and the concentration of any contaminants that may be present.

Cold and Dark: A phrase used to indicate isolation of electrical and mechanical systems so implementation of deactivation activities can proceed safely.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 1980: A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act.

Corrective Action: A USEPA requirement to conduct remedial procedures under RCRA 3998(h) at a facility when there has been a release of hazardous waste or constituents into the environment. Corrective action may be required beyond the facility boundary and can be required regardless of when the waste was placed at the facility.

Exposure: Contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, digestive tract, etc.) and available for absorption.

Federal Facility Agreement (FFA): The legally binding agreement between regulatory agencies (USEPA and SCDHEC) and regulated entities (USDOE) that sets the standards and schedules for the comprehensive remediation of the SRS.

Media: Pathways through which contaminants are transferred. Five media to which a release of contaminants may occur are groundwater, soil, surface water, sediments, and air.

National Priorities List (NPL): USEPA's formal list of the nation's most serious uncontrolled or abandoned waste sites, identified for possible long-term remedial response, as established by CERCLA.

Operable Unit (OU): A discrete action taken as one part of an overall site cleanup. The term is also used in USEPA guidance documents to refer to distinct geographic areas or media-specific units within a site. A number of operable units can be used in the course of a cleanup.

Operation and Maintenance (O&M): Activities conducted at a site after a response action occurs to ensure that the cleanup and/or systems are functioning properly.

Overall Protection of Human Health and the Environment: The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

Proposed Plan (PP): A legal document that provides a brief analysis of remedial alternatives under consideration for the site/operable unit and proposes the preferred alternative. It actively solicits public review and comment on all alternatives under consideration.

Record of Decision (ROD): A legal document that explains to the public which alternative will be used at a site/operable unit. The record of decision is based on information and technical analysis generated during the remedial investigation/ feasibility study and consideration of public comments and community concerns.

Resource Conservation and Recovery Act (RCRA), 1976: A Federal law that established a regulatory system to track hazardous substances from their generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Responsiveness Summary: A summary of oral and/or written comments received during the proposed plan comment period and includes responses to those comments. The responsiveness summary is a key part of the ROD, highlighting community concerns.

Superfund: The common name used for CERCLA; also referred to as the Trust Fund. The Superfund program was established to help fund cleanup of hazardous waste sites. It also allows for legal action to force those responsible for the sites to clean them up.

Target Risk Range: USEPA guidance for carcinogenic risk due to exposure to a known or suspected carcinogen between one excess cancer in an exposed population of ten thousand (1.0E-04) and one excess cancer in an exposed population of one million (1.0E-06). Risks within this range require risk management evaluation of remedial action alternatives to determine if risks can be reduced below one excess cancer in one million (1.0E-06). Risks greater than 1.0E-04 indicate that remedial action is generally warranted.

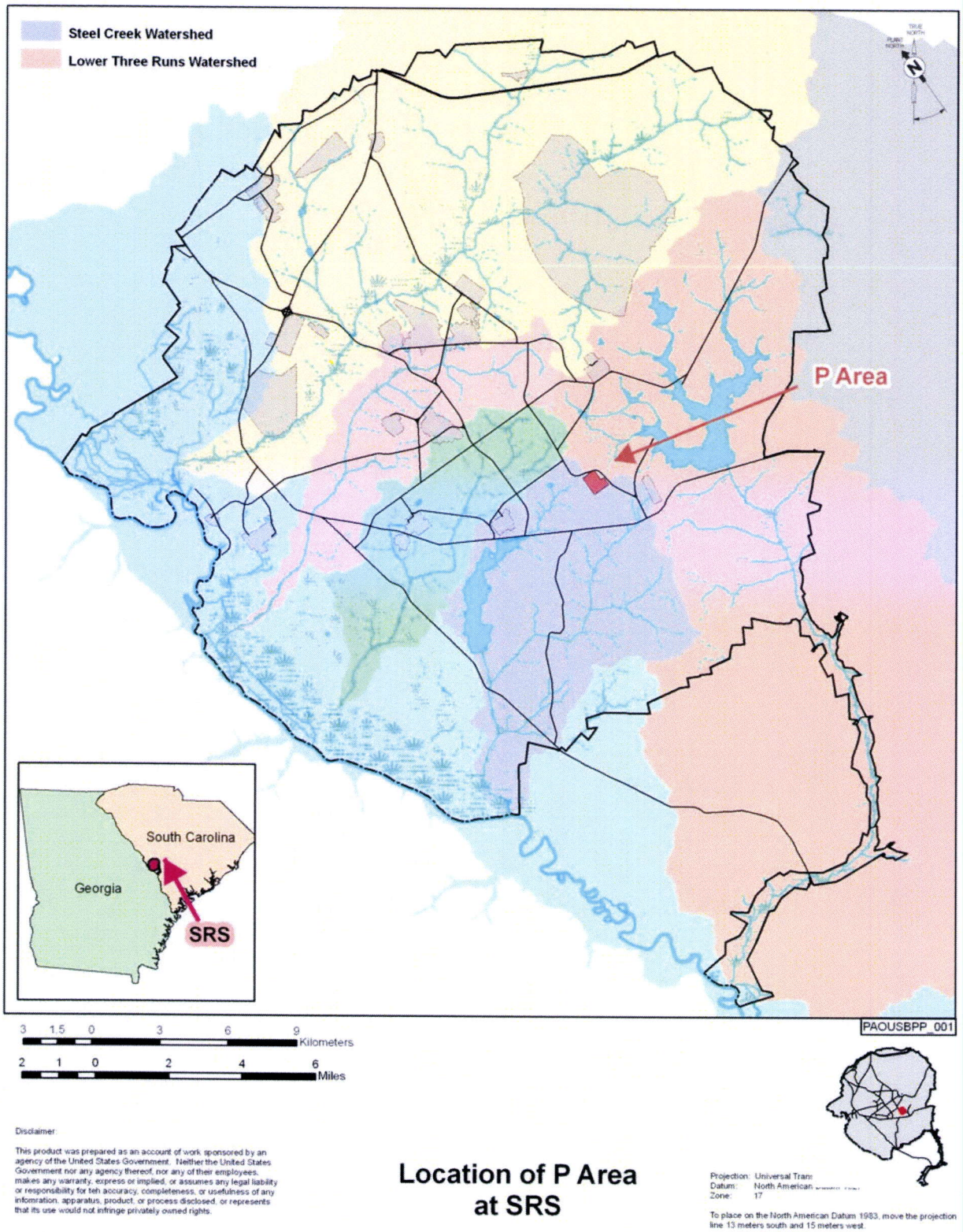

Figure 1. Location of the P Area within the Savannah River Site.

