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Release Date: 12/08/94

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7. Abstract <p>The hazard classification of the Plutonium Recycle Test Reactor (PRTR)/309 building as a "Radiological Facility" and the office portions as "Other Industrial Facility" are documented by this report. This report provides: a synopsis of the history and facility it's uses; describes major area of the facility; and assesses the radiological conditions for the facility segments. The assessment is conducted using the hazard category threshold values, segmentation methodology, and graded approach guidance of DOE-STD-1027-92.</p> <div style="text-align: center; margin-top: 100px;"> APPROVED FOR PUBLIC RELEASE </div>		
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ACRONYMS

AC	Alternating Current
AEC	U. S. Atomic Energy Commission
BNWL	Battelle Northwest Laboratory
D&D	Decontamination and Decommissioning
DOE	Department of Energy
EM	Office of Environmental Restoration and Waste Management
FERTF	Fuel Element Rupture Test Facility
FFTF	Fast Flux Test Facility
FY	Fiscal Year
HEDL	Hanford Engineering and Development Laboratory
HEPA	High-Efficiency Particulate Air (filter)
HVAC	Heating Ventilating and Air Conditioning
HW	Hanford Works
IE&M	Interim Examination and Maintenance Cell
INEL	Idaho National Engineering Laboratory
IX	Ion Exchange
M&M	Maintenance and Mockup
NDA	Nondestructive Assay
NE	Department of Energy Office of Nuclear Energy
NRC	U. S. Nuclear Regulatory commission
PCBs	Polychlorinated Biphenyls
PNL	Pacific Northwest Laboratories
PRCF	Plutonium Recycle Critical Facility
PRTR	Plutonium Recycle Test Reactor
PUREX	Plutonium Uranium Extraction (Facility)
RLA	Rupture Loop Annex (Alias FERTF)
RLWS	Radioactive Liquid Waste System
TRU	Transuranic
TW	Transfer Waste

EXECUTIVE SUMMARY

The PRTR/309 building is categorized as a "Radiological Facility," in accordance with DOE-EM-5502-94 "Hazard Baseline Documentation" and DOE-STD-1027-92 "Hazard Categorization and Accident Analysis Techniques for Compliance With Doe Order 5480.23, Nuclear Safety Analysis Reports."

The facility category is based upon a quantitative and qualitative assessment of materials in the building. The nuclear hazard category 3 threshold values for radionuclides found in DOE-STD-1027-92 were used for this determination. Segmentation of the facility is used where areas in the facility are isolated (i.e., the material in one segment cannot interact with the material in other segments). When the radioactive material form and availability for release are considered, all segments of the facility are below Hazard Category 3 thresholds.

Building "Radiological Facility" segments with potentially releasable radioactive materials in excess of 40 CFR 302 Appendix B levels are the following: waste tank farm, PRTR ion exchange vault, rupture loop ion exchange vault, rupture loop annex, fuel storage basin, containment structure, fuel transfer pit, fuel exam cell, and reactor cavity. These facility segments have potentially releasable materials below 29 CFR 1910.119 and 40 CFR 355 thresholds.

The south and west wings of the building are categorized as "Other industrial facility." Potentially releasable radioactive material is below 40 CFR 302 Appendix B levels. Potentially releasable hazardous chemicals are less than 40 CFR 302.4 Table Levels.

**PRTR/309 BUILDING NUCLEAR FACILITY
PRELIMINARY HAZARD ASSESSMENT**

1. PURPOSE

The purpose of this report is to document the hazard category of the 309/Plutonium Recycle Test Reactor (PRTR) building. The classification of the building determines the documentation level and detail required for regulatory compliance.

2. PROCESS AND CRITERIA

The process to determine the hazard baseline documents needed to identify and control radiological and non-radiological hazards is specified in DOE-EM-STD-5502-94 "Hazard Baseline Documentation." Figure 1 illustrates the process used to determine the 309 building hazard category.

Criteria for facility categorization are those contained in DOE-STD-1027-92 Table A1, "Thresholds for Radionuclides." In applying the threshold limits, only radiological material at risk and available for release shall be considered. Material available for release is based upon quantity, form, location, dispersibility and interaction with available energy sources.

The process embraces the graded approach to a facility near the end of its life cycle, with no active process and no identified nuclear facility mission, and minimal hazards. The graded approach considerations include: (1) the relative importance to safety, safeguards and security; (2) the magnitude of the potential hazards involved; (3) the life cycle stage of the facility; (4) programmatic mission of the facility; and (5) the particular facility characteristics.

The hazard categorization may be determined using facility segmentation, provided that radiological material in one segment cannot interact with radiological materials in other segments. For example: independence of heating ventilating and air conditioning (HVAC) and piping, separation by soil or structural barriers.

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** Other types of safety and health hazard identification and control documentation may be necessary such as construction safety requirements, Chemical Hygiene Plans, and Hazcomm. All facilities with hazardous waste activities require a HASP as defined in 29 CFR 1910.120(a).

Figure 1. Hazard Baseline Documentation Process

(Ref. DOE-EM-STD-5502-94 Figure 1)

3. FACILITY DESCRIPTION

3.1 309 FACILITY HISTORY

The original 309 building mission was to provide an operating test reactor in the Hanford Works (HW) Plutonium Fuels Utilization Program whose purpose was to research and develop nuclear fuel technology. This test reactor was known as the Plutonium Recycle Test Reactor (PRTR). In 1962, the Plutonium Recycle Critical Facility (PRCF) was added to support PRTR operations as the location where reactivity values of fuel assemblies were checked.

In 1963, Fuel Element Rupture Test Facility (FERTF), (hereafter called the Rupture Loop) operations began in one fringe channel of the PRTR. The Rupture Loop itself was a pressurized, light-water-cooled loop within the main, heavy-water-cooled calandria. The Rupture Loop was used as a pilot irradiation facility to test new fuel element designs and new operating regimes. Many of its tests involved pre-defecting fuel elements with pinhole breaks to study the stability of various pre-defected materials under irradiation.

