United States Department of Energy

Savannah River Site

Scoping Summary for the 105-P Reactor Building (U)

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

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KEY CHANGES TO SCOPING SUMMARY			
Date	Section	Description of Change	Rationale for Change
July 2006	All	This is a modification of the P Area Operable Unit (PAOU) scoping summary. All subunits other than the 105-P Reactor have been removed from the original PAOU scoping summary. The PAOU scoping summary will be maintained for future scoping.	Based on the May 23, 2006 Citizens Advisory Board meeting, an early decision on the end state of the 105-P Reactor is recommended prior to the P Area Operable Unit final decision. Based on this rationale, all subunits other than the 105-P Reactor have been removed from this scoping summary. This has been done in order to focus this scoping summary on the early decision requirements for the 105-P Reactor. The PAOU scoping summary will be maintained for future scoping.

RECORD OF KEY AGREEMENTS	
Date	Description of Agreement
2 Nov 2005	The end state of the Reactor Building (105-P) will most likely be *in situ* decommissioning. The project team should evaluate the building as a consolidation unit. The land use is non-residential and the industrial worker scenario will apply to risk assessments.
8 Mar 2006	The Area Completion Team (ACT) agreed that development of a tiered contaminant migration screening approach is acceptable to evaluate the reactor baseline conditions and to determine future *in situ* disposal conditions.

1.0 Project Phase

The July 26, 2006 Scoping Meeting supports the decision making process of achieving an Interim Record of Decision (IROD) for the P-Reactor subunit of the P-Area Operable Unit (PAOU). The IROD will be used to document end state decisions for the reactor facility and will support and be integrated into the PAOU final ROD. Only the Reactor Building (105-P) and ancillary structures are discussed in this scoping summary.

In March, 2006, the Project Team submitted the P-Area Operable Unit (PAOU) Work Plan to the United States Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC). The Work Plan presented the characterization activities for all components of the PAOU with the exception of the 105-P Reactor Building. USEPA and SCDHEC have both reviewed the work plan and provided comments.

An Area Completion Team (ACT) meeting was held in November 2005 to discuss the integration of the 105-P facility into the PAOU. The ACT members concurred that the hardened 105-P facility would be included with the PAOU and evaluated using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The ACT also concurred that the desirable end state for the 105-P facility was *in situ* disposal with the potential to use the intact hardened facility for consolidation of P-Area waste from remediation of the remaining PAOU components. A P-Reactor Contaminant Migration Screening White Paper for PAOU has been developed using Tier I analysis (screening) modeling to help determine an acceptable end-state and assess residual quantities of waste that can be left in-situ in the 105-P facility.

Early stakeholder involvement is needed to determine the final end state of the reactor facility and multiple public workshops are expected to obtain input from citizens on a final end state. The Citizen's Advisory Board has subsequently been informed about the process and endorsed this approach on May 23, 2006 with a recommendation which states (in part):

> *"Based upon these workshops, the Three Parties should consider issuing an early decision (Record of Decision – ROD) on the final Reactor End State prior to the P-Area Operable Unit ROD in 2010. Such Action would help provide guidance for future hardened facilities End State decisions at SRS."*

This scoping summary supports the administrative path forward and development of an Interim Action Proposed Plan (IAPP) and IROD for the P-Reactor subunit of the PAOU.

2.0 Background

P Area is located in south-central SRS. The primary sources of radioactive contamination in P Area are fission products and tritium, both of which were by-products of operation of the 105-P Reactor. In addition, solvents, which were used to clean fuel and targets, are a source of non-radioactive contamination.

In February 1954, P-Reactor went operational. 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. P-Reactor is now in shutdown with no capability of restart. All irradiated fuel assemblies, target material, and moderator have been removed from the facility. The building is structurally sound. Equipment associated with P Reactor is de-energized, drained of hazardous material, laid up, and/or maintained in accordance with facility operation procedures. There are no operable habitability systems in P Reactor. A trace amount of tritium-contaminated moderator liquid (deuterium oxide) remains inside the P Reactor, but this liquid is neither exposed to, nor can leak to the environment. Radioactive and contaminated process equipment is stored inside the reactor building.

3.0 Land Use

The end state for the Reactor Building (105-P) is anticipated to be *in situ* decommissioning. No current or projected future development of P Area is planned. There are no identified area(s) or structures that may be subjected to future usage. However, an industrial land use scenario is established for the protection of human health and the environment as designated in the Land Use Control Assurance Plan (LUCAP). There is no current or projected future use of the groundwater as a drinking water source.

