WCH-567
Rev. 0

River Corridor
Closure Contract

105-N/109-N Reactor Interim Safe Storage Project Final Report

January 2013

For Public Release

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

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ACRONYMS

ARARS	Achieve Applicable or Relevant and Appropriate Requirements
ARACS	Automated Radiological Access Control System
BDI	Basin Disposal Inc.
CCRC	Centralized Consolidated Recycling Center
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CVP	Cleanup Verification Package
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DQO	Data Quality Objective
D4	Deactivation, Decontamination, Decommission and Demolition
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
Ecology	Washington State Department of Ecology
FSB	Fuel Storage Basin
FSCF	Facility Status Change Form
FY	Fiscal Year
ISS	Interim Safe Storage
ORRCO	Oregon Re-Refining Company
PCB	Polychlorinated Biphenyl
PSR	Project Safety Representative
RCT	Radiological Control Technician
RESRAD	RESidual RADioactivity
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
RTD	Resistant Temperature Detector
S&M	Surveillance and Maintenance
SAP	Sampling and Analysis Plan
SSE	Safe Storage Enclosure
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WMIS	Waste Management Information System
WCH	Washington Closure Hanford, LLC.

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
Inches	25.4	millimeters	Millimeters	0.039	Inches
Inches	2.54	centimeters	Centimeters	0.394	Inches
Feet	0.305	Meters	Meters	3.281	Feet
Yards	0.914	Meters	Meters	1.094	Yards
Miles	1.609	kilometers	Kilometers	0.621	Miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
Acres	0.405	Hectares	Hectares	2.47	Acres
Mass (weight)			**Mass (weight)**		
Ounces	28.35	Grams	Grams	0.035	Ounces
Pounds	0.454	Kilograms	Kilograms	2.205	Pounds
Ton	0.907	metric ton	metric ton	1.102	Ton
Volume			**Volume**		
teaspoons	5	Milliliters	Milliliters	0.033	fluid ounces
tablespoons	15	Milliliters	Liters	2.1	Pints
Fluid ounces	30	Milliliters	Liters	1.057	Quarts
Cups	0.24	Liters	Liters	0.264	Gallons
Pints	0.47	Liters	cubic meters	35.315	cubic feet
Quarts	0.95	Liters	cubic meters	1.308	cubic yards
Gallons	3.8	Liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	Millibecquerels	0.027	Picocuries

1.0 SCOPE

The following information documents the deactivation, decontamination, decommissioning and demolition (D4) of the 105-N Reactor and 109-N Heat Exchanger Building and placement of the reactor core into interim safe storage (ISS). The D4 activities for the facility included characterization, engineering, removal of hazardous and radiologically contaminated materials, equipment removal, decontamination, demolition of the structure, and restoration of the site. The ISS work also included construction of the safe storage enclosure (SSE), which required the installation of a new roofing system, power and lighting, a remote monitoring system, and ventilation components; and, sealing of building penetrations.

2.0 FACILITY DESCRIPTION AND CONDITIONS

2.1 HISTORY

In 1942, the United States government commissioned the Hanford Site for the production of plutonium for use in weapons production. Between 1942 and 1955, eight water-cooled, graphite-moderated production reactors were constructed along the Columbia River in the 100 Areas of the Hanford Site (Figure 2-1). Construction of the 105-N Reactor Facility began in December 1959 and the Reactor operated from 1963 through 1987. The 105-N Reactor Facility was a 4,000-megawatt (thermal) nuclear reactor designed to operate as a dual purpose reactor. The reactor core is a graphite-moderated, light water-cooled, horizontal pressure-tube facility designed to produce plutonium, and steam for commercial power generation. On the south side of the 105-N facility is the 109-N Heat Exchanger Building, which shares a common wall with 105-N. Reactor primary coolant water from 105-N was circulated through the reactor to steam generators located in the 109-N Building. Steam from the steam generators was either routed to the now demolished 185-N Hanford Generating Plant (HGP) to generate electricity or sent to the dump condensers inside the 109-N Facility (S&M).

The HGP was an electrical generation facility owned and operated by the Washington Public Power Supply System (WPPSS) that produced electricity for use by the public. The 105-N Reactor facility is located in the 100-N Area of the Hanford Site (S&M).

Deactivation of 105-N and 109-N was completed in 1998, which included shutdown and isolation of all operational systems, cleanup of most radiological and hazardous wastes, inventory of remaining hazardous materials, sealing access areas, and securing both buildings (S&M).

2.2 FACILITY DESCRIPTION

The 105-N Facility was approximately 85,450 ft^2 (7,939 m^2) and included three below-grade floor areas (minus 10-ft level, minus 16-ft level and minus 21-ft level), a main floor area (0-ft level), and five above-grade floor areas (plus 15-ft level, plus 28-ft level, plus 40-ft level, plus 51-ft level, and plus 60-ft level). The roof was at the plus 70-ft level and also included a penthouse structure that extended to 80-ft (24-m) above grade. An aerial photograph looking east prior to demolition is shown in Figure 2-2. The reactor core and other primary reactor support areas are constructed of reinforced concrete. Interior walls are composed of steel frame, concrete block (concrete masonry unit), and insulated panel construction. The exterior of the building was covered with insulated corrugated-metal wall panels. A pre-demolition floor plan layout at ground level is shown in Figure 2-3. A floor plan layout following demolition is shown in Figure 2-4. The roof was covered with built-up roofing with felt strips near the edges and over-covered with urethane foam and two sealer coatings (RAWP).

Figure 2-1. Hanford Site Map.

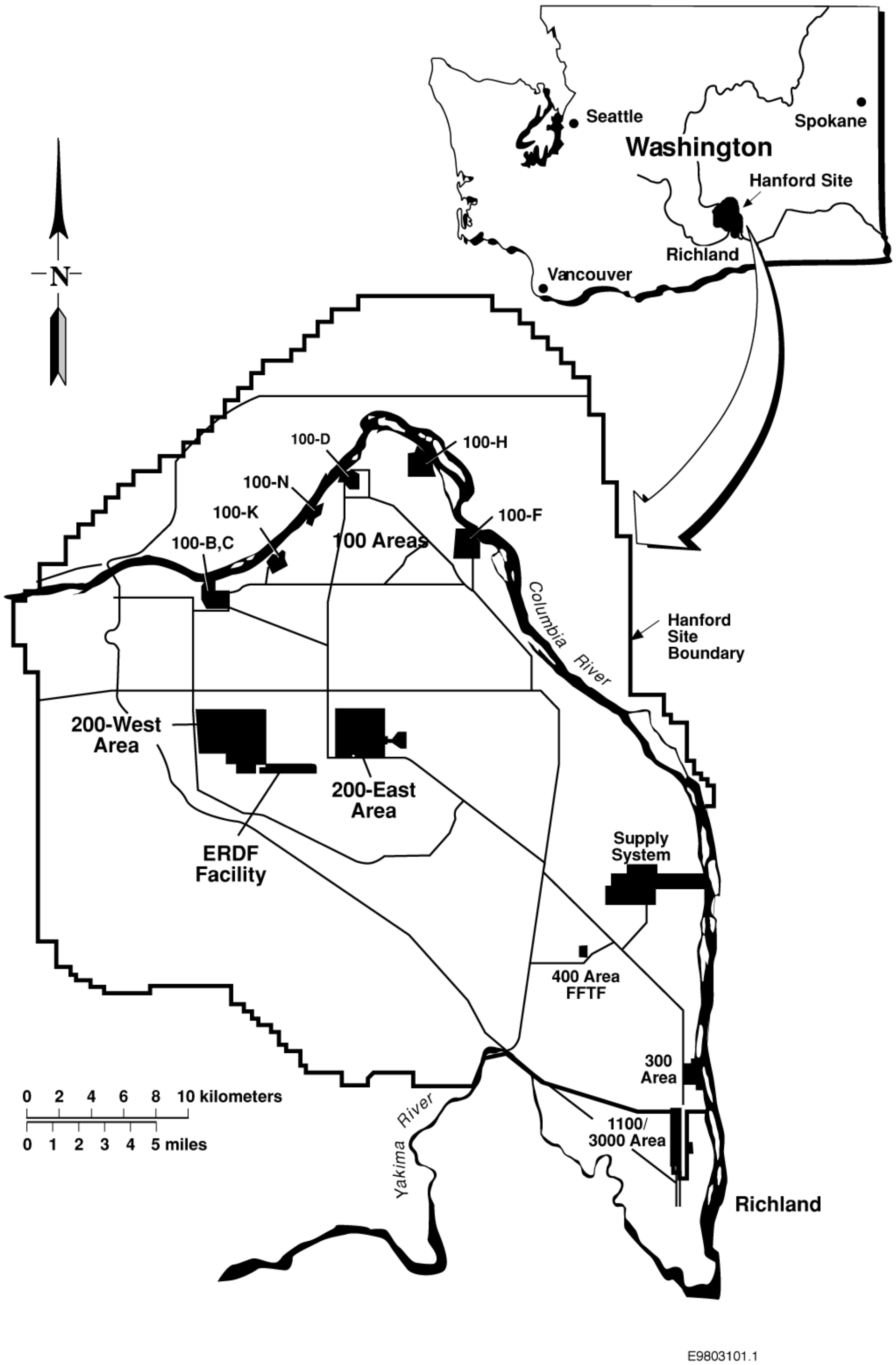


Figure 2-2. Pre-Decontamination and Decommissioning Aerial Photograph (Looking East).