Such Rupture Loop tests continued under increasing thermal conditions until a serious (Type A) operating accident occurred on September 29, 1965 (fuel rod failure). After the subsequent cleanup, the PRTR resumed critical experiments and began what was known as the Batch Core Experiment. It experimented with augmenting the standard control rods with a "chemical shim" in the form of varied concentrations of boric acid dissolved in the heavy water moderator. This experiment ran for only about half of its planned duration before a flaw was discovered in the P-4 valve (the main valve in the primary coolant inlet system). The PRTR was shut down in order to replace the valve in early 1969. The U.S. Atomic Energy Commission (AEC) decided not to refuel the PRTR. The PRTR was laid away in 1969 and subsequently decommissioned. By 1975 the PRTR had been deactivated, all fuel removed and the fuel storage basin decontaminated.

Following the PRTR layaway, the PRCF continued to operate although its original mission soon gave way to housing experimental lattice testing for the design of various light-water-cooled reactors. Later, a commercial license obtained from the Nuclear Regulatory Commission (NRC) by Battelle Northwest Labs (BNWL) allowed the PRCF to experiment with commercial fuels from a variety of sources (this NRC license has since been closed out). In 1976 the PRCF was closed down due to its outdated technology. In 1988, PRCF hardware and equipment were removed, the area decontaminated, and portions of the area rendered inaccessible.

In 1975 the Interim Examination and Maintenance (IEM) Cell was built in the old maintenance and mockup (M&M) cell area. It is an exact "cold" replica of the operating cell in the Fast Flux Test Facility (FFTF) reactor and is still used to train and re-qualify operators and to check operating procedures.

In the late 1970s, the ground floor level inside the PRTR containment dome was emptied and converted into a "clean shop" (i.e., one using no radioactive materials and no sodium) to fabricate loops that would be used in

the 324, 335 and 337 buildings to test sodium flow. In conjunction with this shop was a welding qualification room that later became an electronics repair shop (now offices 404a and 404b).

The contaminated sewer system from the building was modified in the early 1980s. The modification included plugging drains to the contaminated sewer, cutting pipes to the 300 Area radiological sewer, and installing a rain cover over the rupture loop vault.

In 1986-87 a space technology development program known as SP-100 was assigned to the 309 Building. This program immediately undertook an extensive clean-out of the PRTR facilities in the building. The clean-out included removal of all PRTR process equipment from the containment floor, A, B, and C cells, and equipment and storage tanks from the south basement. In 1991, the SP-100 program was placed on a 5-yr "hold," thus ceasing any further clean-out. The SP-100 program was terminated by DOE in November 1993, which has brought about the transition of the facility.

The PRTR ion exchange vault was opened in March 1994 to inspect the conditions and assess the stability. A characterization of the vault materials was performed as well.

Today the 309 building is used by various organizations for offices space, engineering records, and a soils physics laboratory (rooms 404a and b).

3.2 MISSION

The mission of the 309 building has evolved since original construction. It's original mission has ended, the facility is now 37 years old and nearing the end of it's useful life. The facility has been declared excess by the Department of Energy Office of Nuclear Energy (NE) and at present is being transitioned to DOE Office of Environmental Restoration and Waste Management (EM-40, by way of EM-60), for ultimate decontamination and decommissioning (D&D). No new missions involving radiological materials have been identified for the facility. Presently, cleanout and stabilization are the only planned activity for the facility which would present a potential radiological hazard. The facility's present use is office space, however, portions of the building are used for a soil physics laboratory, and temporarily for the tank farm's "Core Drill Truck" assembly.

The transition/deactivation of the 309 building is projected to be completed by the end of fiscal year (FY) 1998. The major stabilization and decontamination efforts include the reactor cavity, fuel examination cell, fuel transfer pit, waste transfer (TW) tanks, rupture loop and PRTR ion exchange vaults. In addition to stabilizing contaminated areas, equipment, components, records, waste products, etc., will be dispositioned, and all nonessential systems (i.e., heating, ventilation, and air conditioning, electrical, monitoring, fluids) will be shut down and drained/de-energized. Laboratory, and office areas will be secured. Following shut down, the facility will be operated at a level commensurate with its surveillance needs while awaiting D&D.

3.3 309 BUILDING DESCRIPTION

The 309 facility is located in the 300 Area of the Hanford Site. The facility consists of the containment vessel structure, 309 main building, PRTR and rupture loop ion exchange vaults, and the waste tank farm. The 309 building is currently in transition status. There are no active nuclear operations or processes. The main building currently provides office space for 110 people, a mockup facility for the FFTF IEM cell, and a soil physics laboratory. Figures 2, 3, 4 and 5 show the facility layout. Descriptions of radiological portions of the facility are found in the following sections. Non-radiological portions of the building include the south wing, and maintenance and mock-up wing.

The PRTR containment vessel is a welded steel cylindrical structure with a hemispherical top and bottom. The PRTR reactor is centrally located inside the vessel, below grade and inside a concrete structure. The main building contains a south wing, maintenance and mock-up wing, old fuel storage basin area, and rupture loop annex.

The building is a one-story steel structure and basement that adjoins the containment dome. The Service Building dimensions are 24.4 m by 30.5 m (80 by 100 ft), the Maintenance and Mockup Wing is 18.6 m by 30.5 m (61 ft by 100 ft). The building has approximately 4,340 m² (46,700 ft²) of floor area. Of this area, the first floor offices and personnel corridors comprise 2000 m² (21,600 ft²); the basement offices and personnel corridors, 413 m² (4,450 ft²); the south wing basement service area, 920 m² (9,900 ft²); the IEM cell, 135 m² (1,450 ft²); rooms 20 and 19 (rupture loop annex and access tunnel), 235 m² (2,525 ft²); inaccessible below grade portion of the PRCF and Fuel Storage Basin, 163 m² (1,750 ft²); and containment vessel, 467 m² (5,025 ft²).

The 309 facility is serviced by several utility services. These include normal AC and standby electrical power (480 volt and 120 volt), steam, sanitary water, compressed air, sanitary sewer, process sewer. The containment vessel has a HEPA-filtered exhaust system. The exhaust system includes fans, filters, underground ducting and a 30.5 m (100 ft.) exhaust stack. External to the building there is low level radioactive contamination in the process sewer (i.e., manholes numbers MH-1A, MH-4, and MH-2A) and inside the exhaust system structures (i.e., stack base, filter pit and exhaust stack pit).