4.0 P-Area Operable Unit

The PAOU Work Plan was submitted in March 2006. To support the characterization effort developed in the PAOU Work Plan, the eleven subunits of the PAOU (FFA waste units and D&D facilities) have been grouped into the following investigative units:

- P-Reactor Investigative Unit;
- Cooling Water System Investigative Unit;
- P-Area Ash Basin Investigative Unit;
- Northern Vadose Zone Investigative Unit; and
- Southern Vadose Zone Investigative Unit.

The P-Reactor Investigative Unit includes the105-P Reactor Building, the Potential Release from the P-Area Disassembly Basin, the P-Area Reactor Area Cask Car Railroad Tracks as Abandoned, the P-Area Process Sewer Lines as Abandoned, and three Potential Source Areas (PSAs) which may be sources of groundwater contamination. Characterization activities developed in the PAOU Work Plan include all subunits of the P-Reactor Investigative Unit with the exception of the 105-P Reactor Building.

Groundwater is not a subunit of the PAOU, but is a separate operable unit – P Area Groundwater OU. Based on available data, it does not appear that 105-P Reactor Building is currently a continuing source of groundwater contamination. Characterization associated with the PAOU Work Plan, specifically the P-Reactor Investigative Unit, includes soil-gas sampling, subsurface soil sampling, and groundwater sampling which will be used to identify groundwater source areas.

5.0 Reactor Building (105-P)

The Reactor Building (105-P) is a subunit of the PAOU. Ancillary structures associated with the 105-P facility include:

- Engine Houses (108-1P and 108-2P).
- Process Water Storage Tank (106-P)
- Purge Water Storage Basin (109-P)

The Process Water Storage Tank (106-P) and Purge Water Storage Basin (109-P) are located external to the Reactor Building. The two engines houses (108-1P and 108-2P) are attached externally to the Reactor Building. Primary access to the engine houses is through the lower level of the Reactor Building.

The Reactor Building (105-P) is a massive reinforced concrete structure of nuclear blast resistant design, with multiple levels over 39.6 m (130 ft) above and 12.2 m (40 ft) below ground surface. The subsurface footprint of the building is not the same as the ground level footprint. Walls, floors, and roofing of the building vary between approximately 1.4 to over 2.1 m (4.5 to over 7.0 ft) in thickness of reinforced concrete. For example, the floor and the roof of the disassembly basin vary between 1.5 to 2.3 m (5 to 7.5 ft) and 0.7 to 1.5 m (2.5 to 5 ft) thick, respectively. The facility is structurally sound; however, there is evidence of rainwater ingressions which is subsequently collected in sumps and pumped out by site services. Since shutdown of the reactor in 1991, some of the reusable equipment and materials have been removed from the building. The reactor has been de-fueled, all fissile materials have been removed, and no bulk storage of moderator (heavy water) remains in any of the P Area buildings. Because electricity to the facility was disconnected, the ventilation system does not operate to circulate air throughout the building. With the absence of fresh air, there is an accumulation of moisture within the building which in turn has contributed to stale air, condensation, and mold. There is also evidence of peeling paint, which may contain lead and PCBs. There are no chemicals stored within the Reactor Building (105-P).

Semi-annual inspections are performed on the sumps inside the Reactor Building (105-P). Some areas within the Reactor Building require regulated access because of the remaining low levels of radioactivity and transferable contamination in various rooms. There is no indication of compromise to structural integrity.

<u>Problems Warranting Action</u>

- There are contaminated structures, systems, and components associated with the 105-P Reactor Building and ancillary structures. These components could result in unacceptable human and/or environmental exposure. The presence of non-fixed radiological or chemical contamination could potentially result in an unacceptable release of contamination to the environment.
- The 105-P Reactor Building and ancillary structures likely contain areas of radiological contamination within the facility that may present an unacceptable dose or risk should exposure occur.

- The 105-P Reactor Building and ancillary structures contains a radiological inventory that may migrate to groundwater above MCLs.
- The 105-P Reactor Building and ancillary structures may contain lead-based, or PCB-containing, paint. If peeling, this type of paint presents a hazard/risk for human exposure.