Figure 2-3. Pre-Demolition Floor Plan Layout at Ground Level.

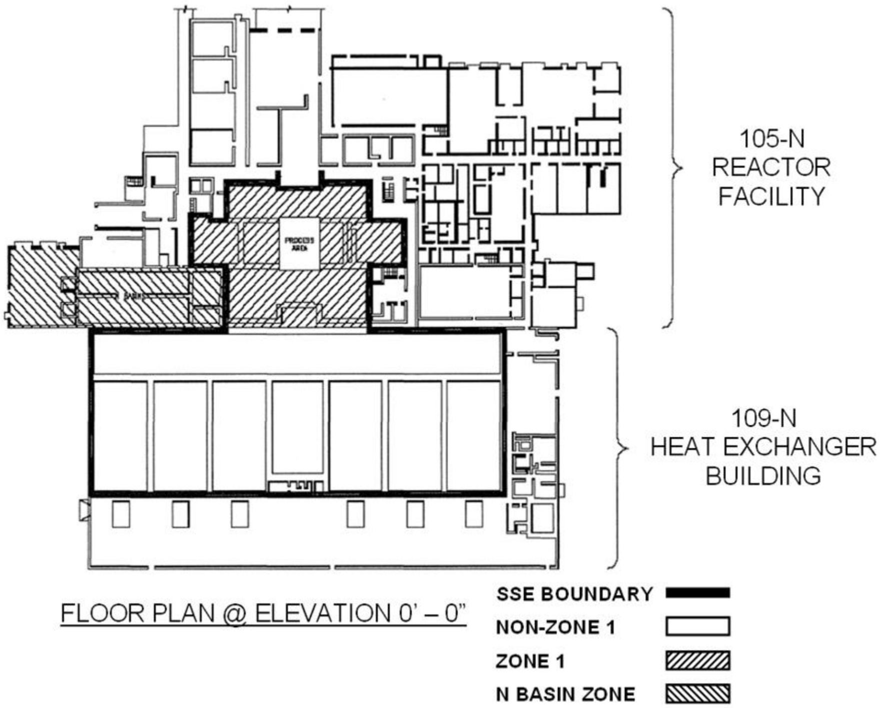
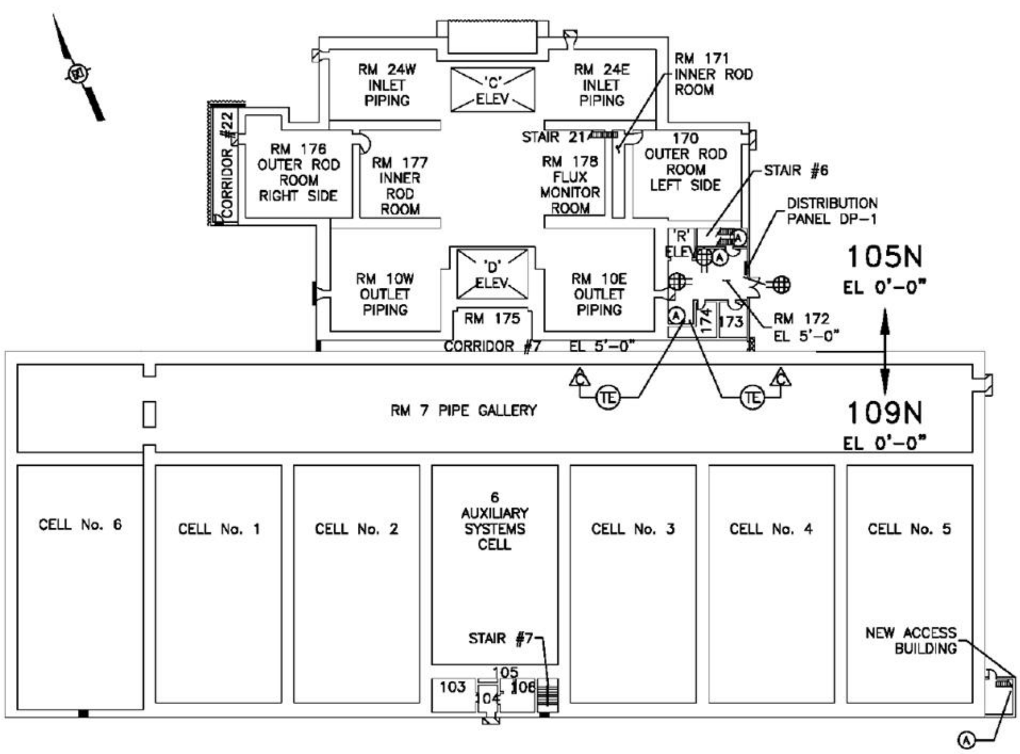


Figure 2-4. General Plan of 105-N & 109-N Interim Safe Storage at Ground Level.



The 109-N facility footprint was approximately 90,480 ft^2 (8,406 m^2) and included a below-grade floor area (minus 16-ft level), a main floor area (0-ft level) and two above grade floor areas (plus 15-ft level and plus 24-ft level). The roof was at the plus 38-ft level and also included a penthouse structure that extended to 80-ft (24-m) above grade (RAWP). The 109-N Building is constructed of reinforced concrete and polyurethane roofing material over a 4-in (10-cm) to 3-ft concrete slab. Interior walls are concrete block. The reinforced concrete walls around the steam generator cells are approximately 5-ft (1.5-m) thick.

Structural modifications to the 105-N/109-N complex for Interim Safe Storage (ISS) included removal of the fuel storage basin, ancillary support buildings, and most portions of the 105-N Building structure outside of the shield walls that surrounded the reactor (Figure 2-3). In addition, the Heat Exchanger Building was removed up to the steam generator cells. The pressurizer and its surrounding building were left in place as part of the ISS. A new steel roof was installed over the remaining structures using the existing concrete shield walls as the “new” outside walls of the buildings to enclose both the Reactor and Heat Exchanger Building within a weather-protected structure. All existing siding was removed and new siding installed over exposed structural-steel framing/supports (S&M) (Figures 8-1 through 8-3).

2.3 DECOMMISSIONING DECISIONS

After deactivation, the 105-N Reactor was in a condition of minimum Surveillance and Maintenance (S&M). Permanent decommissioning alternatives for the Hanford Site production reactors were assessed in the *Final Environmental Impact Statement, Decommissioning of the Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119F). The “Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland Washington” (ROD) was issued by the U.S. Department of Energy (DOE) (58 *Federal Register* [FR] 48509).

The 100-N Area was constructed and operated as a nuclear reactor facility to produce special nuclear materials and steam for electrical power generation. Past operations, disposal practices, spills and unplanned releases have resulted in contamination of the facility structures, underlying soil, and underlying groundwater in the 100-N Area. Consequently, in November 1989, the 100 Areas (which includes 100-N Area) was one of four areas of the Hanford Site that were placed on the U.S. Environmental Protection Agency’s (EPA) national Priorities List under the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA). The Washington State Department of Ecology (Ecology) and the DOE, Richland Operations Office (RL), have determined that hazardous substances in the facilities present a substantial threat of release that poses a risk to human health and the environment to the extent that a removal action is warranted (RAWP).

Alternatives for conducting a non-time-critical removal action was evaluated in the *Engineering Evaluation/Cost Analysis for the 105-N Reactor Facility and 109-N Heat Exchanger Building* (105-N/109-N EE/CA) (DOE-RL 2004). This EE/CA recommended deactivation followed by demolition recommendations were approved in the *105-N Reactor Building and 109-N Heat-Exchanger Building Action Memorandum* (Ecology 2005), signed by Ecology, the EPA and DOE. The DOE is the agency responsible for implementing the removal actions in the 100-N Area. Ecology is the lead regulatory agency for facilities in the 100-N Area.

Buildings surrounding 105-N/109-N were evaluated as non-time critical removal actions per the *100-N Area Ancillary Facilities Action Memorandum* (Ecology 1999) as well as the *Action Memorandum for General Hanford Site Decommissioning Activities* (DOE/RL 2010).

Placing the 105-N and 109-N facilities into ISS, along with the stabilization, complete or partial demolition, and disposal of the associated ancillary facilities, will reduce the potential hazards these 100-N Area facilities currently pose to public health and the environment. Waste products generated from the D4 and ISS activities will be segregated into a variety of waste streams each of which will be disposed at appropriate disposal facilities.

In general, the goal of this removal action is to reduce the footprint and associated maintenance of the 105-N and 109-N Buildings. The only building materials that are expected to remain in place are (1) those physically connected to the 105-N and 109-N facilities that cannot be removed without compromising the physical integrity of the SSE, or (2) those that meet the cleanup criteria of the 100-NR-1 ROD (EPA 2000), or those below-grade structures approved to remain.

3.0 ENGINEERING EVALUATIONS/COST ANALYSIS FOR 105-N/109-N

The 105-N/109-N EE/CA (DOE/RL-2004-46) resulted in the recommendation to decontaminate and demolish the contaminated reactor buildings (except for the reactor blocks and other Zone 1 areas inside the shield walls) the ancillary facilities, and construct a SSE over the reactor and remaining portion of the Heat Exchanger Building. The recommendation was approved in (Ecology 2005), signed by Ecology, EPA, and DOE. The DOE is the agency responsible for implementing this removal action. Ecology is the lead regulatory agency for facilities in the 100-N Area.