The PRTR/309 building can be separated into segments for the purpose of hazard classification. There are portions of the facility outside the building proper, and segments within the building. Descriptions for each facility segment description are contained below (sections 3.3.1 to 3.3.11).

3.3.1 Containment Vessel

The containment structure is a concrete and welded steel vessel. The containment vessel is 24.4 m (80 ft) in diameter and extends from 15.2 m (50 ft) below grade to 22.9 m (75 ft) above grade for a 38.1 m (125 ft) total height. The interior walls, partitions and pits are all concrete as is the crane rail which supports the 30-ton circular crane. Access is through a personnel air lock and a 3.7 m by 4.9 m (12 ft by 16 ft) slide up door.

Figure 2. Plutonium Recycle Test Reactor - 309 Building Plot Plan

309 Building Plan 1st Floor - Elev 0'-0"

Figure 3. 309 Building Floor Plan - Ground Floor

309 Bld Plan Below Elev 0'-0"

Figure 4. 309 Building Floor Plan - Below Grade

Containment Structure North South Cross Section

308cont1.as

Figure 5. Containment Vessel Cross Section

Emergency egress is available through an emergency air lock. All three openings are equipped with air expansion seals. The containment vessel is held at a negative pressure by the HEPA filtered exhaust system.

At present, the containment ground level floor area is used to assemble "Core Drill Trucks" for use at 200 Area tank farms.

The containment floor area has fixed contamination. The reactor hall dose rate is less than 0.5 mrem/hr; however, several spots sealed with paint, have fixed 6,000 to 20,000 dpm beta/gamma contamination. Routine radiological surveys are performed, surveys indicate loose or smearable contamination is below detection limits.

3.3.2 A-Cell, B-Cell, and C-Cells

Below the containment vessel hall are three large cells with their floors at 9.8 m (32 ft) below grade. The A-Cell is the largest, occupying almost half of the area under the containment dome. During PRTR operation it contained the reactor process equipment for the primary and secondary coolant systems. Also located within A-Cell was the principal heat exchanger for the reactor. The B-Cell occupies about one-fourth of the area under the containment dome and was the experimental cell. During PRTR operation B-Cell contained the in-vessel rupture loop equipment, the gas loop equipment, and cooling blowers for the Hot Fuel Examination Facility. C-Cell, about the same size as B-Cell, was the instrument cell and consisted of three levels (-11 ft, -21 ft and -32 ft). SP-100 efforts removed all PRTR process equipment from A, B, and C-Cells and shipped it to the 200 Area solid waste burial grounds.

The containment vessel also contains a "green" (fresh) fuel storage pit, located below grade between A-Cell and C-Cell and just north of the irradiated fuel storage pit. This small concrete facility is 1.1 m by 1.9 m by 6.4 m (3.5 ft x 6.3 ft x 21 ft) deep.

Decontamination activities undertaken in the 1970s and 1986-1987 (SP-100 work) resulted in a significant reduction of equipment and hazardous materials within the containment dome. During SP-100 efforts, all of the piping, tanks and heat exchangers were removed from A-Cell. The HVAC equipment, and electrical switch gear is all that remains in A, B, and C-Cells from the PRTR reactor.

Routine radiological surveys indicate no loose or smearable contamination on surfaces routinely accessible. The C-Cell -11 ft, and -21 ft level dose rates are less than 0.5 mR/hr general area and 2.0 mR/hr maximum; however, several spots sealed with paint, have fixed beta/gamma contamination of 6,000 to 300,000 dpm. The radiological contamination in the A-Cell, B-Cell, and -32 ft C-Cell is: 2,800 dpm alpha, 200,000 dpm beta/gamma fixed; smearable contamination is below detection limits, 20 dpm alpha and 1000 dpm beta/gamma; dose rates are 10 mrem/hr maximum and less than 0.5 mrem/hr general area.

3.3.3 Reactor Cavity

The reactor cavity contains the activated PRTR structure and the moderator storage tank. The reactor cavity is located in the center of the containment vessel. Access to the reactor cavity is gained by removing a large steel plate at the -32 foot level in C-Cell, or through a 68.6 cm (27 in.) thick rotating shield assembly in the containment 0 ft. (ground floor) level. The reactor cavity access is bolted closed, and the rotating shield grouted and painted closed. The reactor cavity has no active supply ventilation, but the cell is exhausted through the containment HEPA-filtered exhaust.

The PRTR reactor core is located in a calandria (tank) 3.7 m (12 ft) in diameter and 2.9 m (9.5 ft) high. The reactor core consisted of a moderator tank containing 84 10.2 cm diameter (4 in) and one 15.2 cm dia (6 in) vertical aluminum shroud tubes. Inside each shroud tube is a Zircaloy-2 process tube. During operation each process tube held a fuel "cluster" or "bundle" of 19 fuel rods. Primary control for the reactor was achieved by varying the heavy water moderator level inside the calandria. The auxiliary control feature was 18 additional core positions that contained a total of 54 half-rods (safety or shim rods, three in each of the 18 positions). Located below the calandria is the moderator storage tank which stored the heavy water moderator and introduced it into the calandria using helium pressure. The top of the reactor core was shielded by a 68.6 cm (27 in) thick concrete slab at ground level.

Decontamination activities undertaken in the 1970s resulted in a significant reduction of hazardous materials. The fuel from the reactor core was removed and processed through the Plutonium-Uranium Extraction (PUREX) facility in 1972-73. Some PRTR fuel elements containing special oxide blends were processed in the hot cell in the 325 (and/or 324) building in 1976 and buried in the 200 Area solid waste burial grounds. The heavy water in the moderator storage tank was drained and shipped to the Savannah River Plant in 1969 (a possible heel remains in the tank). In the late 1970s all ports and plugs in the top reactor shield were sealed with grout and painted with sealant to fix any contamination.