Scope of Problem Warranting Action

- The 105-P Reactor Building covers approximately 385,000 ft^2.
- The 108-1P Engine House covers approximately 6162 ft^2. The 108-1P Engine House connects to the 105-P Reactor Building at the -20 ft level.
- The 108-2P Engine House covers approximately 9161 ft^2. The 108-2P Engine House connects to the 105-P Reactor Building at the -20 ft level.
- There is over 4 million gallons of contaminated water in the Disassembly Basin.
- There is approximately 4,380 cubic feet of contaminated sludge in the Disassembly Basin.
- There are eleven (11) spent process water deionizers in the Purification Area.
- The 106-P storage tank is an 86,850 gallon underground concrete tank.
- The 109-P storage basin is a 9,050 gallon underground concrete tank.

Remedial Action Objectives

- Prevent migration of radiological and chemical contamination from the 105-P reactor facility to groundwater.
- Eliminate or control all routes of human exposure to radiological or chemical contamination.

Likely Response Actions

The final disposition of the 105-P Reactor Building has been identified as *in situ* disposal.

Uncertainty

There are two principal uncertainties associated with the 105-P Reactor Building and ancillary structures: (1) is there a potential contaminant migration threat associated with radiological or chemical contaminants within the structure; and (2) is there a potential threat to human health from exposure to radiological or chemical contaminants within the structure.

The following sections provide additional information regarding known hazards for the process areas of the Reactor Building (105-P) and the ancillary structures.

5.1 Process Area

The Process Area houses the reactor vessel that was embedded in the floor of the process room. The irradiated components are in solid form and the contaminants on the irradiated components have no credible release mechanism.

Problem Warranting Action

- The reactor tank contains irradiated aluminum and stainless steel reactor components such as sleeve housings, plenum plugs, semi-permanent sleeves, muffs, septifoils, safety rod thimbles, automatic incident action rods, thermocouple rods, and spargers.

Likely Response Actions

- Institutional controls to prevent (limit) exposure to radiological contamination.

Uncertainty

- It is uncertain of the levels and extent of radiological contamination in the Process Area. This uncertainty impacts the problem warranting action and will be managed by further evaluation.

5.2 Disassembly Basin

The disassembly basin no longer contains irradiated fuel assemblies. The basin is divided by walls into seven interconnected, water-filled smaller basins. A description on the usage for each of the seven smaller basins is as follows:

- Vertical tube storage – used to cool reactor fuel;
- Machine basin – used to disassemble and handle fuel from the vertical tube storage basin;
- Emergency basin – used to segregate and contain damaged assemblies in harps;
- Dry cave basin – used to process control rods;
- Inspection basin – used for developmental work and was small and isolable;
- Horizontal bundle and bucket storage basin – used to store fuel and target tube bundles prior to shipping from the machine basin; and
- Shipping transfer basin (pits) – used to place fuel and target tube bundles into shipping casks.

Problem Warranting Action

- The P-Reactor Disassembly Basin contains over 4 million gallons of radiologically contaminated water. The primary contaminant in the water is tritium. The total curie content of the Disassembly Basin water is approximately 4,950 curies.
- The P-Reactor Disassembly Basin contains approximately 4,380 cubic feet of radiologically contaminated sludge. The total curie content of the Disassembly Basin sludge is approximately 57.5 curies. Tritium represents approximately 62% of the total

curies, followed by nickel-63 (~22%), cobalt-60 (~5%), plutonium isotopes (~4%), cesium-137 (~2%), and carbon-14 (~2%).

- The basin also contains an unspecified quantity of debris and equipment remnants.

Likely Response Actions

- Removal of contaminated water and/or sludge in the Disassembly Basin to prevent potential migration to groundwater.
- Stabilization of contaminated water and/or sludge in the Disassembly Basin (e.g., grout) to reduce potential migration to groundwater.
- Institutional controls to prevent (limit) exposure to radiological contamination.

Uncertainty

- The presence of contaminated water and sludge in the Disassembly Basin represents the greatest potential for impact to groundwater above MCLs. Current groundwater data indicates that a leak from the Disassembly Basin has not occurred in the past; however it is uncertain if a leak will occur in the future. This uncertainty is currently being managed by a vadose zone characterization (P Reactor Investigative Unit of the PAOU). The integrity of the basin will be managed by a remedial response action.

5.3 Purification Area

The Purification Area provides storage for the process (moderator) water deionizers. The deionizers have been de-deuterized (i.e., deuterium has been removed) with light water and, in addition, oil dry has been added to some of the deionizers to absorb residual moisture after the light water was drained. The only credible release of radionuclides is a fire or explosion due to build up of hydrogen gas, which is considered unlikely.

Problem Warranting Action

- Eleven (11) spent process water deionizers are present in the Purification Area, each containing approximately 30 ft^3 of resins. The curie content of the resins is approximately 146 curies (total) in the form of mixed fission products and tritium.