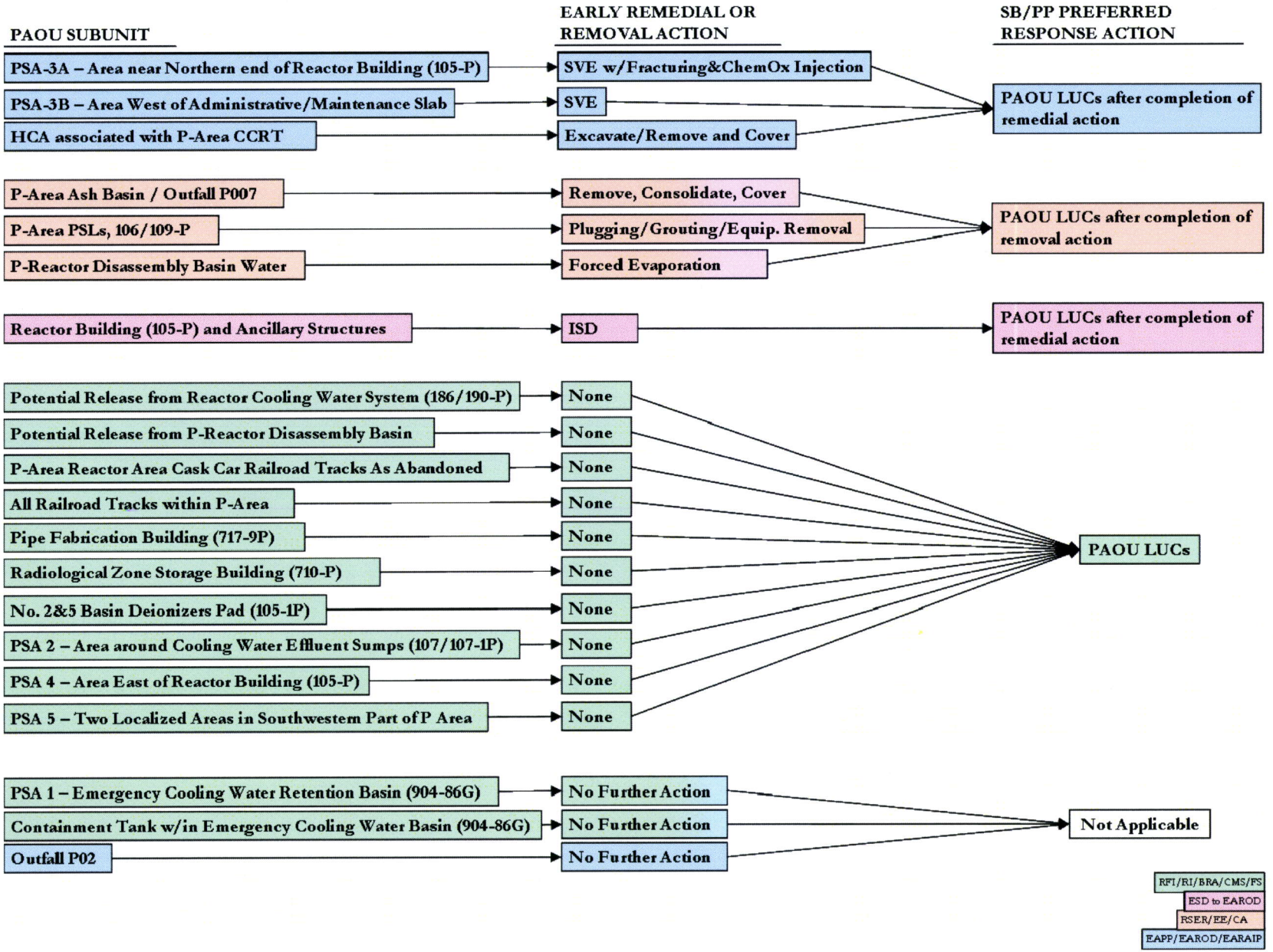

Figure 2. Administrative Paths for the PAOU Subunits.

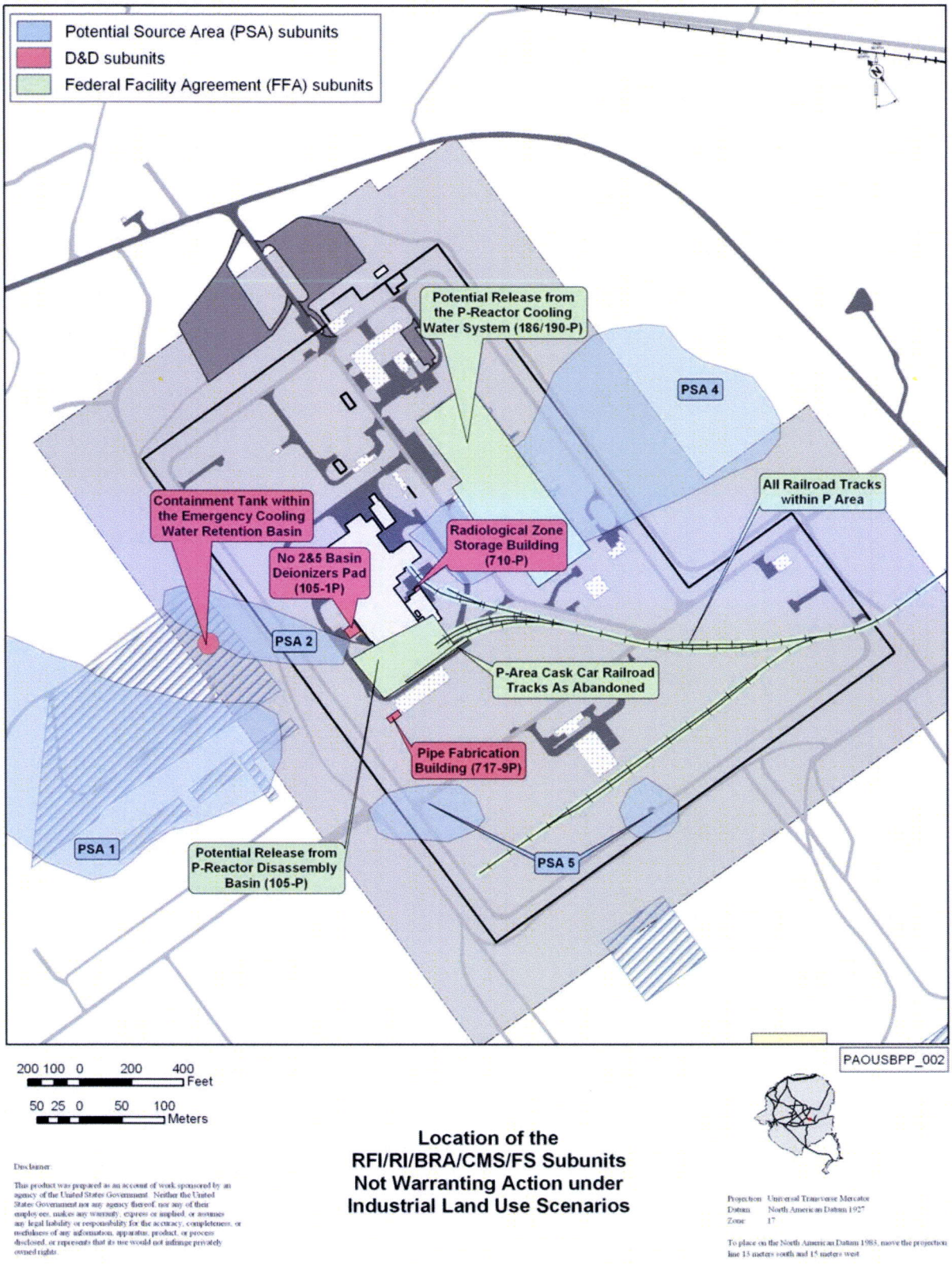

Figure 3. Location of the PAOU Subunits described in the RFI/RI/BRA/CMS/FS as Not Warranting Action under an Industrial Land Use Scenario.