The radiological contamination in the cell is primarily due to activated structures. The 1965 accident may have deposited as much as 1.8 g Pu_{239} in the PRTR reactor systems. Radiological surveys performed in December 1970 on a PRTR process tube indicates (PRTR has 85 process tubes total): 1) a peak gamma dose of 18 R/hr at one foot standoff, 2) smearable contamination of <500 dpm alpha and 30,000 cpm beta/gamma on internal surface, and 3) smearable contamination of 1,000 dpm alpha and 100,000 cpm beta/gamma on external surface. The access space below the reactor has a general gamma field dose of 300 Mr/hr, 500 mR/hr to the head, smears on the process tube jumpers were 8,000 cpm and 20,000 cpm on the thermal barrier.

3.3.4 Fuel Transfer Pit

Located between A-Cell and C-Cell was the irradiated fuel storage and transfer pit. Constructed of concrete, the 6.4 m by 1.2 m by 7.9 m (21 ft x 4 ft x 26 ft) deep fuel transfer pit is directly above a pipe chase between A and C-Cells. The pit has been drained, closed and sealed. The fuel transfer pit has a drain line going through the structural concrete into the B-Cell

sump. The drain line is equipped with a valve, which is closed. There is no ventilation of this space. Access to the fuel transfer pit is through a 8,200 Kg (9 ton) plug in the containment dome floor.

Process knowledge indicates that there is smearable contamination within the fuel transfer pit. Records of the quantity and form of radioactive contamination have not been located. Material in the pit would originate from fuel elements passed through the cell. This material would be similar to that found in the fuel storage basin, except the pit will not have settled particulate from the air, or material from handling fuel. Analysis of basin sediment in 1969 show the following: (Isotopes with a half life of 2 years are not included).

<u>Isotope</u>	<u>Activity/g sediment</u>	<u>Ci Isotope/gram sediment</u>
Total Alpha	1.02 E03 d/m-g *	4.72 E-10 Ci/g as Pu ²³⁹
Total Beta	9.34 E05 d/m-g	4.2 E-07 Ci/g as Sr/Y ⁹⁰
Cs ¹³⁷	1.46 E05 d/m-g	6.5 E-08 Ci/g
Co ⁶⁰	8.29 E05 d/m-g	3.74 E-07 Ci/g
Pu ²³⁹	Below Detection limits for analysis	
	(* near detection limit)	

3.3.5 Fuel Element Examination Cell

The fuel element examination cell is located between the B-Cell and A-Cell. The Fuel Element Examination Facility functioned as a hot cell where personnel conducted preliminary gamma scans and other tests on breached, irradiated fuel. The 1.8 m by 1.2 m by 8.2 m (6 ft by 4 ft by 27 ft) deep concrete structure with a 15.2 mm (16-gauge) stainless steel liner extending to the cell bottom, was equipped with manipulators, periscopes and other remote handling devices. A control console for the facility was located on the ground floor level of the containment dome (north side). The control console, periscope, fuel handling vehicle, and equipment protruding above the containment floor were removed during the facility conversion to the sodium test loop fabrication shop.

The cell access is from B-Cell through a heavy metallic bank vault-type door. The cell was normally air-cooled and was equipped with a 10.2 cm (4 in) bottom drain line that flushed liquid wastes to the B-Cell sump. The cell does not receive active ventilation, however the drain to the B-Cell sump is not plugged.

Radiation surveys performed in December 1970 and May 1971 indicate the cell to have a 200 mRad/hr general gamma field, 40 mRad/hr beta field, and 20,000 dpm smearable on tubing in the cell.

3.3.6 Plutonium Recycle Critical Facility (PRCF)

The PRCF was originally designed to support PRTR operations as the place where the reactivity values of the fuel assemblies before and after irradiation were checked. The PRCF control room was located in room 304. The reactor core is a concrete cell 4.0 m by 3.0 m by 8.2 m (13 ft x 10 ft x 27 ft) deep with its bottom at 9.8 m (32 ft) below grade. The cell was below the east wing of the 309 building, just south of the fuel storage basin but not

inside the containment dome. The PRCF was shut down in 1976. The reactor fuel and neutron sources were removed and water was drained from the system. During 1989, PRCF hardware and equipment were removed, the area decontaminated, and the below grade portion rendered inaccessible (the report WHC-SD-DD-TI-041 (Griffin 1989) documents the decontamination and decommissioning).

The PRCF decommissioning involved the removal of the reactor vessel and associated components dedicated to the PRCF that were remaining in the reactor cavity, room 404B and exhaust fan pit. The project removed PRCF components and decontaminated the reactor cavity. It isolated low-level residual contamination in the exhaust duct, effluent lines and other structural wall links in a manner to minimize environmental impacts, and sealed the cell entrance with a concrete cap. When decommissioning was completed the PRCF interior met the criteria for release as a radiation zone.

3.3.7 Fuel Storage Basin/Room 404

The fuel storage basin area includes the fuel storage basin and a truck loadout area. Today this area is called rooms 404A and 404B. The fuel storage basin and truck loadout bay are covered by heavy grating and plywood forming a floor. The space above the floor is used for offices and the soil physics laboratory.

The fuel storage basin is a 3.7 m by 12.2 m by 7.9 m (12 ft x 40 ft x 26 ft) deep concrete structure adjacent to the containment vessel. During PRTR operation it provided underwater fuel element storage. A water passage into the containment vessel provided for transfer of irradiated fuel elements from the reactor hall, through the fuel transfer pit, into the storage basin. Fuel was transferred into the fuel storage basin from the fuel transfer pit through a sluice gate. The sluice gate was an underwater 61 cm (24 in) square gate valve in the containment vessel wall.

The basin was drained, cleaned, and decontaminated. The decontamination was completed in 1975 by Pacific Northwest Laboratory (PNL) and facility management became Hanford Engineering and Development Laboratory's (HEDL) responsibility. An adjacent truck loadout facility and ion exchange vault and pit was filled with sand during the decontamination activities. The basin cover deck consist of I-beams welded in place to support heavy deck plating and a plywood floor, at approximately ground level. The above grade portion of the basin has been used as a welding qualification shop and presently as the soil physics laboratory.

Final cleanup of the basin area included the handling area decks, truck load out area and truck ramp into the building. A basin overflow, prior to draining the basin, contaminated the truck load-out area floor, drain and the outside ramp. After decontamination and replacement of some asphalt in the ramp and decontamination of floor drains and gratings over outside drains, levels of approximately 10 mRad/hr non-smearable remained.