4.0 PROJECT ACTIVITIES

4.1 ENGINEERING AND PERMITS

The *Removal Action Work Plan for 105-N/109-N Buildings Interim Safe Storage and Related Facilities* (DOE/RL-2005-43) was prepared to satisfy the requirements in the action memorandum (Ecology et al. 2005), outlining how compliance with and enforcement of applicable regulations will be achieved for cleanup and ISS of the 105-N/109-N Buildings. Additionally, DOE/RL-2005-43 serves as the decommissioning plan and project management plan for the 105-N/109-N Project. The removal action work plan was prepared in accordance with Section 7.2.4 of the *Hanford Federal Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998) and approved by RL and the regulators.

The removal action work plan established the methods and activities to perform the following removal functions:

- Complete D4 of the portions of the 105-N and 109-N facilities located outside the SSE
- Complete necessary deactivation and isolation of the systems and spaces inside the footprint of the SSE at 105-N Reactor Facility and 109-N Heat Exchanger Buildings
- Complete D4 of the six 100-N Area ancillary facilities affected by and directly related to the ISS of the 105-N and 109-N facilities
- Decommission groundwater and vadose zone wells, no longer required for service, encountered during D4 and ISS of the facilities with *Washington Administrative Code* (WAC) 173-160, "Minimum Standards for Construction and Maintenance of Wells."
- Ensure impacted waste sites (e.g., french drains) within the footprint of the facilities are adequately defined and/or updated within the Waste Information Data System (WIDS)
- Modify structures as necessary and construct an ISS for the 105-N Reactor Facility and the 109-N Heat Exchanger Building
- Manage and dispose of all waste generated during these actions.

The Ecology (2005) action memorandum specifies other deliverables that must be submitted by DOE to the lead regulatory agencies for review and approval. The removal action work plan (DOE/RL-2005-43) describes the deliverables and provides a schedule for meeting the deliverables. The deliverables specified in the action memorandum and discussed in the removal action work plan include the following:

- Sampling and Analysis Plan (SAP) *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (DOE/RL-2005-92)
- Treatment plans if treatment is necessary prior to waste disposal in the Environmental Restoration Disposal Facility (ERDF)
- Facility Status Change Form (FSCF).

The intent of the removal action work plan (DOE/RL-2005-43) is to identify the basis and provide guidance for preparation of work packages for the project tasks. Using the most recent information concerning facility conditions, field-level work packages were developed to direct work activities and instruct workers in the most applicable work methods.

The 105-N/109-N ISS (DOE/RL-2005-43) and ancillary building/demolition project schedule, which encompasses the work scope through project completion, presents the logical progression of events and estimated durations for each activity.

The removal action objectives were as follows:

- Control the migration of contaminants from the facilities to the environment
- Protect human receptors from exposure to contaminants in excess of acceptable exposure levels in facility structures
- Facilitate remediation of 100-N Area waste sites in accordance with the *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit, Hanford Site, Benton County, Washington* (100-NR-1 ROD) (EPA 2000)
- Prevent adverse impacts to cultural resources and threatened or endangered species
- Safely treat, as appropriate, and dispose of waste streams generated by the removal action
- Achieve Applicable or Relevant and Appropriate Requirements (ARARS) to the fullest extent practicable
- Support actions for the final disposition of the 105-N Reactor block
- Reduce the threat of release of hazardous substances contained within facilities
- Protect workers from hazards posed by these facilities
- Minimize or eliminate long-term Surveillance and Maintenance (S&M) requirements and associated costs
- Facilitate and be consistent with future remediation in areas where facilities are located.

The *Ecological and Cultural Resources Review for Hazard Removal and Demolition of 105-N, 105-NA, 109-N, 1605-NE, and 1722 (06-ER-039)* (CCN 127991) was performed prior to mobilization at the 105-/109-N Reactor site. The findings of this ecological review revealed no evidence of roosting in any of the facilities visited. If demolition occurs during nesting bird season (mid-March to late July), then follow-up surveys must be conducted by the WCH Natural Resources staff to determine if nesting migratory birds are present. No additional species of concern were identified either inside or in areas surrounding the 105-/109-N Reactor Building.

Plant Forces Work Reviews (PFWR) were performed on the entire scope of work required to bring the 105-N/109-N Reactor into its final state of ISS. The Plant Forces work reviews are documented in PFWR No. 8850-011-06 Rev. 0, PFWR No. 8850-023-06 Rev.0 and PFWR No. 8850-002-09 Rev. 0.

The *Auditable Safety Analysis and Final Hazard Classification for the 105-N Reactor Zone and 109-N Steam Generator Zone Facility* (BHI-01179) and *Final Hazard Categorization for the 105-N/109-N Facility Interim Safe Storage Project* (WCH-26) summarizes the inventories of radioactive and hazardous materials present within the 105-/109-N Reactor. BHI-01179 also documents the operations associated with the ISS Project, which includes D4 activities and construction of the SSE. This document also identifies accident scenarios, performs a bounding evaluation of the potentially significant accident scenario consequences, and establishes a hazard classification based on the bounding consequence evaluation. The result of the evaluation is that the final hazard classification for the 105-/109-N ISS Project is "radiological" (less than Hazard Category 3 per the *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear safety Analysis Reports [DOE 1997]*).

4.2 MOBILIZATION

Site Mobilization activities in support of pre-demolition housecleaning, asbestos and hazardous material removal, and liquid pipe checks were initiated in January 2007 (FY 2007). Mobilization activities consisted of establishing field support and Radiological Control Technician (RCT) trailers and associated electrical systems. Field trailers for offices and lunch rooms were setup near the reactor facility for both the subcontractor field personnel and WCH field personnel and RCTs. Field trailers included a separate trailer for RCT use as a count trailer. Trailer setup included electrical systems, and computer and ARACS connections. Temporary electrical power to support temporary facilities was run from existing site electrical power. As all permanent power at the 105-N and 109-N facilities was disconnected prior to start of the project, temporary power was setup for asbestos and hazardous material removal activities inside and around the buildings, and was also provided from existing site electrical power or separate mobile electrical generators. Prior to the start of asbestos and hazardous waste remediation activities, self-contained shower facilities were provided onsite.

4.3 HAZARDOUS MATERIAL REMOVAL

The scope of the demolition project included removing and properly disposing flammable and hazardous material (e.g., oils, grease, asbestos-containing material, mercury, lead and polychlorinated biphenyls [PCBs]). The majority of the flammable and hazardous material was removed inside and outside of the SSE, with the exception of the reactor block and other similar Zone I areas that will not be encountered during future surveillance activities. The material was typically removed prior to heavy equipment demolition, with the exception of the lead joints in bell and spigot piping and a few heavy pieces of lead-encased equipment which were carefully removed during demolition.

4.3.1 Asbestos

Asbestos monitoring was performed in support of asbestos removal activities. Removal work activities included the use of glove-bags, a cut-and-wrap technique, and negative-pressure enclosure. Applicable areas were sprayed with a "lock-down" paint material after the asbestos work. An asbestos clearance sampling and inspection program was implemented to release each area from asbestos concerns following the asbestos abatement in each area. Approximately 82,107 ft^3 (2,325 m^3) of asbestos insulation and other asbestos containing material were removed (WMIS).

The ISS Project identified a location where asbestos containing material could not be removed practically. The material is a mastic that was used to hold a cold joint material on the outside of the SSE wall on the south side of the 109-N Building, from approximately minus 16-ft level to grade level. This area of the wall has been backfilled and is covered with clean soil.

4.3.2 Lead

The reactor block and reactor block components within the SSE structure contain significant amounts of lead which are integral radioactive shielding, and could not be removed during the ISS Project. Lead-based paint was originally used throughout the facility, but resultant concentrations were determined to be below regulatory limits. The majority of lead encountered during D&D was in the form of protective shielding; however, lead was encountered in additional forms, as follows:

- Sheet material
- Lead blankets
- Small lead balls
- Lead poured around piping and plumbing p-traps
- Lead joints from bell and spigot drain piping
- Light bulbs.

During D&D, 32.8 tons of lead were removed from the reactor building (WMIS). All lead was macro encapsulated at ERDF.

4.3.3 Mercury

267.2 lbs (121.2 kg) of mercury were found in numerous switches, manometers and instruments. Mercury was sent to the ERDF for treatment and disposal, and to Centralized Consolidated Recycling Center (CCRC) for recycle.

4.3.4 Polychlorinated Biphenyls

No regulated quantities of PCBs were found in any of the grease or oil. Five 55-gal drums of light ballasts and some applied dried paints were the only PCB waste stream requiring disposal under the 105-N ISS Project.

4.4 EQUIPMENT REMOVAL

Some of the major equipment removed during the ISS Project is listed in Table 4-1.

Table 4-1. Major Equipment Removed During the Interim Safe Storage Project.