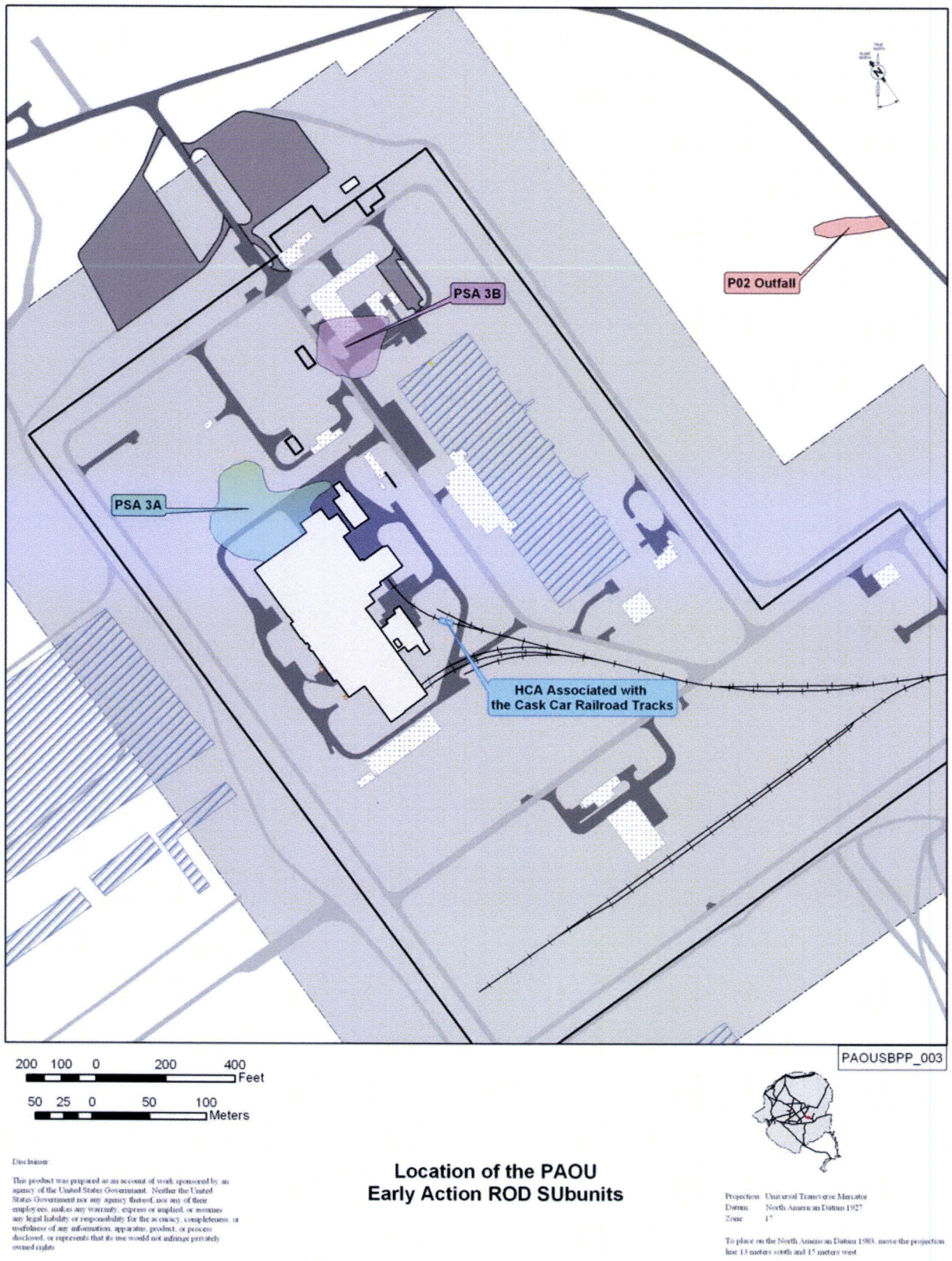

Figure 4. Location of the PAOU EAROD Subunits.

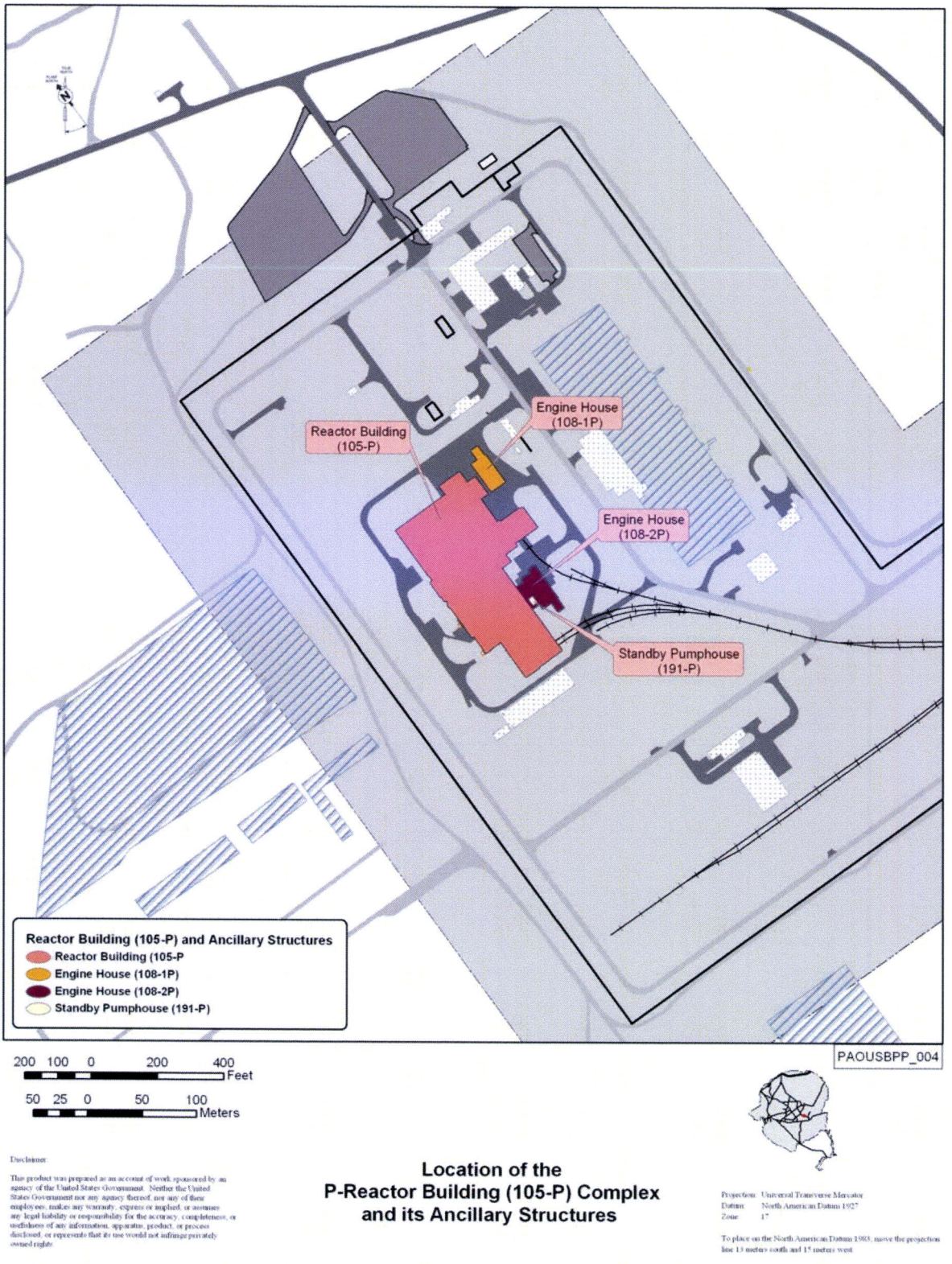

Figure 5. Location of the P-Reactor Building (105-P) Complex and its Ancillary Structures.

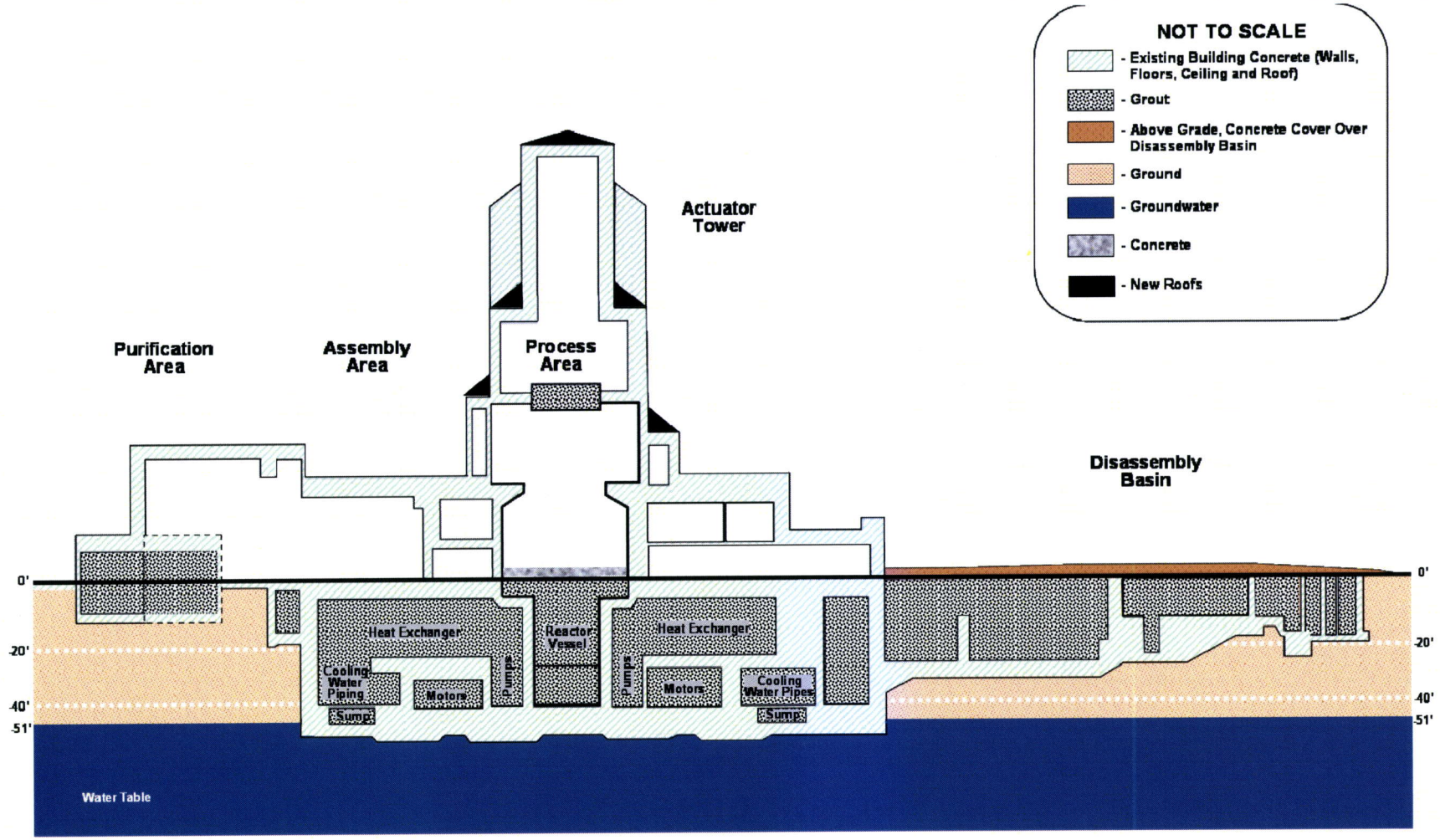

Figure 6. General Representation of the P-Reactor Building (105-P) depicting Alternative R-2A (ISD with the Reactor Vessel Grouted in Place).