During the mid 1970s a high pressure water jet was used to clean the basin to non-smearable levels, spot painting was done on the wall and the basin floors were completely painted with yellow primer sealer. During the cleanout, waste that could not be removed was flushed to a sump in the basin.

The sump was filled with cement of sufficient thickness to provide shielding and containment of fines in the sump. Upon completion of the job the basins were found essentially to have no detectable levels of smearable contamination. Dose rate at the 0 ft level are less than 0.2 mrem/hr.

3.3.8 Rupture Loop Annex

The rupture loop annex (RLA) also (room 20) is external to the containment vessel but is adjacent to it on the west side. The annex is completely underground and is constructed of concrete. Included in the RLA is an inner valve room and sampling station. Access, when required, is through locked doors in room 19 of the office section of the 309 building basement. Two equipment hatches, which require a mobile crane for access, are available. This area is not sealed and is not held at a negative pressure; however, it is exhausted to the outside by an 1000 cfm HEPA filtered exhaust fan.

The RLA housed the Rupture Loop mechanical equipment including tanks, pipes, and pumps. The inner valve room contains a decontamination and storage tank, floor drain trench and pumps. The main pump motors were removed in the mid 1970s and sent to Idaho National Engineering Laboratory (INEL) for reuse. The remainder of the equipment remains as left by the facility deactivation.

The RLA, particularly the inner valve room, has a potential for the release of particulate beta/gamma and/or alpha particles. No problems have been encountered since the PRTR was deactivated. There are hot spots, which include the drain trenches, and pump bases. The rupture loop piping and equipment may also contain 0.88 grams of Pu²³⁹ from the 1965 accident.

- 1) General area radiation readings are less than 0.5 mrem/hr. The inner valve room has an average dose rate less than 1 mR/hr, smears in the area are less than 2,200 dpm (beta/gamma) and less than 440 dpm (alpha). The outer room has a maximum reading of 10,000 cpm on piping and maximum smears of 500 cpm.
- 2) The RLP-2 pump base is in the inner valve room. The RLP-2 pump has been removed and a 10.2 cm (4 in) concrete cap placed over the contaminated pump base. Before encapsulation in 1982 the RLP pump and base had a 130 mrad/hr maximum dose rate, 100,000 dpm alpha on contact, and smearable contamination of 2,200 dpm alpha/beta and 440 dpm alpha.
- 3) The trenches have a maximum 25 mRad/hr dose rate, and smearable radioactivity of approximately 300 cpm beta/gamma, no alpha contamination as indicated by a 1992 radiation survey.

3.3.9 Rupture Loop Ion Exchange Vault

The rupture loop ion exchange (IX) vault is located 1.8 m (6 ft) north of the RLA and northwest of the containment dome. The rupture loop IX vault is a below grade concrete structure measuring 8.0 m by 4.8 m by 4.9 m deep (26.16 ft by 15.83 ft by 16 ft) and is equipped with a rain cover. The vault floor drains to RLA valve room sump. The vault has no active ventilation.

The rupture loop IX vault contained the IX columns used to deionize the cooling water for the Rupture Loop section within the reactor. The vault has

room for the three IX columns used for the rupture loop coolant cleanup and deoxygenation process with storage for up to 12 additional spent columns.

The vault is believed to contain three partially spent ion exchange resin columns; one mixed bed, one cation, and one deoxygenator. Although the vault has spent column storage capabilities, no spent columns are thought to be stored within. The ion exchange columns in the vault are known to contain an estimated 5.3 grams of Pu^{239} from the 1965 accident. The IX column resins and contamination possibilities are similar to those in the PRTR ion exchange vault which are Co^{60} , Cs^{137} , and Sr/Y^{90} .

3.3.10 PRTR Ion Exchange Vault

The PRTR IX vault is located north east of the containment building. It contained PRTR cleanup system ion exchange columns. The columns were used to deionize the heavy water used in the reactor.

The vault is a below grade concrete structure, without ventilation. The vault has two chambers. The upper section (Main IX Vault) is 4.3 m by 4.3 m (14 ft by 14 ft) square and 4.9 m (16 ft) deep and is equipped with a rain cover. Access into the upper vault is through a rain cover and three layers of 61.0 cm (24 in.) thick shield blocks. The lower section (Resin Disposal Vault) is 4.7 m (15.5 ft) diameter cylinder that is 6.7 m (22 ft) deep. Access to the lower vault is by either of two 0.9 m (2 ft 11 in.) diameter plugs in the 61.0 cm (24 in.) thick main vault floor.

In 1986, the IX column piping to the containment vessel was drained of heavy water, cut inside containment, and closed off. A detailed inspection and radiological survey was performed during entrance activities (March 1994). During July 1994 one of the upper vault IX columns was sampled for hazardous wastes and a nondestructive assay (NDA) was performed.

The IX columns contain both an acidic cation exchange resin and a basic anion exchange resin. They also contain a variety of contaminants as a result of reactor operations. These contaminants include transuranics (TRUs), cesium, cobalt-60, tritium and fission products. The lower vault was used to store spent IX columns. The upper vault contains five IX columns. The lower vault holds seven spent IX columns and approximately 54.9 KI (14,500 gal) of rainwater. Analysis of the rainwater revealed that it is a non-hazardous radioactive waste. The vault does not contain airborne contamination or combustible or organic gases.