Likely Response Actions

- The deionizers are to be dispositioned through the SRS waste management program.

Uncertainty

- It is uncertain if residual radiological contamination will be present in the Purification Area upon removal of the deionizers. This uncertainty impacts the problem warranting action and will be managed by further evaluation.

5.4 Assembly Area

Three sealed containers (casks) of radioactive sources are stored in a confined area and do not pose a release to the environment since they are in a solid metallic form. The only credible release of radionuclides is a fire or explosion due to build up of hydrogen gas, which is considered unlikely. Solvents were used in the Assembly Area. Individual rods were thoroughly degreased using trichloroethylene (TCE) to remove any solvents containing hydrogen and carbon. Due to handling and operating practices using tanks and drums, TCE is not identified as a problem warranting action.

Problem Warranting Action

- Three sealed containers of radioactive neutron sources (plutonium-241) are stored in a confined area.

Likely Response Actions

- Removal (disposition) of radioactive sources by Spent Fuel.

Uncertainty

- None.

5.5 Miscellaneous Areas of the Reactor Building

The general areas of the Reactor Building (105-P) for the most part have been prepared for shut-down, de-energized, and drained of radioactive and chemical hazards. Even though the systems have been drained and dried, residual liquids and non-releasable contaminants may be present in these drained systems.

Problem Warranting Action

- Three moderator (heavy water) storage tanks located in the -40 ft level have been emptied and it is estimated that approximately three gallons of contaminated moderator (heavy water) is present in the heel of each tank.
- Sand filters on the roof of 105-P present a radiological exposure risk.

Likely Response Actions

- Removal (disposition) of residual moderator.
- Grout moderator storage tanks.
- Removal of sand filters.
- Consolidation of sand filters into the 105-P facility.

Uncertainty

- It is uncertain of the levels and extent of radiological contamination in the general areas of the 105-P facility. This uncertainty impacts the problem warranting action and will be managed by further evaluation.

5.6 Engine Houses, 108-1P and 108-2P

The engine houses were constructed with and connected to the Reactor Building at the -20 ft elevation. The 108-1P and 108-2P engine houses provided back-up emergency power for the reactor. The equipment has been removed from service and some equipment has been removed from the building. No problem warranting action has been identified for the engine houses.

5.7 Process Water Storage Tank, 106-P

The Process Water Storage Tank (106-P) is an 86,850 gallon underground concrete storage tank designed to contain process water used in the operation of P-Area Reactor. The Process Water Storage Tank (106-P) received water from the disassembly basin that was circulated through sand filters and water from a settler tank that was used to receive back wash from the sand filters. The contents of the tank were transferred to the P-Area Reactor Seepage Basins.

Problem Warranting Action

- Residual radiological contamination may be present above PTSM thresholds.
- Residual radiological contamination may be present above contaminant migration thresholds.

Likely Response Actions

- Excavation and removal of the 106-P tank.
- Stabilization of the 106-P tank.

Uncertainty

- It is uncertain of the levels and extent of radiological contamination in the 106-P tank. This uncertainty impacts the problem warranting action and will be managed by further evaluation.

5.8 Purge Water Storage Basin, 109-P

The Purge Water Storage Basin (109-P) is a 9,050 gallon underground concrete settling chamber designed to contain de-ionized shield water from the reactor shield system. The basin contains a series of baffles designed to allow activated particulates to settle out of the shield water. The water then overflowed to the process sewer system.

Problem Warranting Action

- Residual radiological contamination (activation products such as cobalt-60) may be present above PTSM thresholds.
- Residual radiological contamination (activation products such as cobalt-60) may be present above contaminant migration thresholds.

Likely Response Actions

- Excavation and removal of the 109-P basin.
- Stabilization of the 109-P basin.

Uncertainty

- It is uncertain of the levels and extent of radiological contamination in the 109-P basin. This uncertainty impacts the problem warranting action and will be managed by further evaluation.

6.0 Operable Unit Strategy

The Project Team proposes to develop an Interim Action Proposed Plan / Interim Record of Decision (IAPP/IROD) to document the end state decisions for the 105-P Reactor Building and ancillary structures. Included in the IAPP/IROD will be an allowance for consolidation of PAOU waste material into the 105-P Reactor facility, provided the waste material meets acceptance criteria to be outlined in the IAPP/IROD. The identification of waste material for consolidation will be provided in the PP/ROD for the PAOU.