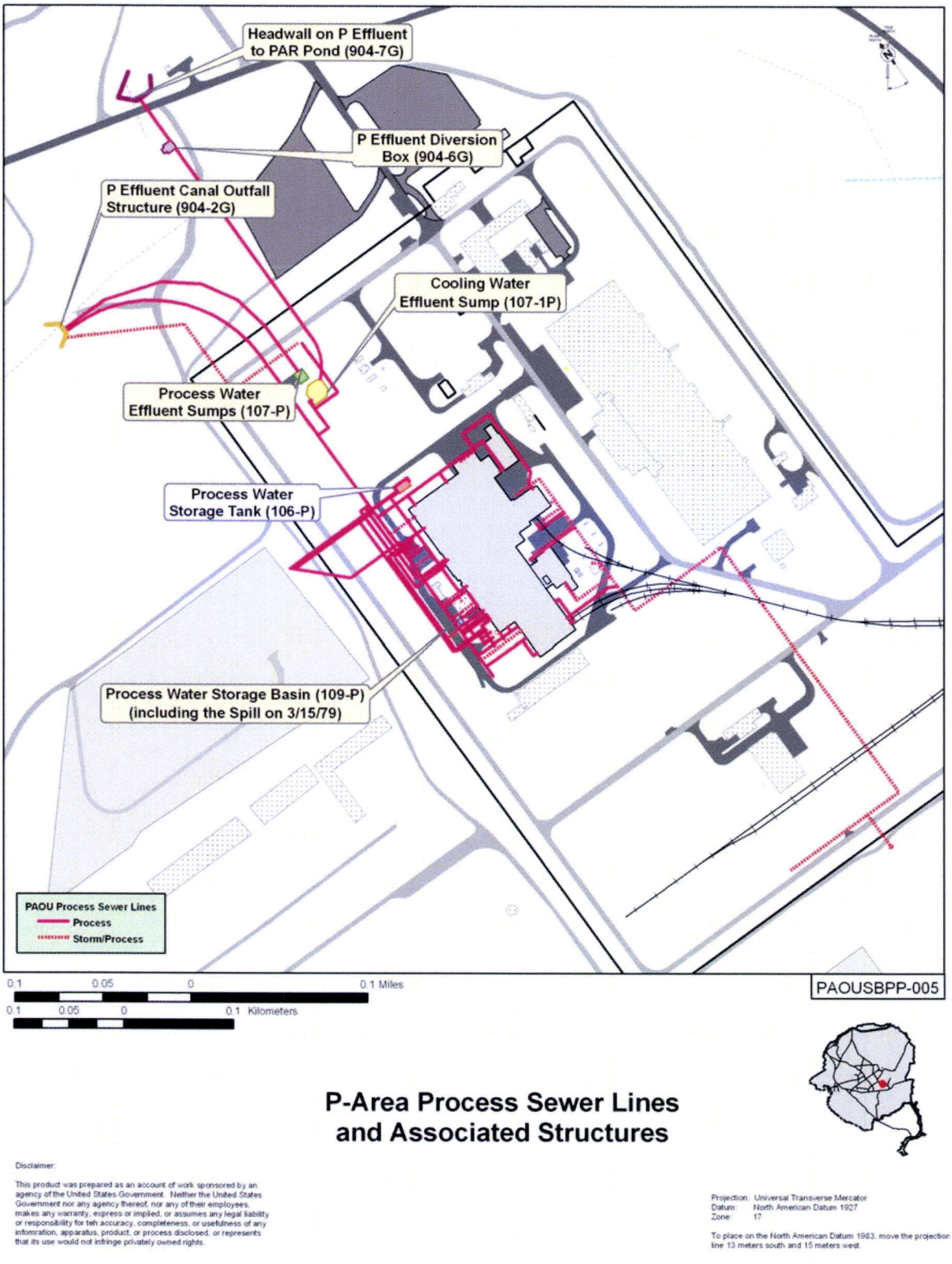

Figure 7. Layout of the P Area Process Sewer Lines As Abandoned within PAOU.

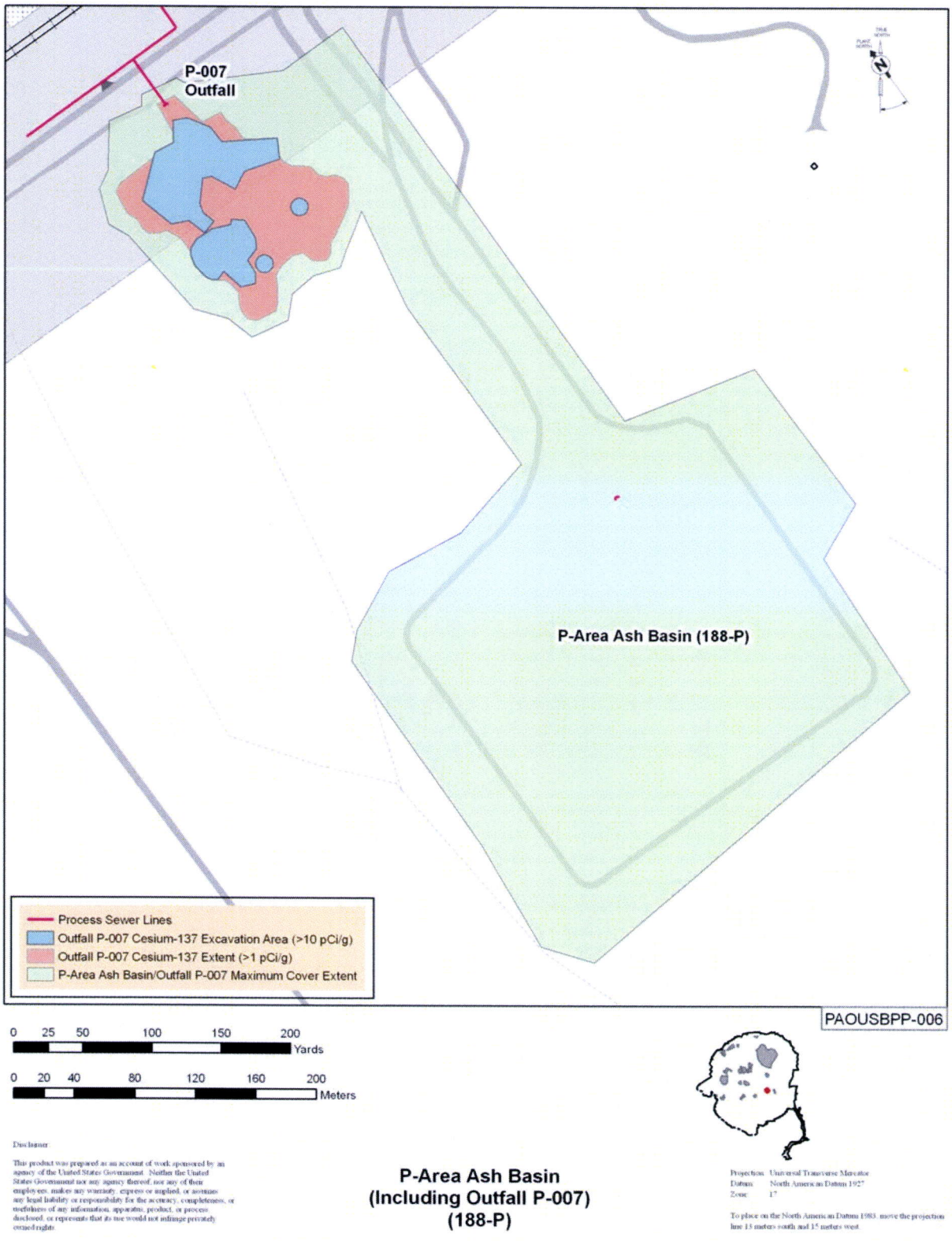

Figure 8. Layout of the P-Area Ash Basin (Including Outfall P-007) (188-P)