Radioactive inventory in the vault is as follows:

<u>Location</u>	<u>Isotope</u>	<u>Total Quantity</u>
Upper Vault	Sr/Yr (assumed, based on Cs)	0.01 Ci
	Co ⁶⁰	0.6 Ci
	Cs ¹³⁷	0.01 Ci
Lower Vault	Pu ²³⁹ (from fuel failures)	0.35 Ci (5.41 g)
	Sr/Yr ⁹⁰ (assumed, based upon Cs)	<1.0 Ci
	Co ⁶⁰	1.8 Ci
	Cs ¹³⁷	1.0 Ci
Lower Vault	Total Alpha (as Pu ²³⁹)	2.23 x10 ⁻⁵ Ci
Water	Total Beta (as Sr/Yr ⁹⁰)	0.38 Ci
	C ¹⁴	0.93 Ci
	H ³	0.77 Ci
	Co ⁶⁰	9.3 x10 ⁻⁴ Ci
	Cs ¹³⁷	1.2 x10 ⁻³ Ci

3.3.11 Waste Tank Farm (TW Tanks)

The waste tank farm consists of three underground tanks, a valve pit and underground piping. The TW tanks are located inside a fenced area, below grade, north east of the PRTR containment dome. The three TW hold-up tanks, known as TW-1 TW-2 and TW-3, served as holdup and sampling containers for a variety of liquid wastes. A valve pit is located just east of the tanks along with an IX column. There is also a liquid shipping cask stored inside the fence, (the cask is an excess item obtained by the SP-100 program).

The TW tanks are no longer in use. During the late 1970s the contaminated sewer (now known as Radioactive Liquid Waste System (RLWS) piping to the 340 building was cut and capped. All lines into the tanks and valve pits from the 309 building have been cut and capped. The only active line from the TW farm is one line to the process sewer at Manhole 2A. The electrical power supply has been cut and removed. There is no active ventilation of the TW tanks or valve pit.

The TW-1, TW-2 and TW-3 tanks have a 19.0 Kl (5,026 gal), 19.5 Kl (5,141 gal) and 15.8 Kl (4,185 gal) capacity respectively and are buried at depths ranging from 2.9 m (9.51 ft) to 4.6 m (15.0 ft). The maximum depth of the tanks is 7.5 m (24.6 ft). The TW tanks are covered by a 7.6 cm (3 in) concrete pad. Above grade portions of the tanks include pumps, vent lines and an ion exchange column.

The tanks were used to collect waste water from the PRTR. The TW-3 tank collected water from the rupture loop sump, floor drains in the basin and load-out areas, and the containment HVAC equipment pits. The TW-1 and TW-2 tanks collected waste liquids from reactor cooling systems. During reactor operations uncontaminated waste from the tanks was released to the Columbia River via manholes 2 & 3. Contaminated waste was pumped to the 340 building via a contaminated sewer/RLWS.

The radiological conditions at the TW farm are as follows: at ground level the maximum dose rate is 3.0 mrem/hr on the liquid shipping cask; the

ion exchange column is reading 2.5 mR/hr gamma; the piping above the tanks have a maximum reading of 1.5 mR/hr; and the general area dose is less than 0.05 mrem/hr, alpha contamination is less than detectable, and 25,000 dpm beta/gamma smearable. During isolation of the TW farm the tanks were pumped to remove as much liquid as possible. The tanks are expected to contain a low activity heel.

4. COMPARISON TO CRITERIA

4.1 STAGE IN LIFE CYCLE

The PRTR building is 37 years old, and is at or near the end of the facility life cycle. Initial construction on the facility began in 1958. The reactor was operational in 1962. Additions to the building structure were made during the 1960s (i.e. truck loadout and rupture loop annex). Modifications have been made since original construction to facilitate new missions; however, with the exception of an upgraded fire detection system, new telephone lines, and a chilled water source, no upgrades have recently been made to the facility. Some systems such as the steam, sanitary water, and HVAC systems require frequent maintenance to keep them functioning.

4.2 FACILITY SEGMENTATION

The PRTR/309 building can be separated into segments for the purpose of hazard classification. There are portions of the facility outside the building proper, and segments within the building. The isolation basis for each segment is listed in Table 5.1. Segmentation is achieved when hazardous materials in one segment cannot react with hazardous materials in other segments. For example, independence of HVAC and piping must exist between two areas for those areas to be facility segments.

4.3 CRITERIA COMPLIANCE ASSESSMENT

4.3.1 Radiological Assessment

The PRTR/309 facility radiological categorization is based upon either a quantitative assessment or a qualitative approach. The preferred method is a quantitative, however a qualitative approach is used when exact quantities are not available. A qualitative approach is justifiable because: there are no active processes, the remaining systems in the facility are not complex, and the general radiological conditions are known. Table 5.1 contains assessment information for the various facility segments.

Qualitative criteria for facility categorization are those contained in DOE-STD-1027-92 Table A1, "Thresholds for Radionuclides." In applying the threshold limits only radiological material at risk and available for release are considered. Material available for release is based upon quantity, form, location, dispersibility and interaction with available energy sources. Appendix A contains a comparison of the category 3 thresholds to facility segment inventories.

For a quantitative assessment, information such as the general condition of the segment is important, as are general radiological conditions and the presence of smearable contamination. Smearable contamination is an indicator of material available for release by ventilation systems. General radiation measurements can qualitatively be compared to dose rates for a threshold quantity of material.

The hazard baseline documentation process also provides for an industrial or radiological assessment. The facility is categorized as "non-nuclear" if the amount of radioactive materials potentially releasable from the facility is less than the value listed in Appendix B to Table 302.4 of 40 CFR 302. Table 5.1 provides an assessment of material quantities to the limits. The isotopes of particular interest for the PRTR assessment and their 40 CFR 302 reportable release quantities are listed below:

<u>Isotope</u>	<u>Limits Ci</u>	<u>Equivalent Grams</u>
Co ⁶⁰	10.0 Ci	8.85 E-03
Cs ¹³⁷	1.0	5.93 E-03 (with Ba ^{m137})
C ¹⁴	10.0	2.24 E+00
Pu ²³⁹	0.01	1.62 E-01
Sr ⁹⁰	0.1	7.20 E-04
Y ⁹⁰	10.0	1.84 E-05

4.3.2 Hazardous Materials Assessment.

The facility categorization is also dependent upon the hazards associated with materials in the facility. Criteria for radiological facilities are those found in 29 CFR 1910.119 "Process Safety Management of Highly Hazardous Chemicals," and or 40 CFR 355 "Emergency Planning and Notification." For facilities with no radiological hazard the criteria are those of 40 CFR 302.4 "Designation, Reportable Quantities and Notification." See Table 5.3 for an assessment summary of the facility segment to these criteria.