Description	Location
105-N	
“F” Elevator	NE Corner 105-N
“S” Elevator	North Side 105-N
“W” Elevator	North Side 105-N
Fuel Loading Equipment	“W” Elevator Room
Control Room Equipment	Control Room
Zone 1, 2 and 3 Supply Air Fans	Supply Fan Room
Zone 1 Exhaust Fans	Zone 1 Exh. Fan Room
Zone 2 Exhaust Fans	Zone 2 Exh. Fan Room
Zone 3 Exhaust Fans	NW Corner 105-N, El. 60’
Switch Gear Equipment	Switch Gear Room
Electrical Equipment	Pile Inst. And Elec. Rm
Gas Facility Piping and Equipment	Gas Tunnel 32 and 40
Transducer Equipment	Transducer Rooms
Process and Service Piping (Outside Zone I)	N, E and W Side 105-N
109-N	
Dump Condensers (16 each)	Turbine Bay
Drive Turbines (6 each)	Turbine Bay
Drive Turbine Condensers (6 each)	Turbine Bay
Condensate Surge Tank	Turbine Bay
Decontaminant Mix Tank and Equipment	Solution Prep Area
Sodium Hydroxide Storage Tanks (2 each)	Solution Prep Area
Phosphoric Acid Storage Tank	SE Side 109-N
Ion Exchange Tank	Solution Prep Area
Hydrogen Peroxide Storage Tank	Solution Prep Area
Zone 1 Air Conditioning Equipment	Mechanical Room
Zone 2 Air Conditioning Equipment	Mechanical Room
Zone 3 Air Conditioning Equipment	Mechanical Room
Freight Elevator	SE Corner 109-N
Process and Service Piping (Outside Zone I)	S and E Side 109-N

The reactor block and the associated equipment in the Zone I area were not disturbed (Figure 2-3 and 2-4).

4.5 DEMOLITION OF ABOVE-GRADE STRUCTURES

After the hazardous materials removal and the isolations were performed (as discussed in Sections 4.2 and 4.3), the above-grade structures were ready for demolition (Figure 4-1). Demolition was performed based on whether the areas were relatively radiologically “clean” or contaminated.

Many areas of the reactor (e.g., supply air fan room, office spaces, control room, and electrical room) had very little radiological contamination.

For the areas of the building to be demolished, it was not cost effective or safe to decontaminate entirely. The major portion of the loose contamination was removed, and a fixative was applied as required.

The building structure was demolished using excavator-mounted hydraulic shears and a hoe-ram. The debris was segregated for disposal or salvage.

The original footprint area of the 105-N/109-N Reactor and the Heat Exchanger Buildings was approximately 175,930 ft^2 (15,799 m^2). The final footprint area of the 105-N/109-N SSE is 78,200 ft^2 (7,265.02 m^2) (see Figures 2-2, 2-3, and 2-4). Thus, the footprint area of the reactor and heat exchanger buildings was reduced by 55%. To avoid confusion, the footprint area is strictly the at-grade area and does not include the square footage of the any above-grade rooms or below-grade rooms/tunnels.

Figure 4-1. Photograph Showing 105-N Demolition in Progress

The elevators that were left in place inside the SSE facility included the "C", "D" and "R" elevators in the 105-N Building. The elevators were secured and placed in the lowest position near grade level.

4.6 UTILITY AND DRAIN ISOLATION

4.6.1 Electrical System

The power supply to the reactor complex and field trailers utilized temporary electrical power run from existing site electrical power or mobile electrical generators during all phases of the ISS Project. Permanent power was installed in 105-N and 109-N for lighting and to monitor the facility additional details are documented in Section 8.2.

4.6.2 Water Systems

All Hanford Site water supply lines have been isolated to the 105-N Reactor SSE. The two fire hydrants one northeast and the other southeast of the 105-N Reactor site remain active.

4.6.3 Equipment and Floor Drains

All operations at the 105-N Reactor and 109-N Heat Exchanger Building have been shut down since 1987. All liquids have been flushed and drained to the extent possible, as part of the shutdown and deactivation process. Liquid pipe checks have been performed at low points of the piping systems to ensure that no liquids remain. Contaminated piping systems (e.g., the gas piping and process effluent piping) remaining in the facility were sealed as within the SSE; therefore, liquids should not be encountered during normal surveillance activities.

4.7 SAFE STORAGE ENCLOSURE DEMOLITION

Demolition work on the reactor complex was divided between Hanford Plant Forces and the Building Trades ISS subcontractor in accordance with the requirements of PFWR 8850-011-06, 8850-023-06 and 8850-002-09. The SSE subcontractor performed the demolition on the 105-N Reactor and the 109-N Heat Exchanger Building to reduce the structure to the SSE boundaries and achieve proper interface for the new SSE construction. The SSE subcontractor demolition also included removal of large equipment from the buildings. Plant Forces performed the demolition of the highly contaminated 105-N Fuel Storage Basin and most of the 105-N and 109-N ancillary structures.

4.8 BELOW-GRADE VERIFICATION SURVEYING AND SAMPLING

The goal of the Data Quality Objective (DQO) process was to establish the sampling and analysis design strategy to support decontamination and closeout decisions. The historical information for the 105-N Reactor explains the mechanism by which the below-grade structures and the underlying soils were contaminated, what contamination can be documented, which constituents are eliminated from further consideration, and which constituents are the subject of the sampling and analysis design. The process, along with the closeout criteria and procedures, is documented in the *DQO Summary Report for 105-N/109-N Interim Safe Storage Project Waste Characterization* (WCH-15).

Figure 4-2. Photograph Showing Upper Reactor Roof Demolition in Progress

Using the DQO summary report as the basis, WCH-15 was developed to present the rationale and strategies for the sampling, field measurements and analyses of the below-grade concrete and soil. The regulators (i.e., EPA and Ecology) were instrumental in helping RL and the Environmental Restoration Contractor team (DOE Contractor) develop the Sample Analysis Plan (SAP). The significant aspects of the SAP include the following:

- Shallow- and deep-zone distinctions for both structures and soil
- The applicable or relevant and appropriate requirements are consistent with the 100 Area ROD (EPA 2000) (15 mrem/yr above background, and the “Model Toxics Control Act Cleanup” [*Washington Administrative Code 173-340*] for residual contamination levels in structures and soils).

For the implementation of the SAP, the *105-N Soil Contamination at Zone 1 Supply Plenum* (CCN 167658) and the 105-N/109-N Facility Status Change Form (FSCF) (D4-100N-0046) were developed to provide a clear, concise set of instructions to radiological survey personnel and samplers in field.

The survey results and sample analysis results are subjected to a data quality assessment to verify that the objectives of the DQO have been satisfied. The data will then be used in the RESidual RADioactivity (RESRAD) dose model and RESRAD-BUILD computer model to verify that cleanup criteria are satisfied. A brief summary of the data and the analysis results will be included in the 105-N/109-N FSCF (D4-100N-0046). The FSCF summarizes and compares the results against the cleanup criteria. Approval of the FSCF for ISS Ancillary facilities satisfies the requirements of a closure verification package per Ecology (1999).

4.9 BELOW-GRADE DEMOLITION

The below-grade portions of the facility outside the SSE were not completely demolished and the portions of the building remaining are documented in the 105-N Reactor Post Demolition Summary Report (PDSR) (CCN 165386) and 109-N Heat Exchanger Building PDSR (CCN 165387). All below-grade areas were backfilled, or will be back-filled to eliminate future subsidence.

4.10 SITE RESTORATION

Upon completion of the demolition activities, the area will be backfilled to grade with soil/aggregate, compacted, and graded to match the surrounding terrain. The backfill will be obtained from pit 22 (100-N Area borrow pit).

4.11 INTERFACE WITH SURVEILLANCE AND MAINTENANCE

During the ISS Project, the 105-N Reactor and 109-N Heat Exchanger Building were temporarily under the control of the D4/ISS Projects to perform the ISS work on the 105-N Reactor complex. The 105-N/109-N SSE was completed in September 2012. Transfer of the 105-N/109-N SSE Facility back to S&M was also completed in September 2012 (CCN 167975). The SSE completion has been documented in "Transmittal of 105-N and 109-N Safe Storage Enclosure Final Room Status Report." This document is available on the Administrative Record in the following locations shown in Section 12.1. The ISS Project completion will also be summarized and documented in the Facility Status Change Form (FSCF) (D4-100N-0046).

The *Surveillance and Maintenance Plan for the 105-N/109-N Reactor Safe Storage Enclosure* (DOE/RL-2011-106) was developed as one of the end-point criteria. The S&M Project has estimated its cost will be $5,000 per year for yearly radiological surveys and tumbleweed removal. Every fifth year, the S&M costs for the SSE will be $41,000 in order to perform surveillance inside of the SSE. The decreased S&M costs for the SSE result in an average annual savings of $190,000 per year (this value excludes any major costs, such as the major roof repair that would have been required) (S&M).

4.12 DEMOBILIZATION

Demobilization was completed in September 2012 (FY 2012) following the completion of the Safe Storage Enclosure on the 105-N/109-N Facilities.