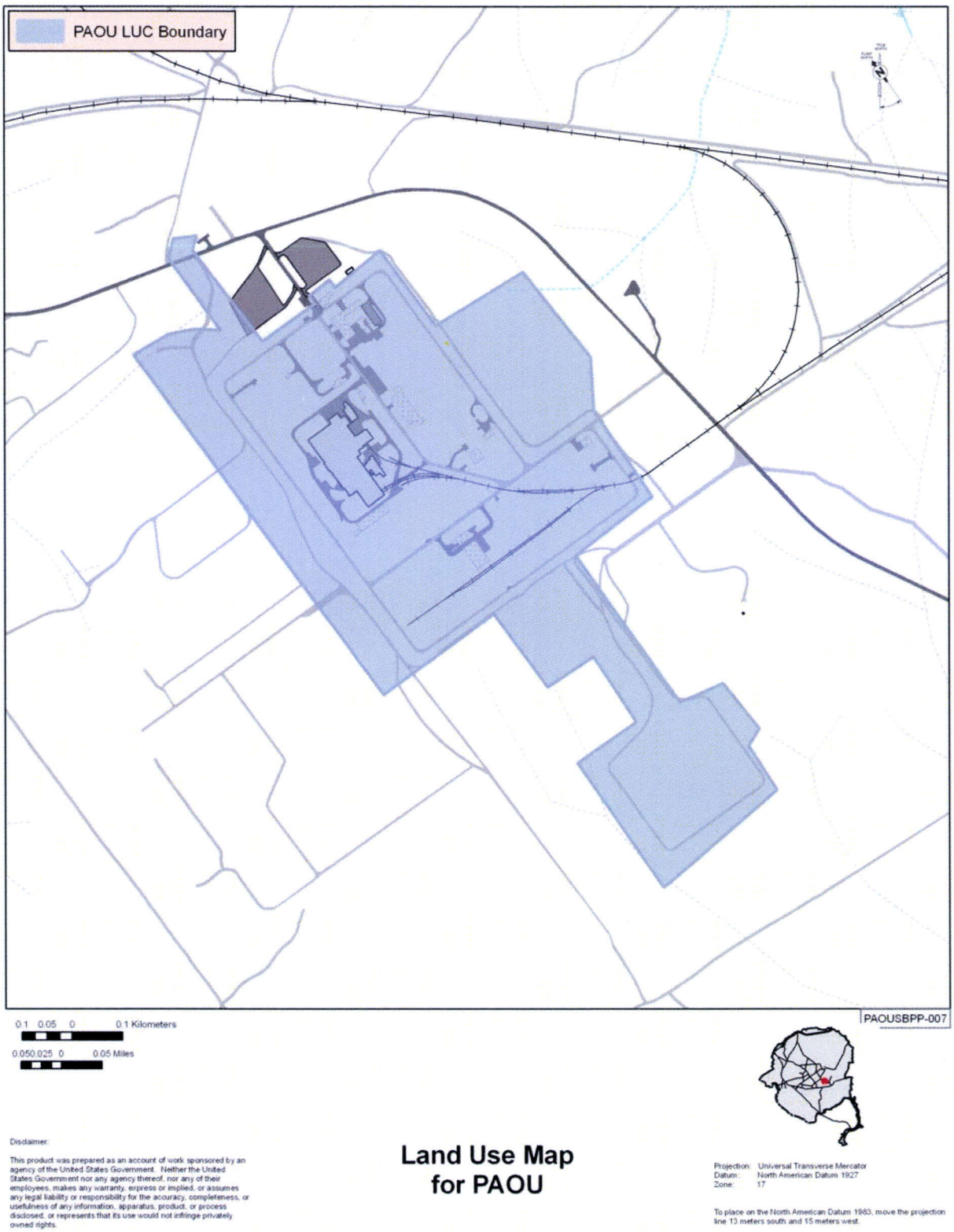

Figure 9. Land Use Map for the P-Area Operable Unit.

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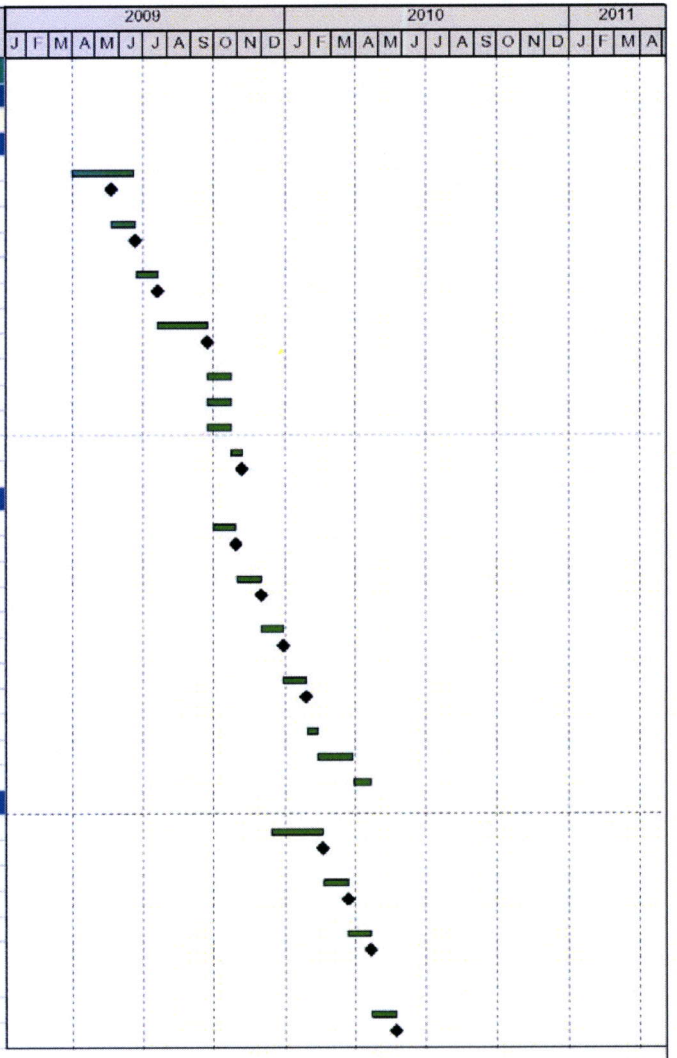
Activity Name	OD	Start	Finish
Steel Creek Watershed	446d	8-Dec-08 A	15-Mar-11
P Area Operable Unit	446d	8-Dec-08 A	15-Mar-11
Regulatory Requirements	285d	1-Apr-09 A	7-Sep-10
Early Action Record of Decision	122d	1-Apr-09 A	5-Nov-09
Develop ESD to EA ROD	80d	1-Apr-09 A	21-May-09
Submit Rev. 0 ESD to EA ROD to EPA & SCDHEC	0d		21-May-09
EPA & SCDHEC Review ESD to EA ROD	32d	22-May-09	22-Jun-09
EPA & SCDHEC Submit Comments on ESD	0d		22-Jun-09
SRS Responds to Comments on ESD	28d	23-Jun-09	20-Jul-09
SRS Submits Comment Responses & Redline ESD	0d		20-Jul-09
EPA & SCDHEC Final Review & Approval of ESD	63d	21-Jul-09	21-Sep-09
Receipt of ESD Approval	0d		21-Sep-09
DOE Obtain Signature on ESD	31d	22-Sep-09	22-Oct-09
EPA Obtain Signature on ESD	31d	22-Sep-09	22-Oct-09
SCDHEC Obtain Signature on ESD	31d	22-Sep-09	22-Oct-09
Prepare for Public Notice	14d	23-Oct-09	5-Nov-09
Issue ESD to P Area EA ROD	0d		5-Nov-09
Statement of Basis / Proposed Plan	109d	30-Sep-09	21-Apr-10
Develop Rev. 1 Statement of Basis / Proposed Plan	30d	30-Sep-09	29-Oct-09
Submit Rev. 1 Statement of Basis / Proposed Plan to EPA & SCDHEC	0d		29-Oct-09
EPA & SCDHEC Review Rev. 1 Statement of Basis / Proposed Plan	32d	30-Oct-09	30-Nov-09
EPA & SCDHEC Submit Comments on Rev. 1 SB/PP	0d		30-Nov-09
SRS Responds to Comments on Rev. 1 SB/PP	29d	1-Dec-09	29-Dec-09
SRS Submits Comment Responses & Rev. 1.1 SB/PP	0d		29-Dec-09
EPA & SCDHEC Final Review & Approval of Rev. 1.1 SB/PP	30d	30-Dec-09	28-Jan-10
Rev. 1.1 Statement of Basis / Proposed Plan Approval	0d		28-Jan-10
Notification of Public Comment Period	14d	29-Jan-10	11-Feb-10
Public Comment Period	46d	12-Feb-10	29-Mar-10
Develop Responsiveness Summary	23d	30-Mar-10	21-Apr-10
Record of Decision	145d	14-Dec-09	7-Sep-10
Develop Rev. 0 ROD without Resposiveness Summary	67d	14-Dec-09*	18-Feb-10
Submit Rev. 0 ROD to EPA & SCDHEC	0d		18-Feb-10
EPA & SCDHEC Review Rev. 0 ROD	32d	19-Feb-10	22-Mar-10
EPA & SCDHEC Submit Comments on Rev. 0 ROD	0d		22-Mar-10
SRS Responds to Comments on Rev. 0 ROD	30d	23-Mar-10	21-Apr-10
SRS Submits Comment Responses & Rev. 1 ROD w/ Responsiveness Summary	0d		21-Apr-10
EPA & SCDHEC Final Review & Approval of Rev. 1 ROD	33d	22-Apr-10	24-May-10
Rev. 1 ROD Approval	0d		24-May-10