The 309/PRTR facility does not exceed the criteria of 40 CFR 355. There are no processes in the 309/PRTR, therefore there are no processes involving chemicals at or above 29 CFR 1910.119 Appendix A threshold quantities. Also, there are no processes which use flammable liquids or gases on the facility site, beyond that used for work place consumption (i.e., gasoline for vehicles).

The 309/PRTR does not contain materials above 40 CFR 302.4 release criteria limits. (The "Release Criteria Limit" is identified in DOE-STD-EM-5502-94 as the 40 CFR 302.4 reportable quantity multiplied by the potential release fraction. Release fractions prescribed by DOE-STD-1027-92 are: gases, 1.0; Highly Volatile and or combustible, 0.5; semi-volatile [mercury], 0.01; solid, powder or liquid, 0.001). Listed materials in the non-radiological portions of the facility include: Polychlorinated Biphenyls (PCBs), mercury, non-friable asbestos, lead, and sulfuric acid, below is a listing of these materials and there use.

PCBs: Old ballasts in florescent lighting contain PCBs (replacement ballasts do not contain PCBs). Inventory is much less than 454 Kg (1000 lb) release criteria limit.

Mercury: Located in pressure switching devices and thermostats (electrical contact). Inventory (estimated at 31.3 g) is much less than 45.3 Kg (100 lb) release criteria limit.

Asbestos: Asbestos in the facility is not in a friable form, it is used for insulation on steam pipes and floor tile. Inventory is much less than 454 Kg (1000 lb) friable release criteria limit.

Sulfuric Acid: Sulfuric acid is used in the lead acid batteries in the facility. Battery use is emergency lighting and alternating current switch gear power. Inventory, estimated at 132 Kg (292 lb) is much less than 453 Kg (1000 lb) release criteria limit.

Lead: Lead in the facility includes: radiological shielding in RLA/room 20, 284 Kg (625 lbs); lead acid switch gear batteries in south wing, 371 Kg (817 lbs); emergency lighting batteries, 357 Kg (787 lbs); and equipment counterweights and bricks in IEM cell, 1,860 Kg (4,100 lbs). Release limit for final recordable amount of lead is 4,536 Kg (10,000 lbs). The total lead in the facility is less than 2,865 Kg (6,317 lbs), no facility segment has greater than 50% of the release limit.

5. CONCLUSION

Based on criteria of DOE-EM-5502-94 "Hazard Baseline Documentation" and DOE-STD-1027-92 "Hazard Categorization and Accident Analysis Techniques for Compliance With Doe Order 5480.23, Nuclear Safety Analysis Reports"; the PRTR/309 building is classified as a "radiological facility." Office portions of the 309 building meet the "other industrial facility" criteria.

The facility classification is based upon a quantitative and qualitative assessment of the building. The nuclear hazard category 3 threshold values for radionuclides found in DOE-STD-1027-92 are used for this determination. Segmentation of the facility is used where areas in the facility are isolated. When the radioactive material form and availability for release are considered, all segments of the facility are below Hazard Category 3 thresholds.

Building "Radiological Facility" segments with potentially releasable radioactive materials in excess of 40 CFR 302 Appendix B levels are the following: waste tank farm, PRTR ion exchange vault, rupture loop ion exchange vault, rupture loop annex, fuel storage basin, containment structure, fuel transfer pit, fuel exam cell, and reactor cavity. Potentially releasable materials are below 29 CFR 1910.119 and 40 CFR 355 thresholds. There are no active processes in the facility. Several areas within the facility have had most equipment removed. Utilities (electrical, air, sanitary water, steam, and sewers) are the only active systems.

The south and west wings of the building are categorized as "Other Industrial Facility." Potentially releasable radioactive materials in the wings are below 40 CFR 302 Appendix B levels. Potentially releasable hazardous chemicals in the facility are below 40 CFR 302.4 Table 302.4 quantities.

Table 5.1 PRTR Facility Segmentation and Radiological Hazard Categorization

Location	Segment/Area	Segmentation Basis	Radiological Assessment DOE-STD-1027 92	Release Assessment to 40 CFR 302 Appendix B Limits	Radiation Hazard Category
Inside Containment Vessel	Reactor Cavity	Space is exhausted through containment HEPA filtered exhaust, no active liquid systems, and contains the lowest physical location in the complex.	Primary sources are in form not available for release (see facility description). Potential Pu content is approximately 20% of Category 3 threshold. Dose rates are significantly below rates expected for an area with category 3 threshold quantities.	Pu-239 quantity exceeds appendix B limit.	Radiological Facility
	Fuel Transfer Pit	Space has no active ventilation, cell has drain to B-Cell sump, and there are no liquid systems.	Residual contamination is confined to cell and is not available for release. Access to the cell requires the removal of a 9 ton plug. Quantity of material to exceed Category 3 threshold is unlikely (see facility description).	Residual contamination is assumed to be greater than Appendix B limit.	Radiological Facility
	Fuel Examination Cell	Space has no active ventilation, cell has drain to B-Cell sump, and there is no liquid systems.	Contamination in this area is low. Dose rates taken during the 1970s are below rates expected for a facility with category 3 threshold material quantities.	Beta/gama dose rate is above level expected from an Appendix B limit of contamination.	Radiological Facility
	Containment Floor, A-Cell, B-Cell and C-Cell	Space is isolated from remainder of facility by air locks, a separate HVAC system.	Contamination is low with a max contact dose rate of 10 mR/hr. It is fixed and not available for release (see facility description). Dose rates are significantly below rates expected for category 3 thresholds.	Dose rates in the area are low, however, residual contamination is assumed to be greater than Appendix B limit.	Radiological Facility
Separate Structure Located Outside Building	PRTR Ion Exchange Vault	Located outside 309 building, no active ventilation. Lines into vault are either a closed loop or plugged.	Isotopic inventory in vault is 78% of Category 3 threshold.	Material in vault exceeds Appendix B limits.	Radiological Facility
	Rupture Loop Ion Exchange Vault	Located outside 309 building, no active ventilation, Vault has drain to RLA sump, however, vault has no active liquid system and has rain cover.	Pu-239 inventory in vault is 63% of Category 3 threshold. Other isotopes are expected to be similar in quantity and form to PRTR ion exchange vault, which by quantitative assessment is a radiological facility.	Material in vault exceeds Appendix B limits.	Radiological Facility
	Waste Tank Farm (TW Tanks)	Located outside 309 building, no active ventilation, all pipe to PRTR facility is cut and capped.	Materials located in tanks are in a form not available for release. The tank and below grade pipes have been isolated. Above grade portions of the facility have low levels of contamination. Dose rates in this area are below rates expected for a category 3 threshold material quantity.	Residual contamination is assumed to be greater than Appendix B limit.	Radiological Facility