5.0 COST AND SCHEDULE

5.1 SCHEDULE

Some key dates for the 105-/109-N ISS Project include the following:

Regulator SAP approval	January, 2006
Initiated N Reactor characterization and design	March, 2006
Trailer mobilization initiated	January, 2007
D&D work started	March, 2007
Initiated structure demolition	November, 2008
Awarded SSE subcontract	
Asbestos & Hazardous Waste Removal	January, 2007
Demolition & SSE Construction	August, 2008
West Side Final Construction	March, 2012
Completed SSE roof	November, 2011
S&M Plan	November, 2011
ISS work completed	September, 2012
105-N returned to S&M status	September, 2012

PAS-105-N/109-N Asbestos and Hazardous Material Removal

Notice of Award	1/24/2007
Notice to Proceed	3/24/2007
Start Waste Removal at 109-N	3/24/2007
Complete Waste Removal at 109-N	12/2007
Start Waste Removal at 105-N	12/2007
Complete Waste Removal at 105-N	12/2008

Fowler General Construction: Job Order 21

Notice of Award	03/05/2012
Complete Mobilization	04/11/2012
Notice to Proceed	04/12/2012
105-N & 109-N Construction Start	04/12/2012
105-N & 109-N Construction Finish	07/30/2012
Completion Demobilization	08/06/2012
Notice of Final Acceptance	10/03/2012

WM Dickson Company: C00N508A00

Notice of Award	08/14/2008
Complete Mobilization	10/13/2008
Notice to Proceed	10/15/2008
Start 109-N Demolition & Waste Removal	10/20/2008
Complete 109-N Demolition & Waste Removal	07/15/2009
Complete 109-N SSE Design	07/10/2009
Complete 109-N SSE Shop Drawings	10/29/2009
Start 109-N SSE Fabrication	10/07/2009
Finish 109-N SSE Fabrication	01/26/2010
Complete Construction of 109-N SSE	09/29/2010
Start 105-N Demolition & Waste Removal	02/15/2009
Complete 105-N Demolition and Waste Removal	01/26/2011
Complete 105-N SSE Design	11/09/2011
Complete 105-N SSE Shop Drawings	03/19/2011
Complete Construction 105-N SSE	11/15/2011
Complete Demobilization	12/01/2011

5.2 COST

The total ISS Project cost of $67,264K is summarized by FY. The tasks associated with each FY are briefly described in Section 5.1.

FY 2005	$21K
FY 2006	$760K
FY 2007	$2,798K
FY 2008	$11,054K
FY 2009	$17,839K
FY 2010	$15,786K
FY 2011	$12,152K
FY 2012	$6,854K
	$67,264K

The ISS subcontractor's costs for asbestos and hazardous waste removal work scope in FY 2007, 2008 and 2009 are summarized below.

FY 2007	$1,161K
FY 2008	$4,329K
FY 2009	$4,747K
	$10,237K

The ISS subcontractor's costs for demolition and construction associated with work scope in FY 2008, 2009, 2010, 2011 and 2012 are summarized below.

FY 2008	$2,189K
FY 2009	$12,438K
FY 2010	$13,204K
FY 2011	$8,310K
FY 2012	$3,731K
	$39,872K

The 105-N Fuel Storage Basin WCH costs for demolition associated with work scope in FY 2010, 2011 and FY 2012 are summarized below.

FY 2010	$877K
FY 2011	$2,384K
FY 2012	$1,855K
	$5,116K

WCH costs for Ancillary Structure demolition and project support associated with work scope in FY 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012 are summarized below.

FY 2005	$21K
FY 2006	$760K
FY 2007	$1,637K
FY 2008	$4,536K
FY 2009	$654K
FY 2010	$1,705K
FY 2011	$1,513K
FY 2012	$1,164K
	$11,990K

6.0 RECYCLED MATERIAL AND WASTE DISPOSAL

One of the objectives of the 105-N Reactor ISS Project was to support recycling and waste minimization.

6.1 RECYCLING AND WASTE MINIMIZATION

Materials listed in Table 6-1 were recycled during the 105-N/109-N Reactor ISS Project for all of the 100-N Area WCH projects. Materials sent for recycling were segregated by material, but not additionally by building (WMIS).

Table 6-1. 105-N/109-N Area Recycle/Redistribution Log.

Waste Description	Amount (lbs)	Location
Batteries (i.e., Alkaline, Ni-Cad, Lithium-Ion, Etc.)	17,415.2	CCRC
Lamps (i.e., Fluorescent, Low-Pressure Sodium, Halogen, Incandescent, Mercury Vapor, Etc.)	15,027.1	CCRC
Petroleum based products (i.e., Oil, Diesel, Hydraulic Oil, Etc.)	32,790.7	ORRCO
Anti-Freeze	3,859.9	CCRC
Aerosol Cans	2477.6	CCRC
De-Icer	846.6	CCRC
Capacitors (i.e., Non-PCB Ballast)	526.0	CCRC
Mercury Containing Equipment	267.2	CCRC
Wood Waste	N/A	BDI

BDI = Basin Disposal Inc.
CCRC = Centralized Consolidated Recycling Center
N/A = Not Available
ORRCO = Oregon Re-Refining Company

6.2 WASTE DISPOSAL

Waste disposed, transferred, or recycled from the 105-N/109-N Reactor ISS Project included the following:

- Approximately 10,490 bulk containers of low-level debris were shipped to ERDF, accounting for approximately 139,875 tons (about 26,668.3 lb average per container) (WMIS).
- 1,695 tons of asbestos tiles, lagging and transite was disposed to ERDF (WMIS).
- 2,645 gal (10,012.4 L) of mixed (radioactive and dangerous) waste oil was sent to the Perma-Fix's Diversified Scientific Services, Inc. (DSSI) (WMIS).

- More than 65,600 lb (29,755 kg) of lead (primarily shot, sheets and bricks) were macro-encapsulated at ERDF (WMIS).

- 5-55 gallon drums of PCB ballasts were shipped to ERDF (WMIS).

7.0 OCCUPATIONAL EXPOSURES

7.1 PERSONNEL INJURIES

There were zero lost workdays and four Occupational Safety and Health Administration recordable cases during the ISS subcontract.

7.2 PERSONNEL RADIOLGICAL EXPOSURES

There were six elevated air sampling events with three resulting in personnel contamination, and one contamination event posted outside of a CA during the demolition for the ancillary sections and construction of the roof for the 105-N/109-N Reactor ISS Project.

The total combined dose of all 105-N Reactor personnel was approximately 20,086.9 person-mrem for the entire project duration. The majority of the dose was received during basin cleanout and demolition activities.

8.0 SAFE STORAGE ENCLOSURE

The Hanford Site's 100-N Reactor was chosen as the sixth reactor to be placed into long-term safe storage (Figures 8-1 through 8-3). The primary objective of the 105-N Reactor ISS Project is to provide storage up to 75 years, with minimal maintenance required. Design objectives are summarized as follows:

- Safe storage for up to 64 years (DOE, 1999).
- No credible releases of radionuclides to the environment under normal design conditions.
- Interim inspection required only on a 5-year frequency per the S&M plan (DOE/RL 2011-106). Further evaluation for extending this frequency will be performed by the project group upon completion of the first 5-year surveillance.
- SSE configuration will not preclude or significantly increase the cost of any final decommissioning alternative.

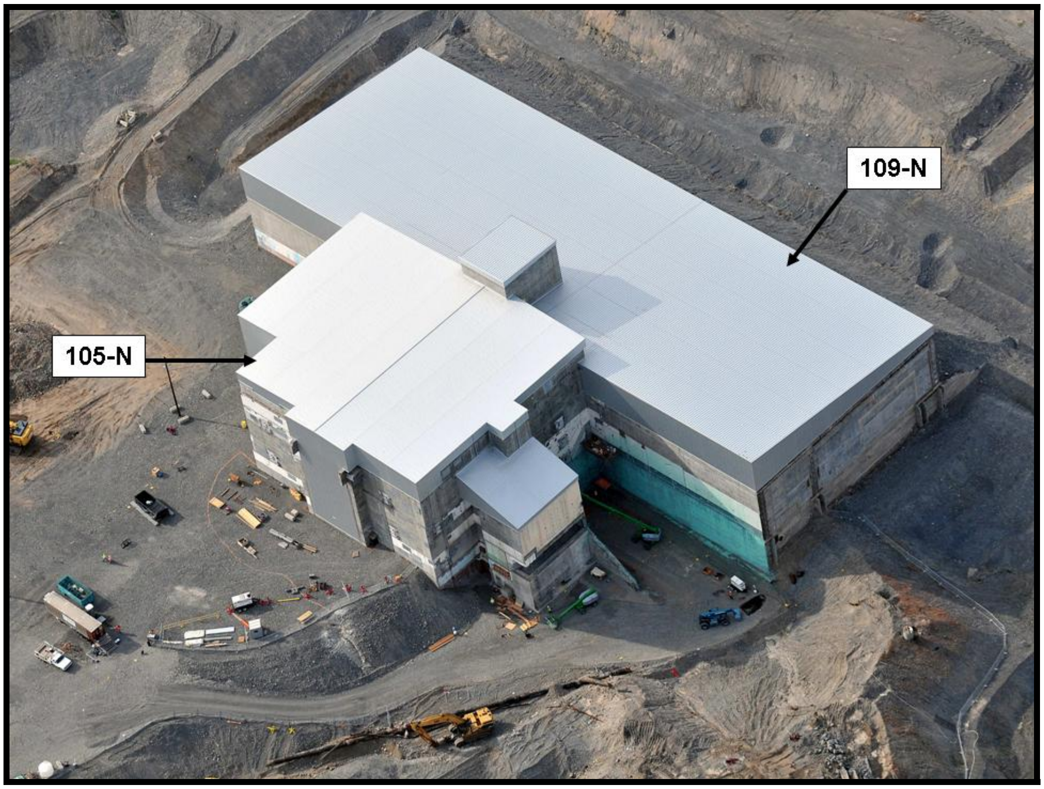
Figure 8-1. Photograph of Completed Safe Storage Enclosure (Looking West).