Primary Baseline
Milestone

ACP
AREA COMPLETION PROJECTS

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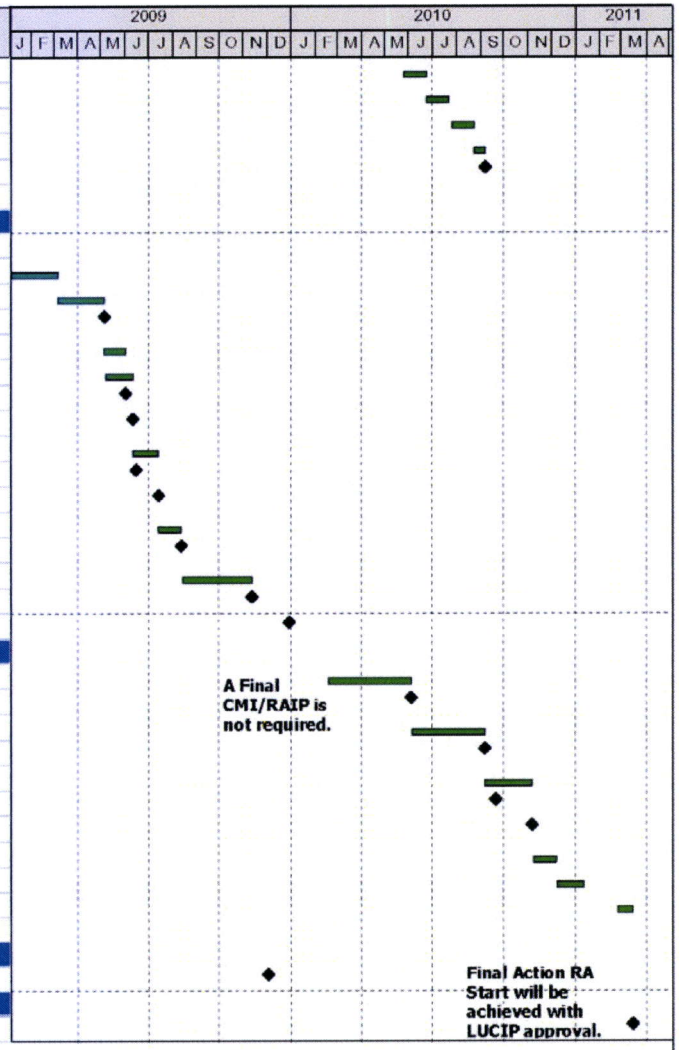
P-AREA OPERABLE UNIT

RCRA/CERCLA Implementation Schedule

Date	Revision	Che...	Approved

Figure 10. Post-ROD Schedule.

Activity Name	OD	Start	Finish
DOE Obtain Signature on Rev. 1 ROD	30d	25-May-10	23-Jun-10
EPA Obtain Signature on Rev. 1 ROD	30d	24-Jun-10	23-Jul-10
SCDHEC Obtain Signature on Rev. 1 ROD	30d	26-Jul-10	24-Aug-10
Prepare for Public Notice	14d	25-Aug-10	7-Sep-10
Issue Rev. 1 ROD	0d		7-Sep-10
Detailed Engineering & Pre-Construction	446d	8-Dec-08	15-Mar-11
Early Action RAIP	208d	8-Dec-08	29-Dec-09
Submit Rev. 0 Early Action RAIP	0d		8-Dec-08
EPA/SCDHEC review Rev. 0 Early Action RAIP	88d	9-Dec-08	6-Mar-09
Incorporate EPA/SCDHEC Early Action RAIP Comments	60d	7-Mar-09	5-May-09
Submit Comment Responses & Redline Rev. 1 EA RAIP	0d		5-May-09
EPA & SCDHEC Review Rev. 1 EA RAIP	27d	6-May-09	1-Jun-09
Develop Rev. 1.1 EA RAIP	35d	8-May-09	11-Jun-09
EPA & SCDHEC Conditional Approval of Rev. 1 EA RAIP	0d		1-Jun-09
Submit Rev. 1.1 EA RAIP to EPA & SCDHEC	0d		11-Jun-09
EPA & SCDHEC Review Rev. 1.1 EA RAIP	33d	12-Jun-09	14-Jul-09
Issue Early Action Fact Sheet - 1 for PSA & CERT	0d		15-Jun-09
EPA & SCDHEC Submit Comments on Rev. 1.1 EA RAIP	0d		14-Jul-09
SRS Responds to Comments on Rev. 1.1 EA RAIP	30d	15-Jul-09	13-Aug-09
SRS Submits Comment Responses & Rev. 1.2 EA RAIP	0d		13-Aug-09
EPA & SCDHEC Final Review & Approval Rev. 1.2 EA RAIP	91d	14-Aug-09	12-Nov-09
Rev. 1.2 EA RAIP Approval	0d		12-Nov-09
Issue Early Action Fact Sheet - 2 for ISD	0d		29-Dec-09
LUCIP	212d	18-Feb-10	15-Mar-11
Develop LUCIP	74d	18-Feb-10	4-Jun-10
Submit Rev. 0 LUCIP	0d		4-Jun-10
EPA/SCDHEC review Rev. 0 LUCIP	92d	7-Jun-10	6-Sep-10
EPA/SCDHEC return Rev. 0 LUCIP comm.	0d		6-Sep-10
Incorporate EPA/SCDHEC LUCIP Comments	60d	7-Sep-10	5-Nov-10
OU LUCIP Comment Resolution Meeting	0d		20-Sep-10
Submit Redline Rev.1 LUCIP	0d		5-Nov-10
EPA/SCDHEC Final Rev/Approval LUCIP	30d	8-Nov-10	7-Dec-10
Sumbit LUCIP Clean Copy	21d	8-Dec-10	10-Jan-11
Develop Letter for RA Start	14d	24-Feb-11	15-Mar-11
Construction	251d	2-Dec-09	15-Mar-11
Early Action	0d	2-Dec-09	2-Dec-09
Early Action Remedial Action Start	0d		2-Dec-09
Final Action	0d	15-Mar-11	15-Mar-11
Remedial Action Start	0d		15-Mar-11



Primary Baseline
Milestone

ACP
AREA COMPLETION PROJECTS

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P-AREA OPERABLE UNIT

RCRA/CERCLA Implementation Schedule

Date	Revision	Che...	Approved

Figure 10. Post-ROD Schedule (continued).

Table 1. List and Status of Subunits at the PAOU.