Table 5.1 PRTR Facility Segmentation and Radiological Hazard Categorization

Location	Segment/Area	Segmentation Basis	Radiological Assessment DOE-STD-1027 92	Release Assessment to 40 CFR 302 Appendix B Limits	Radiation Hazard Category
General 309 Building	Office Space South Wing	N.A.	No Significant Radiation	Material in area is below Appendix B limits.	Non-Rad.
	Office Space West Wing	N.A.	No Significant Radiation	Material in area is below Appendix B limits.	Non-Rad.
	PRCF	Space has been isolated from remainder of the facility and has no active ventilation.	Area designated as a non-radiological as a result of D&D activities.	Material in area is below Appendix B limits.	Non-Rad.
	Fuel Storage Basin	No physical access without modification, space passively ventilated to atmosphere.	Area has been cleaned and contamination fixed, remaining material is not in a form available for release (see facility description).	Residual contamination is assumed to be greater than Appendix B limit.	Radiological Facility
	Fuel Element Rupture Loop Test Facility	Access is administratively closed, has active HEPA exhaust system.	Pu-239 content is 10.5% of Category 3 threshold. Remaining contamination in a form available for release (smearable) is less than 2,200 dpm beta/gamma and 440 dpm alpha. Total inventory is very low as indicated by the average dose rates of <1 mR/hr. Dose rates are significantly below rates expected for category 3 thresholds.	Suspected Pu-239 inventory is above Appendix B limit.	Radiological Facility

Table 5.2 PRTR Facility Hazard Baseline Summary

Table 5.2 PRTR Facility Hazard Baseline Summary							
Location	Facility Segment	Does potentially releasable radiation exceeds DOE-STD-1027 Category 3 Thresholds?					Facility Category
		Yes	If less than Category 3 Threshold, does potentially releasable radiation RQ meet or exceed 40 CFR 302 Appendix B Levels?				
			Yes. Is potentially releasable material below 29 CFR 19010.119 or 40 CFR 355 Thresholds?		No. Does potentially releasable hazardous chemical RQ meet or exceed Table 40 CFR 302.4 Levels?		
			Is below Threshold	Is greater than Threshold	Meets or exceeds level	Is less than level	
			Nuclear Facility	Radiological Facility	Radiological w/Non-Nuclear Facility Documentation	Non-Nuclear Facility	
Inside Containment Vessel	Reactor Cavity	*	YES	*	*	*	Radiological
	Fuel Transfer Pit	*	YES	*	*	*	Radiological
	Fuel Examination Cell	*	YES	*	*	*	Radiological
	Containment Floor, A-Cell, B-Cell and C-Cell	*	YES	*	*	*	Radiological
Separate Structure Located Outside Building	PRTR Ion Exchange Vault	*	YES	*	*	*	Radiological
	Rupture Loop Ion Exchange Vault	*	YES	*	*	*	Radiological
	Waste Tank Farm (TW Tanks)	*	YES	*	*	*	Radiological
General 309 Building	Office Space South Wing	*	*	*	*	YES	Industrial
	Office Space West Wing	*	*	*	*	YES	Industrial
	PRCF	*	*	*	*	YES	Industrial
	Fuel Storage Basin	*	YES	*	*	*	Radiological
	Fuel Element Rupture Loop Test Facility	*	YES	*	*	*	Radiological

* Answer is No, or Not Applicable

6. REFERENCES

- DOE-STD-1027-92, "Hazard Analysis and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," U.S. Department of Energy, Washington, D.C. 20585, 1992.
- DOE-STD-EM-5502-94, "Hazard Baseline Documentation," U.S. Department of Energy, Washington, D.C. 20585, August 1994.
- DOE Order 5280.23, "Nuclear Safety Analysis Reports," U.S. Department of Energy, Washington, D.C. 20585, April, 1994.
- 40 CFR 302, "Designation, Reportable Quantities and Notification," U.S. Environmental Protection Agency, Title 40 Code of Federal Regulations Part 302.
- 40 CFR 355, "Emergency Planning and Notification," U.S. Environmental Protection Agency, Title 40 Code of Federal Regulations Part 355.
- 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," U.S. Occupational Safety and Health Administration, Title 29 Code of Federal Regulations Part 1910.119.
- Griffin 1989, "Facility Decommissioning Report for the Plutonium Recycle Critical Facility," WHC-SD-DD-TI-041 Rev. 0, Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352, December 4, 1989.

Appendix A

QUANTITATIVE RADIOLOGIC HAZARDS ASSESSMENT

Table A-1 Quantitative Radiologic Hazard Assessments					
Location	Isotope	Quantity	Category 3 Threshold Quantity		Category 3 Threshold Fraction
			grams	Curies	
PRTR Ion Exchange Vault	H-3	0.77 Ci		1.0E+03	0.0008
	C-14	0.93 Ci		4.2E+02	0.0022
	Sr/Yr-90	1.39 Ci		1.6E+01	0.0869
	Cs-137	1.01 Ci		6.0E+01	0.0168
	Pu-239	0.35 Ci		5.2E-01	0.673
	Total				0.780
Reactor Cavity	Pu-239	1.8 g	8.4 g		0.214
	Total Calculated				0.214
Rupture Loop Ion Exchange Vault	Pu-239	5.29 g	8.4 g		0.629
	Cs-137*	1.01 Ci		1.6E+01	0.0869
	Estimated Total				0.733
Rupture Loop Annex (Room 20)	Pu-239	0.88 g	8.4 g		0.105
	Total Calculated				0.105

* Estimated based upon PRTR Ion Exchange Vault Cs¹³⁷ and Co⁶⁰ activity.