Figure 8-2. Aerial Photograph of Safe Storage Enclosure (Looking North-West).

8.1 ROOF

After demolition of the 105-N Reactor and 109-N Heat Exchanger Building facilities were completed up to the SSE boundaries, new structural steel was combined with the remaining existing structural steel and attached to the top of the concrete slabs and shield walls. The design for the roofing system is preformed aluminum-zinc alloy-coated steel standing seem roof system BattenLok'® (22 gage) 16-in. width. The design for metal is preformed aluminum-zinc alloy coated steel siding system (22 gage) 36-in. width. The 109-N Building roof panels were laid over steel joists supported by a grid of steel beams and steel columns. The 105-N Building roof panels are laid over a grid of standard steel beams and purlins supported by steel columns (DOE/RL-2011-106). Refer to Section 10.1 for structural concrete, steel and roofing/siding drawings.

Figure 8-3. Aerial Photograph of Safe Storage Enclosure (Looking Southeast).



8.2 ELECTRICAL SYSTEM

Electrical power for the SSE facility is a single-phase, 120/240-volts alternating current (VAC) and is supplied from 13.8-kV overhead electrical line. From a pole-mounted 13.8-kV – 120V/240V transformer, the power cables are connected to the main distribution panel (DP-1) located inside the SSE utility room (room 172). DP-1 provides power for lighting, power receptacles and the instrumentation system (0100N-DD-E0294). Backup power capability to these loads is not provided.

The 105-N/109-N SSE has permanent lighting installed along the surveillance route and the stairwells. In the interest of safety, all facility personnel and visitors must carry a spare light source that can be used for egress if the lighting system should fail during entry.

The 110-VAC receptacles are located at the 5 ft-0 in. level in the SSE access room (room 172). Additional receptacles are located in the 105-N Building in room 7 at the (-)15 ft-0 in. level, room 302 at the 14 ft-6in. level, room 402 at the 28 ft-3in. level, rooms 501/502/503 at the 40 ft-0in. level, in room 520 at the 51 ft-0 in. level, and in rooms 601/602/603/606/607/609/610/611 at the 60 ft-6 in. level. In addition, a receptacle is located in the new 109-N Access Building at the (-)16 ft-0 in. level and at various locations in the 109-N Building at the 40 ft-0 in. level under the new SSE roofing enclosure (DOE/RL-2011-106). Refer to Section 10.2 for electrical drawings.

8.3 REMOTE MONITORING SYSTEM

The 105-N/109-N SSE is configured with three sets of temperature sensors (resistance temperature detectors) and three sets of flooding sensors (float switches), which include installed spares for each sensor. Temperature sensors are located under the new roofing enclosure in 105-N Building room 172 at elevation 5 ft-0 in., in the 109-N Building at the 40 ft-0 in. elevation on the east side of the pressurizer, and two are located below the original 105-N Building roof at upper stair 6A landing. In addition, two level sensors are located at the (-)16 ft-0 in. level near the north wall in the new 109-N Access Building and below the (-)16 ft-0 in. level in 105-N Building near the bottom of Stair No. 6 and also near the top of the floor drain in 105-N Building room 24W at the (-)16 ft-0 in. level near the west wall. See drawings H-1-89875 through H-1-89884 for the actual locations of the temperature and level sensors.

The remote sensors are connected to a Blue Tree Wireless modem (Sixnet cellular modem) that handles analog and discrete inputs. Each signal is interrogated at the operation supervisor's workstation via an internet connection. Any personal computer loaded with the SSE reactor query software tool may act as a remote monitoring station. When an alarm condition is observed at the remote monitoring station, personnel will evaluate the alarm and, if required, will go to the 105-N/109-N SSE and take appropriate corrective actions.

Each pair of flooding sensors are normally closed contacts and wired in series to indicate an open circuit of flood condition at the monitoring station. If a flood sensor fails, the backup sensor may be wired to work independently without making an SSE reactor entry.

Redundant Resistance Temperature Detectors (RTDs) are connected to temperature transmitters that send a converted 4-20ma signal to the wireless modem. In the event of an RTD sensor failure, a selector switch located in the SSE utility room (Room 172 in the 105-N Building) can be changed to utilize the redundant field sensor. Instrument replacements will normally be conducted during regularly scheduled surveillance periods (DOE/RL-2011-106).

8.4 VENTILATION

The 105-N/109-N SSE is a deactivated facility that is uninhabited and locked, except during S&M activities. Most of the reactor's components were removed as part of the stabilization effort for placing the facility into ISS. Remaining equipment and components that contain radiological inventory were sealed during deactivation and implementation of the ISS project. Many accessible areas in the interior of the building have had a fixative applied to limit the spread of contamination.

To provide a habitable and essentially radon-free environment inside the SSE during non-routine surveillance, portable skid-mounted exhausters may be used to draw air into and out of the SSE. Two new openings have been provided to allow airflow passage between spaces in the SSE as a supplement to the existing doors and passageways. New openings in the 105-N Building include a 7-ft high by 6-ft wide SSE access door located in room 172 (elevation 5 ft-0 in.) with two 23- by 18-in. louvers to provide an outside air pathway into the building when the exhauster is running, and a 6 ft-8 in. high by 4 ft wide opening with cover plate and two 24 in. diameter flanges at the west side of room 606 (elevation 60 ft-6 in.) to provide an inside air pathway out of the non-zone 1 area of the building when the exhauster is running. When required, the exhausters are attached to either of the 24-in. flanges as necessary.

When the exhauster is not attached, the connection points are sealed with bolted flanges that have security bars installed behind them. The exhauster is no longer available and would have to be reconstructed if needed.

In addition to the above ventilation provisions, a high efficiency particulate air filter has been installed in the east end of the north wall of the zone 1 concrete duct in room 607 (elevation 60 ft-6 in.). The filter was installed to allow a filtered-passive ventilation path to zone 1 and the reactor block to breathe during changing weather conditions. The filter will be inspected and radiologically surveyed during the 5 year planned surveillances (DOE/RL-2011-106).

8.5 SECURITY

Access to the Hanford Site is restricted. The one main access to the 105-N/109-N SSE is located on the east side of the 105-N Building, elevation 5 ft-0 in., at room 172. The door to room 172 is locked and the key is maintained by the S&M Organization. Access to the Tour Route from room 172 is through the door to stair 6, which has a small steel plate tack-welded as a tamper seal. This seal will only be broken for the periodic internal S&M inspections. Additional access can be made through the airlock door at elevation (-)16 ft-0 in. into the 109-N cell area. Entry is made through the new 109-N access Building located on the southeast corner of the 109-N Building. There are no S&M activities planned in this area. This access is provided only if entry into the steam generator cells has to be made. The airlock door is sealed and tack-welded shut. One other access can be made into the 105-N Building through the steel-cover plate located on the east side of the 105-N Building at elevation 5 ft-0 in., corridor 7. This access is provided only if there is a need to access the discharge chute viewing area; no regular S&M activities are planned in this area. The cover plate is bolted to the SSE wall and further secured with tack welds. The SSE will be entered only for S&M required activities.

There are no intrusion alarms or routine security patrols for the 105-N/109-N SSE. The Hanford Patrol continues to provide routine security patrols in the vicinity as part of their patrols throughout the 100-Areas.

9.0 LESSONS LEARNED AND RECOMMENDATIONS

The 105-/109-N Reactor was the sixth ISS Project to complete placement of the reactor core into an SSE. The ISS work was accomplished with valuable lessons learned.

- While supporting construction of the SSE, a 4100 Manitowoc Crane's "headache ball" struck the concrete wall of the 105-N Building when the wind caused the boom to swing over the 105-N Building. The Crane Operator (CO) stated that the swing brake handle had been moved to engage the brake, but only had twisted in the threaded connection. An Ironwork General Foreman was at the 60-ft elevation and noticed the crane line swinging toward the side of the building with no one directing the load. He radioed the CO to stop, but not before the boom had swung over the building causing the headache ball to strike the concrete wall. The corrective action was utilization of a locking nut at the connection point for the swing brake handle, which didn't allow the swing brake handle threads to spin. Additional corrective and follow-up actions are documented in Do it Right The First Time (DIRTFT) Bulletin #2011-012.

- November 27, 2006 a D&D worker was cutting electrical lighting conduit that interfered with the removal of asbestos transite paneling. Plant electricians had switched breakers to remove power from the work area, but the lighting circuit was fed from different panels. The worker saw a spark when his portaband saw cut into the conduit. The employee was not injured. Several issues were determined that led to the event. D4 activities for all work should only be performed in facilities that are "Cold and Dark." This Lessons Learned is documented in RCCC-06-013.

- On July 14, 2009, an Equipment Operator experienced heat related fatigue and felt ill while sizing and sorting debris located on the minus 16-ft level of the 109-N demolition project. The operator was transported to the site occupational health provider for evaluation and released back to work without restrictions. Hydration is necessary when working in any conditions that may involve elevated temperatures. Monitoring of heated work conditions will assist in determining an individual's reaction to heat-related work. Monitoring of heat conditions should be conducted by persons other than the employee to ensure timely response if adverse conditions should arise. This Lessons Learned is documented in JIT-RCCC-2009-0002.