	Subunit		Early Action or Removal Action	Reference Document	SB/PP Preferred Response Action
Federal Facility Agreement Subunits		Potential Release from Reactor Cooling Water System (186/190-P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU Land Use Controls (LUCs)
		Potential Release from P-Reactor Disassembly Basin (105-P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
	P-Area Process Sewer Lines	Process Sewer Lines As Abaondoned (no building number [NBN]); including the spill on 03/15/79 of 500 gallons of contaminated water	Alternative P-2: Isolation Plugging of P-Reactor Building (105-P) PSLs and Drainage System; Grouting of Manholes, Diversion Boxes, and Process Tanks; Select Removal of Process Equipment External to the P-Reactor Building (105-P); Sealing/Plugging of Outfalls; Institutional Controls	RSER/EE/CA - P-Area PSLs	Manage with PAOU LUCs
		Process Water Storage Tank (106-P)			
		Process Water Storage Basin (109-P)			
	P-Area Cask Car Railroad Tracks	P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
		All railroad tracks within the P Area fence	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
		High Contamination Area near the 105-P	Alternative AC-2: Alternative Excavation and Removal; Confirmatory Sampling	EAROD	Manage with PAOU LUCs
	P-Reactor Building (105-P) Complex	P-Reactor Building (105-P)	Alternative R-2A: In-Situ Decommissioning	ESD	Manage with PAOU LUCs
		Engine House (108-1P)			
		Enging House (108-2P) with Standby Pumphouse (191-P)			
		P-Area Ash Basin (Including Outfall P-007) (188-P)	Alternative P-3: Removal and Disposal of Cesium-137; Consolidation as Needed; Soil Cover; Institutional Controls	RSER/EE/CA - P-Area Ash Basin (Including Outfall P-007)	Manage with PAOU LUCs
		Containment Tank within Emergency Cooling Water Retention Basin (904-86G)	None	RFI/RI/BRA/CMS/FS	No Futher Action
		Pipe Fabrication Building (717-9P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
		Radiological Zone Storage Building (710-P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
		No. 2 & 5 Basin Deionizers Pad (105-1P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
Potential Source Area Subunits		PSA-1 - Emergency Cooling Water Retention Basin (904-86G)	None	RFI/RI/BRA/CMS/FS	No Further Action
		PSA-2 - Area around the Cooling Water Effluent Sumps (107/107-1P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
	PSA 3	PSA-3A - Area near the northern end of the Reactor Building (105-P)	Alternative AV-3: Soil Vapor Extraction [SVE] with Fracturing and Chemical Oxidation Injection)	EAROD	Manage with PAOU LUCs
		PSA-3B - West of the Administrative/Maintenance slab	Alternative AV-2: SVE		
		PSA-4 - Area east of the Reactor Building (105-P)	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
		PSA-5 - Two localized areas in the southwestern part of P Area	None	RFI/RI/BRA/CMS/FS	Manage with PAOU LUCs
Other		P02 Outfall	No Further Action	EARAIP	No Further Action
		Disposition of Water in the P-Reactor Disassembly Basin	Alternative 3: Forced Evaporation	RSER/EE/CA & Action Memos - Disposition of Water in the P-Reactor Disassembly Basin	Manage with PAOU LUCs

- Early Action Record of Decision (EAROD) or Early Action Remedial Action Implementation Plan (EARAIP)
- Explanation of Signficant Difference for the Revision 1.1 Early Action Record of Decision for the P-Area Operale Unit (ESD)
- RCRA Facility Investigation / Remedial Investigation with Baseline Risk Assessment and Corrective Measure Study / Feasibility Study (RFI/RI/BRA/CMS/FS)
- Removal Site Evalution Reports / Engineering Evaluation / Cost Assessments (RSER/EE/CA)

Table 2. Summary of Risk Assessment Results (SRNS 2008b).

Subunit	RCOCs	Human Health (Carcinogens>1E-06) (Noncarcinogens>1)	Ecological (Hazard Quotient>1)	PTSM (Carcinogens>1E-03) Noncarcinogens>10	Contaminant Migration (Mean Travel Time>1000 yrs)
Potential Release from Reactor Water Cooling Water System (186/190-P)	none	none	none	none	none
Potential Release from the P-Reactor Disassembly Basin (105-P)	none	none	none	none	none
Process Sewer Lines As Abandoned (NBN); including spill on 03/15/79 of 5000 gal of contaminated water[1]	none	none	none	none	none
P-Area Cask Car Railroad Tracks As Abandoned	none	none	none	none	none
HCA Associated with the Cask Car Railroad Tracks	**Cesium-137 (+D)**	**5.6E-03**	none	**1.8E-02**	none
	Cobalt-60	**9.9E-06**	none	none	none
P-Reactor Vessel	**Barium-133**	**1.8E-02**	none	**1.8E-02**	**Yes**
	Carbon-14	**2.8E-05**	none	none	none
	Cobalt-60	**1.3E+03**	none	**1.3E+03**	**Yes**
	Europium-152	**5.3E-03**	none	**5.3E-03**	**Yes**
	Europium-154	**4.8E-04**	none	none	**Yes**
	Iron-55	**8.2E-05**	none	none	**Yes**
	Molydenum-93	**7.3E-06**	none	none	none
	Nickel-59	**9.3E-06**	none	none	none
	Nickel-63	**2.2E-03**	none	**2.2E-03**	**Yes**
	Niobium-94	**6.1E-05**	none	none	**Yes**
	Potassium-40	**1.1E-05**	none	none	none
	Technetium-99	none	none	none	**Yes**
P-Reactor Disassembly Basin[2]	**Americium-241**	**6.5E-03**	none	**6.5E-03**	none
	Americium-243 (+D)	**7.2E-03**	none	**7.2E-03**	none
	Antimony-125 (+D)	**1.5E-03**	none	**1.5E-03**	none
	Carbon-14	**1.5E-04**	none	none	**Yes**
	Curium-243/244	**3.1E-03**	none	**3.1E-03**	none
	Curium-245	**4.3E-03**	none	**4.3E-03**	none
	Cobalt-60	**3.6E+00**	none	**3.6E+00**	none
	Cesium-137 (+D)	**5.4E-01**	none	**5.4E-01**	none
	Europium-152	**1.9E-02**	none	**1.9E-02**	none
	Europium-154	**5.2E-02**	none	**5.2E-02**	none
	Molydenum-93	none	none	none	**Yes**
	Nickel-59	none	none	none	**Yes**
	Niobium-94	**1.2E-02**	none	**1.2E-02**	none
	Plutonium-238	**1.8E-02**	none	**1.8E-02**	none
	Plutonium-239/240	**1.4E-03**	none	**1.4E-03**	none
	Potassium-40	**3.0E-03**	none	**3.0E-03**	**Yes**
	Radium-228 (+D)	**9.4E-03**	none	**9.4E-03**	none
	Sodium-22	**5.6E-03**	none	**5.6E-03**	none
	Strontium-90 (+D)	**3.1E-03**	none	**3.1E-03**	none
	Thorium-228 (+D)	**1.2E-03**	none	**1.2E-03**	none
	Tritium	**2.0E+00**	none	**2.0E+00**	none
	Total Uranium	**HQ=19**	none	**HQ=19**	none
Minus 20 ft Level of the Reactor Building (105-P) and Ancillary Structures	**Aroclor 1254**	**3.2E-05**	none	none	**Yes**
	Cesium-137 (+D)	**9.9E-03**	none	**9.9E-03**	**Yes**
	Cobalt-60	**4.2E-03**	none	**4.2E-03**	**Yes**
	Strontium-90 (+D)	**2.6E-05**	none	none	**Yes**
	Uranium-238 (+D)	**6.0E-06**	none	none	**Yes**
Minus 40 ft Level of the Reactor Building (105-P) and Ancillary Structures	**Aroclor 1254**	**5.7E-06**	none	none	**Yes**
	Cesium-137 (+D)	**1.3E-02**	none	**1.3E-02**	**Yes**
	Cobalt-60	**5.7E-05**	none	none	**Yes**
	Strontium-90 (+D)	**6.6E-05**	none	none	**Yes**
Minus 49.5 ft Level of the Reactor Building (105-P) and Ancillary Structures	**Cesium-137 (+D)**	**1.7E-04**	none	none	none
Slab Associated with the Containment Tank within the Emergency Cooling Water Retention Basin (904-86G)	none	none	none	none	none
Slab Associated with the Pipe Fabrication Building (717-9P)	none	none	none	none	none
Slab Associated with the Radiological Zone Storage Building (710-P)	none	none	none	none	none
Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P)	none	none	none	none	none

Table 2. Summary of Risk Assessment Results (SRNS 2008b).