- On August 12, 2010, during welding activities a direct path-to-ground arc occurred. The metal cable of a worker's self-retracting lanyard (SRL) contacted the joist being welded and the arc damaged the cable. The lower portion of the SRL anchored to the concrete in the middle of the structure came in contact with the vent valve on which he was standing. When the lanyard contacted the joist that was being welded, it arced causing a gouge in the cable. These two points of contact from the SRL caused a direct path-to-ground. There were no shocks or injuries. Several corrective and follow-up actions are documented in DIRTFT Bulletin #2010-016.

- On September 13, 2010, an employee was working from a 60-ft genie aerial lift, installing bolts in plates that covered holes across the south side of the 109-N building. One of the plates was located behind a temporary 204-volt electrical panel mounted on a mobile unistrut frame that fed the 109-N roof. In the attempt to maneuver the lift basket closer, the worker stuck the panel. At this time he did not notice any damage and continued to install bolts on the plate in the areas that he could reach. He noticed that he moved the panel when he struck it with the lift basket. The employee attempted to straighten the panel and finished out the day without reporting to his supervisor. On September 16, 2010, another employee noticed that the panel was leaning. The Project Safety Representative (PSR) executed a Stop Work and WCH electricians were notified and locked out the panel. During inspection it was determined that the conduit coupling was broken in half 1.5-ft below grade. Inspection of the cables at the break in the conduit showed no damage. This Lessons Learned is documented in DIRTFT Bulletin #2010-019.

- On November 9, 2010, a worker began the shift operating a JLG 1932E2 Scissor Lift on the roof of the 109-N Building. During the function test, it was discovered the machine had a low charge. At this time, the worker exited the lift and plugged it back into the AC power cord to let it continue to charge. At approximately 1205 hours, the welder and fire-watch heard a loud boom as one of the batteries exploded. Smoke was noticed coming from under the scissor lift and the fire-watch quickly unplugged the lift from the charger. The smoking stopped and no one was injured. The battery charger was inspected to determine if it was in proper working order. This Lessons Learned is documented in DIRTFT Bulletin #2010-028.

- Existing site facility drawings for the 105-N and 109-N facilities proved to be, in most cases, complete, detailed and accurate which was beneficial in planning and performing deactivation and demolition activities.

- During demolition preparations, planned precuts on the structure (concrete walls/slabs and structural members/connections) and on the utilities (pipe/electrical/ductwork) were successfully used to control separations to avoid damage to the SSE structure and to achieve proper fit up with the new roof and siding system.

10.0 DRAWINGS

10.1 STRUCTURAL

Number	Cross-Reference Number	Subject
0100N-DD-C0353	H-1-90784 SHT01	100N Area 100-N REACTOR DEMO AND SSE PROJECT ACCESS BUILDING TITLE SHEET (T0.0)
0100N-DD-C0354	H-1-90785 SHT01	100-N AREA REACTOR DEMO AND SSE PROJECT ACCESS BUILDING NOTES AND ABBREVIATIONS (S0.0)
0100N-DD-C0355	H-1-90786 SHT01	100-N AREA 100-N REACTOR AND SSE PROJECT ACCES BUILDING FOUNDATION PLANS (S1.1)
0100N-DD-C0356	H-1-90787 SHT01	100-N AREA 100-N REACTOR DEMO AND SSE PROJECT ACCESS BUILDING ROOF FRAMING PLAN (S1.2)
0100N-DD-C0357	H-1-90788 SHT01	100-N AREA 100-N REACTOR DEMO AND SSE PROJECT ACCESS BUILDING EXTERIOR ELEVATIONS (S2.1)
0100N-DD-C0359	H-1-90790 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING CONCRETE DETAILS (S4.1)
0100N-DD-C0360	H-1-90791 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING STEEL FRAMING DETAILS (S5.1)
0100N-DD-C0361	H-1-90792 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING STEEL FRAMING DETAILS (S6.1)
0100N-DD-C0362	H-1-90793 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING STAIR FRAMING DETAILS (S7.1)
0100N-DD-C0363	H-1-90794 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING STAIR FRAMING DETAILS (S8.1)
0100N-DD-C0364	H-1-90795 SHT01	100-N AREA 100-NREACTOR DEMO AND SSE PROJECT ACCESS BUILDING STAIR FRAMING DETAILS (S9.1)
0100N-DD-C0365	H-1-90796 SHT01	100-N AREA, 109-N SSE TITLE SHEET (T0.0)
0100N-DD-C0366	H-1-90797 SHT01	100-N AREA, 109-N SSE NOTES AND LEGEND (S0.0)
0100N-DD-C0367	H-1-90798 SHT01	100-N AREA, 109-N SSE PLAN AT TOP OF EXISTING CONCRETE, EAST SECTION (S1.1)
0100N-DD-C0368	H-1-90799 SHT01	100-N AREA, 109-N SSE PLAN AT TOP OF EXISTING CONCRETE, CENTRAL SECTION (S1.2)
0100N-DD-C0369	H-1-90800 SHT01	100-N AREA, 109-N SSE PLAN AT TOP OF EXISTING CONCRETE, WEST SECTION (S1.3)
0100N-DD-C0370	H-1-90801 SHT01	100-N, 109-N SSE PLAN AT TOP OF EXISTING CONCRETE, PRESSURIZER (S1.4)
0100N-DD-C0371	H-1-90802 SHT01	100-N AREA, 109-N SSE OVERALL ROOF PLAN (S2.0)
0100N-DD-C0372	H-1-90803 SHT01	100-N AREA, 109-N SSE LOW ROOF FRAMING PLAN EAST SECTION (S2.1)
0100N-DD-C0373	H-1-90804 SHT01	100-N AREA, 109-N SSE LOW ROOF FRAMING PLAN, CENTRAL SECTION (S2.2)
0100N-DD-C0374	H-1-90805 SHT01	100-N AREA, 109-N SSE LOW ROOF FRAMING PLAN, WEST SECTION (S2.3)
0100N-DD-C0375	H-1-90806 SHT01	100-N AREA, 109-N SSE UPPER ROOF FRAMING PLAN, PRESSURIZER (S2.4)
0100N-DD-C0376	H-1-90807 SHT01	100-N AREA, 109-N SSE EXTERIOR ELEVATIONS (S3.1)

Number	Cross-Reference Number	Subject
0100N-DD-C0377	H-1-90808 SHT01	100-N AREA, 109-N SSE EXTERIOR ELEVATIONS (S3.2)
0100N-DD-C0378	H-1-90809 SHT01	100-N AREA, 109-N SSE STEEL FRAMING ELEVATIONS (S4.1)
0100N-DD-C0379	H-1-90810 SHT01	100-N AREA, 109-N SSE STEEL FRAMING ELEVATIONS (S4.2)
0100N-DD-C0380	H-1-90811 SHT01	100-N AREA, 109-N SSE STEEL FRAMING ELEVATIONS (S4.3)
0100N-DD-C0381	H-1-90812 SHT01	100-N AREA, 109-N SSE STEEL FRAMING ELEVATIONS (S4.4)
0100N-DD-C0382	H-1-90813 SHT01	100-N AREA, 109-N SSE STEEL FRAMING ELEVATIONS (S4.5)
0100N-DD-C0383	H-1-90814 SHT01	100-N AREA, 109-N SSE CONCRETE SECTIONS AND DETAILS (S5.1)
0100N-DD-C0384	H-1-90815 SHT01	100-N AREA, 109-N SSE CONCRETE SECTIONS AND DETAILS (S5.2)
0100N-DD-C0385	H-1-90816 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.1)
0100N-DD-C0386	H-1-90817 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.2)
0100N-DD-C0387	H-1-90818 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.3)
0100N-DD-C0388	H-1-90819 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.4)
0100N-DD-C0389	H-1-90820 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.5)
0100N-DD-C0390	H-1-90821 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.6)
0100N-DD-C0391	H-1-90822 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S6.7)
0100N-DD-C0392	H-1-90823 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S7.1)
0100N-DD-C0393	H-1-90824 SHT01	100-N AREA, 109-N SSE STEEL FRAMING SECTIONS AND DETAILS (S7.2)
0100N-DD-C0395	H-1-90826 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING TITLE SHEET (T0.0)
0100N-DD-C0396	H-1-90827 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING NOTES AND ABBREVIATIONS (S0.0)
0100N-DD-C0397	H-1-90828 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING PLAN (S1.0)
0100N-DD-C0398	H-1-90829 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING WALL ELEVATIONS (S2.0)
0100N-DD-C0399	H-1-90830 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING SECTIONS AND DETAILS (S5.0)
0100N-DD-C0400	H-1-90831 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING SECTIONS AND DETAILS (S5.1)
0100N-DD-C0401	H-1-90832 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING SECTIONS AND DETAILS (S5.2)
0100N-DD-C0402	H-1-90833 SHT01	100-N AREA, 105-N BELOW GRADE WALL REINFORCING SECTIONS AND DETAILS (S5.3)
0100N-DD-C0405	H-1-90836 SHT01	100-N AREA, 105-N SSE TITLE SHEET (T0.0)
0100N-DD-C0406	H-1-90837 SHT01	100-N AREA, 105-N SSE GENERAL NOTES (S0.0)