Subunit	RCOCs	Human Health (Carcinogens>1E-06) (Noncarcinogens>1)	Ecological (Hazard Quotient>1)	PTSM (Carcinogens>1E-03) Noncarcinogens>10	Contaminant Migration (Mean Travel Time>1000 yrs)
P-Area Ash Basin	**Arsenic**	**1.70E-05**	none	none	none
	Potassium-40	**4.60E-05**	none	none	none
	Radium-226 (+D)	**1.50E-04**	none	none	none
	Radium-228 (+D)	**2.10E-05**	none	none	none
	Thorium-228 (+D)	**1.20E-05**	none	none	none
	Uranium-238 (+D)	**2.30E-06**	none	none	none
P007 Outfall	**Arsenic**	**2.40E-05**	none	none	none
	Cesium-137 (+D)	**4.50E-04**	none	none	none
	Cobalt-60	**2.30E-06**	none	none	none
	Potassium-40	**3.30E-05**	none	none	none
	Radium-226 (+D)	**8.60E-05**	none	none	none
	Uranium-238 (+D)	**1.40E-06**	none	none	none
Potential Source Area 1	none	none*	none	none	none
Potential Source Area 2	none	none	none	none	none
Potential Source Area 3A	**TCE**	none	none	none	**Yes**
Potential Source Area 3B	**PCE**	none	none	none	**Yes**
Potential Source Area 4	none	none	none	none	none
Potential Source Area 5	none	none	none	none	none
P02 Outfall[3]	none	none*	none	none	none

NC = Not Conducted.

* = Residential human health risk assessment conducted.

1 - Based on soil sampling and data evaluations (risk assessment, PTSM, contamination migration), no contamination was determined as a result of a release from the PSLs. However, there is fixed contamination within the PSLs which could be released to the environment.

2 - Only the major risk drivers (i.e., risk > 1E-03) for the P-Reactor Disassembly Basin are identified on this table. Thirty-one constituents have a risk < 1E-03 but > 1E-06.

3 - P02 Outfall residential risk assessment is documented in the PAOU EARAIP (2009a)

Table 3. Comparative Analysis Summary for the P-Area Operable Unit.

Alternative	Effectiveness	Implementability	Overall Protection of Human health and the Environment	Compliance with RAOs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost		Overall Ranking (1 – 25)	Comments
PAOU-1 – No Action	Not effective in eliminating possible contaminant release. Alternative does not treat or remove waste.	Not Applicable	No	No	1	1	1	5	5	$0	13	No Action alternative is required by NCP.
PAOU-2 – Land Use Controls	Effective in eliminating human access to the PAOU	Easily implemented	Yes	Yes	3	1	5	5	4	$1,580,323	18	No additional remedial action is needed after completion of the early remedial/removal actions.

Note: Numeric range 1 through 5, where 1 = worst and 5 = best

Table 4. List of ARARs for the P-Area Operable Unit

Chemical-Specific			
Citation	**Status**	**Requirement Summary**	**Reason for Inclusion**
National Primary Drinking Water Regulations 40 CFR 141 SC R.61-58 State Primary Drinking Water Regulations SC R. 61-68 Water Classification and Standards	Applicable	Established requirements and standards for chemicals and radionuclides to protect human health from the potential effects of drinking water contamination.	The state of South Carolina classifies all groundwater as potential sources of drinking water and mandates that groundwater meet MCLs established by the Safe Drinking water Act.
Radiation Protection of the Public and the Environment DOE Order 5400.5	To Be Considered	Establishes standards and requirements for operation of the USDOE and USDOE contractors with respect to protection of members of the public and the environment against undue risk from radiation.	P-Reactor facilities, PSLs, and Outfall P-007 contain radioactive contamination and radioactive material. As such, the requirements of the Order must be followed.
USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-18	To Be Considered	Cleanups of radioactive contamination outside the risk range (in general, exceeding 15 mrem/yr effective dose equivalent which equates to approximately 3E-04 increased lifetime risk) are not protective.	USEPA policy establishes protective range for radionuclide cleanups at CERCLA sites. Mandates use of CERCLA risk range rather than dose limits established under other regulations.

Table 4. List of ARARs for the P-Area Operable Unit (continued)

Action-Specific			
SC R.61-107 Solid Waste Management Subarticle 19, Part IV (F)(1)(a)-(d) & Subarticle 19, Part IV (F)(2)(a)(1)-(2)	Relevant and Appropriate	A 2-ft thick final earth cover is required with a 3-5% slope, graded to promote positive drainage. Side slope not to exceed a 3:1 slope. Testing of cap closure by a SC certified professional engineer. Stormwater conveyance system designed to handle a 24-hr, 25-yr storm event. The finished surface to be seeded with suitable ground cover. Maintain 76% or greater vegetative ground cover. Monitor groundwater.	Closure of the P-Area Ash Basin must be in compliance with SC regulations.
South Carolina Proper Closeout of Waste Treatment Facilities SC R.61-82	Applicable	Requires closeout of permitted industrial wastewater facilities.	P-Area Ash Basin was permitted as an industrial wastewater treatment facility. Post-closure maintenance and monitoring requirements.

Table 5. Alternative PAOU-1 - Detailed Cost Estimate – No Action.

Alternative PAOU-1 - P-Area Operable Unit
No Action
P Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
No Action				
Subtotal - Direct Capital Cost				$0 *
Mobilization/Demobilization	20%	of subtotal direct capital		$0 *
Site Preparation/Site Restoration	20%	of subtotal direct capital		$0 *
Total Direct Capital Cost	(sum of * items)			**$0**
Indirect Capital Costs				
Engineering & Design	18%	of direct capital		$0
Project/Construction Management	25%	of direct capital		$0
Health & Safety	5%	of direct capital		$0
Overhead	30%	of direct capital		$0
Contingency	20%	of direct capital		$0
Total Indirect Capital Cost				**$0**
Total Estimated Capital Cost				**$0**
Direct O&M Costs	2.7%	discount rate for costs > 200 years duration[1]		
Annual Costs	200	years O&M		*Years 2010 - 2209*
Subtotal - Annual Costs				$0
Present Worth Annual Costs (2.7% Discount Rate)				$0
Five Year Costs	0			
Remedy Review	0	ea	$15,000	$0
Subtotal - Five Year O&M Costs				$0
Present Worth Five Year Costs				$0
Total Present Worth Direct O&M Cost				**$0**
Indirect O&M Costs				
Project/Admin Management	100%	of direct O&M		$0
Health & Safety	30%	of direct O&M		$0
Overhead	30%	of direct O&M		$0
Contingency	15%	of direct O&M		$0
Total Present Worth Indirect O&M Cost				**$0**
Total Estimated Present Worth O&M Cost				**$0**
TOTAL ESTIMATED COST				**$0**

1. Interest rate for costs with duration < 200 years (i.e., before 2209) is based on SRNS's 25 August 2009 Technical Memorandum.

Table 6. Alternative PAOU-2 - Detailed Cost Estimate – Land Use Controls.

Alternative PAOU-2 - P-Area Operable Unit
Land Use Controls
P Area OU
Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost	
Direct Capital Costs					
Land Use Controls					
Posting of Warning Signs	170	ea	$50	$8,500	
Land Use Control Implementation Plan	1	ea	$5,000	$5,000	
Deed Restrictions	1	ea	$5,000	$5,000	
Subtotal - Direct Capital Cost				$18,500	*
Mobilization/Demobilization	20%	of subtotal direct capital		$3,700	*
Site Preparation/Site Restoration	20%	of subtotal direct capital		$3,700	*
Total Direct Capital Cost	(sum of * items)			**$25,900**	
Indirect Capital Costs					
Engineering & Design	18%	of direct capital		$4,662	
Project/Construction Management	25%	of direct capital		$6,475	
Health & Safety	5%	of direct capital		$1,295	
Overhead	30%	of direct capital		$7,770	
Contingency	20%	of direct capital		$5,180	
Total Indirect Capital Cost				**$25,382**	
Total Estimated Capital Cost				**$51,282**	
Direct O&M Costs	2.7%	discount rate for costs > 200 years duration[1]			
Annual Costs	200	years O&M		*Years 2010 - 2209*	
Access Controls	1	ea	$500	$500	
Annual Inspections / Maintenance	1	ea	$10,000	$10,000	
Subtotal - Annual Costs				$10,500	
Present Worth Annual Costs (2.7% Discount Rate)				$387,002	
Five Year Costs	40				
Well Monitoring (Annual Sampling & Analysis	20	ea	$460	$9,200	
Remedy Review	1	ea	$15,000	$15,000	
Subtotal - Five Year O&M Costs				$24,200	
Present Worth Five Year Costs				$169,013	
Total Present Worth Direct O&M Cost				**$556,015**	
Indirect O&M Costs					
Project/Admin Management	100%	of direct O&M		$556,015	
Health & Safety	30%	of direct O&M		$166,805	
Overhead	30%	of direct O&M		$166,805	
Contingency	15%	of direct O&M		$83,402	
Total Present Worth Indirect O&M Cost				**$973,026**	
Total Estimated Present Worth O&M Cost				**$1,529,041**	
TOTAL ESTIMATED COST				**$1,580,323**	

1. Interest rate for costs with duration < 30 years (i.e., before 2209) is based on SRNS's 25 August 2009 Technical Memorandum.