Number	Cross-Reference Number	Subject
0100N-DD-C0407	H-1-90838 SHT01	100-N AREA, 105-N SSE LEGEND AND SCHEDULES (S0.1)
0100N-DD-C0408	H-1-90839 SHT01	100-N AREA, 105-N SSE PLAN AT TOP OF EXISTING CONCRETE (S1.1)
0100N-DD-C0409	H-1-90840 SHT01	100-N AREA, 105-N SSE PLAN AT GRADE ELEVATIONS (S1.2)
0100N-DD-C0410	H-1-90841 SHT01	100-N AREA, 105-N SSE HIGH ROOF FRAMING PLAN (S2.1)
0100N-DD-C0411	H-1-90842 SHT01	100-N AREA, 105-N SSE EXTERIOR ELEVATIONS (S3.1)
0100N-DD-C0412	H-1-90843 SHT01	100-N AREA, 105-N SSE EXTERIOR ELEVATIONS (S3.2)
0100N-DD-C0413	H-1-90844 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S4.1)
0100N-DD-C0414	H-1-90845 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S4.2)
0100N-DD-C0415	H-1-90846 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S4.3)
0100N-DD-C0416	H-1-90847 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S4.4)
0100N-DD-C0417	H-1-90848 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.1)
0100N-DD-C0418	H-1-90849 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.2)
0100N-DD-C0419	H-1-90850 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.3)
0100N-DD-C0420	H-1-90851 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.4)
0100N-DD-C0421	H-1-90852 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.5)
0100N-DD-C0422	H-1-90853 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.6)
0100N-DD-C0423	H-1-90854 SHT01	100-N AREA, 105-N SSE STEEL FRAMING ELEVATIONS (S5.7)
0100N-DD-C0424	H-1-90855 SHT01	100-N AREA, 105-N SSE COLUMN BASE PLATE DETAILS (S6.1)
0100N-DD-C0425	H-1-90856 SHT01	100-N AREA, 105-N SSE COLUMN BASE PLATE DETAILS (S6.2)
0100N-DD-C0426	H-1-90857 SHT01	100-N AREA, 105-N SSE FOUNDATION SECTIONS AND DETAILS (S6.3)
0100N-DD-C0427	H-1-90858 SHT01	100-N AREA, 105-N SSE FOUNDATION SECTIONS AND DETAILS (S6.4)
0100N-DD-C0428	H-1-90859 SHT01	100-N AREA, 105-N SSE ROOF FRAMING SECTIONS AND DETAILS (S7.1)
0100N-DD-C0429	H-1-90860 SHT01	100-N AREA, 105-N SSE ROOF FRAMING SECTIONS AND DETAILS (S7.2)
0100N-DD-C0430	H-1-90861 SHT01	100-N AREA, 105-N SSE ROOF FRAMING SECTIONS AND DETAILS (S7.3)
0100N-DD-C0431	H-1-90862 SHT01	100-N AREA, 105-N SSE ROOF FRAMING SECTIONS AND DETAILS (S7.4)
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0100N-DD-C0434	H-1-90865 SHT01	100-N AREA, 105-N SSE ROOF FRAMING SECTIONS AND DETAILS (S7.7)
0100N-DD-C0435	H-1-90866 SHT01	100-N AREA, 105-N SSE WALL FRAMING SECTIONS AND DETAILS (S8.1)
0100N-DD-C0436	H-1-90867 SHT01	100-N AREA, 105-N SSE WALL FRAMING SECTIONS AND DETAILS (S8.2)

Number	Cross-Reference Number	Subject
0100N-DD-C0437	H-1-90868 SHT01	100-N AREA, 105-N SSE WALL FRAMING SECTIONS AND DETAILS (S8.3)
0100N-DD-C0438	H-1-90869 SHT01	100-N AREA, 105-N SSE WALL FRAMING SECTIONS AND DETAILS (S8.4)
0100N-DD-C0439	H-1-90870 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE TITLE SHEET (T0.0)
0100N-DD-C0440	H-1-90871 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE GENERAL NOTES (S0.0)
0100N-DD-C0441	H-1-90872 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE LEGEND AND SCHEDULES (S0.1)
0100N-DD-C0442	H-1-90873 SHT01	10-N AREA, 105-N WEST ROD ROOM SSE FOUNDATION PLAN (S1.1)
0100N-DD-C0443	H-1-90874 SHT01	100-N AREA 105-N WEST ROD ROOM SSE PLAN AT TOP FO EXISTING STRUCTURE (S1.2)
0100N-DD-C0444	H-1-90875 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE ROOF FRAMING PLAN (S2.1)
0100N-DD-C0445	H-1-90876 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE EXTERIOR ELEVATIONS (S3.1)
0100N-DD-C0446	H-1-90877 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE EXTERIOR ELEVATIONS (S3.2)
0100N-DD-C0447	H-1-90878 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE EXTERIOR ELEVATIONS (S3.3)
0100N-DD-C0448	H-1-90879 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE STRUCTURAL SECTIONS (S4.1)
0100N-DD-C0449	H-1-90880 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE STEEL FRAMING ELEVATIONS (S5.1)
0100N-DD-C0450	H-1-90881 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE STEEL FRAMING ELEVATIONS (S5.2)
0100N-DD-C0451	H-1-90882 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE STEEL FRAMING ELEVATIONS (S5.3)
0100N-DD-C0452	H-1-90883 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE FOUDNATION DETAILS (S6.1)
0100N-DD-C0453	H-1-90884 SHT01	100-N AREA, 105-N SSE FOUNDATION DETAILS (S6.2)
0100N-DD-C0454	H-1-90885 SHT01	100-N AREA, 105-N SSE FOUNDATION DETAILS (S6.3)
0100N-DD-C0455	H-1-90886 SHT01	100-N AREA, 105-N SSE FOUNDATION DETAILS (S6.4)
0100N-DD-C0456	H-1-90887 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE ROOF FRAMING DETAILS (S7.1)
0100N-DD-C0457	H-1-90888 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE ROOF FRAMING DETAILS (S7.2)
0100N-DD-C0458	H-1-90889 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE ROOF FRAMING DETAILS (S7.3)
0100N-DD-C0459	H-1-90890 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE WALL FRAMING DETAILS (S8.1)
0100N-DD-C0460	H-1-90891 SHT01	100-N AREA, 105-N WEST ROD ROOM SSE WALL FRAMING DETAILS (S8.2)
0100N-DD-C0553	H-1-91066 SHT01	100-N AREA, 105-N, 109-N REACTOR DEMOLITION AND SSE PROJECT 105-N EL(+) 60’-6” FILTER ASSEMBLY

Number	Cross-Reference Number	Subject
0100N-DD-C0554	H-1-91067 SHT01	100-N AREA, 105-N, 109-N REACTOR DEMOLITION AND SSE PROJECT 105-N EL(+) 60'-6" FILTER ASSEMBLY – DETAILS

10.2 ELECTRICAL AND INSTRUMENTATION

Number	Cross-Reference Number	Subject
0100N-DD-E0183	H-1-89875 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N/109-N ELEVATION 0'-0" ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0184	H-1-89876 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (-)10' ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0185	H-1-89877 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N/109-N ELEVATION (-)16' ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0186	H-1-89878 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (-)21' ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0187	H-1-89879 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (+)14'-6" ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0188	H-1-89880 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (+)28'-3" ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0189	H-1-89881 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT,105-N ELEVATION (+)40' ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0190	H-1-89882 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (+)51' ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0191	H-1-89883 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (+)60'-6" ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0192	H-1-89884 SHT01	100-N AREA, 105-N//109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ROOF ELECTRICAL ARRANGEMENT PLAN
0100N-DD-E0290	H-1-96986 SHT01	100-N AREA, 105-N/109-N PERMANENT POWER, 13.8 KV LINE PLAN AND PROFILE
0100N-DD-E0291	H-1-96987 SHT01	100-N AREA, 105-N/109-N PERMANENT POWER, 13.8 KV LINE DETAILS
0100N-DD-E0292	H-1-96988 SHT01	100-N AREA, 105-N/109-N PERMANENT POWER, 13.8 KV LINE DETAILS
0100N-DD-E0294	H-1-96994 SHT01	100-N AREA, 105-N/109-N PERMANENT POWER, ONE-LINE DIAGRAM AND METERING

10.3 MECHANICAL

Number	Cross-Reference Number	Subject
0100N-DD-M0122	H-1-89891 SHT01	100-N AREA, 105-N/109-N REACTOR DEMOLITION AND SSE PROJECT, ELEVATION 0'-0" VENTILATION PLAN
0100N-DD-M0123	H-1-89892 SHT01	100-N AREA, 105-N/109-N REACTOR DEMOLITION AND SSE PROJECT, 105-N ELEVATION (+)60'-6" VENTILATION PLAN
0100N-DD-M0124	H-1-89893 SHT01	100-N AREA SSE CONSTRUCTION AT 100-N REACTOR BUILDING VENTILATION DETAILS
0100N-DD-M0125	H-1-89894 SHT01	100-N AREA SSE CONSTRUCTION AT 100-N REACTOR BUILDING VENTILATION DETAILS

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12.0 ATTACHMENTS

12.1 ATTACHMENT #1

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