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Rev. 0

105-C Reactor Interim Safe Storage Project Final Report

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Environmental Restoration

Submitted by; Bechtel Hanford, Inc.

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105-C Reactor Interim Safe Storage Project Final Report

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FIGURES

ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
ARARs	applicable or relevant and appropriate requirements
ASA	auditable safety analysis
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CVP	cleanup verification package
D&D	decontamination and decommissioning
DDFA	decontamination and decommissioning focus area
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
DOH	Washington State Department of Health
DQA	data quality assessment
DQO	data quality objective
EE/CA	engineering evaluation and cost analysis
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
Ecology	Washington State Department of Ecology
FHC	final hazard classification
FIG	field implementation guide
FSB	fuel storage basin
FY	Fiscal Year
HCR	horizontal control rod
IRA	independent readiness assessment
ISS	interim safe storage
LSDDP	large scale technology demonstration and deployment project
MEF	metal examination facility
MITUS	Mobile Integrated Temporary Utility System
MOC	management of change
MTCA	*Model Toxics Control Act*
NOC	Notice of Construction
PCBs	polychlorinated biphenyls
PFWR	Plant Forces Work Review
PLC	programmable logic controller
PNOV	Preliminary Notice of Violation
RCT	radiological control technician
RESRAD	Residual Radioactivity Dose Model
RL	U.S. Department of Energy, Richland Operations Office

ACRONYMS AND ABBREVIATIONS (continued)

ROD	Record of Decision
S&M	surveillance and maintenance
SAP	sampling and analysis plan
SSE	safe storage enclosure
Tri-Party Agreement	***Hanford Federal Facility Agreement and Consent Order***
UNI	United Nuclear Industries, Inc.
USQ	unreviewed safety question
VAC	volt-alternating current
VSR	vertical safety rod

METRIC CONVERSION CHART

The following conversion chart is provided to the reader as a tool to aid in conversion.

In To Metric Units

If You Know	*Multiply By*	*To Get*
Length		
inches	25.4	millimeters
inches	2.54	centimeters
feet	0.3048	meters
yards	0.914	meters
miles	1.609	kilometers
Area		
sq. inches	6.452	sq. centimeters
sq. feet	0.093	sq. meters
sq. yards	.0836	sq. meters
sq. miles	2.6	sq. kilometers
acres	0.405	hectares
Mass (weight)		
ounces	28.35	grams
pounds	0.454	kilograms
ton	0.907	metric ton
Volume		
teaspoons	5	millimeters
tablespoons	15	millimeters
fluid ounces	30	millimeters
cups	0.24	liters
pints	0.47	liters
quarts	0.95	liters
gallons	3.8	liters
cubic feet	0.028	cubic meters
cubic yards	0.765	cubic meters
Temperature		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius

Out of Metric Units

If You Know	*Multiply By*	*To Get*
Length		
millimeters	0.039	inches
centimeters	0.394	inches
meters	3.281	feet
meters	1.094	yards
kilometers	0.621	miles
Area		
sq. centimeters	0.155	sq. inches
sq. meters	10.76	sq. feet
sq. meters	1.196	sq. yards
sq. kilometers	0.4	sq. miles
hectares	2.47	acres
Mass (weight)		
grams	0.035	ounces
kilograms	2.205	pounds
metric ton	1.102	ton
Volume		
millimeters	0.033	fluid ounces
liters	2.1	pints
liters	1.057	quarts
liters	0.264	gallons
cubic meters	35.315	cubic feet
cubic meters	1.308	cubic yards
Temperature		
Celsius	multiply by 9/5, then add 32	Fahrenheit

1.0 SCOPE

The following information documents the decontamination and decommissioning (D&D) of the 105-C Reactor Facility and the placement of the reactor core into interim safe storage (ISS). The D&D of 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 the 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.

2.0 FACILITY DESCRIPTION AND CONDITIONS

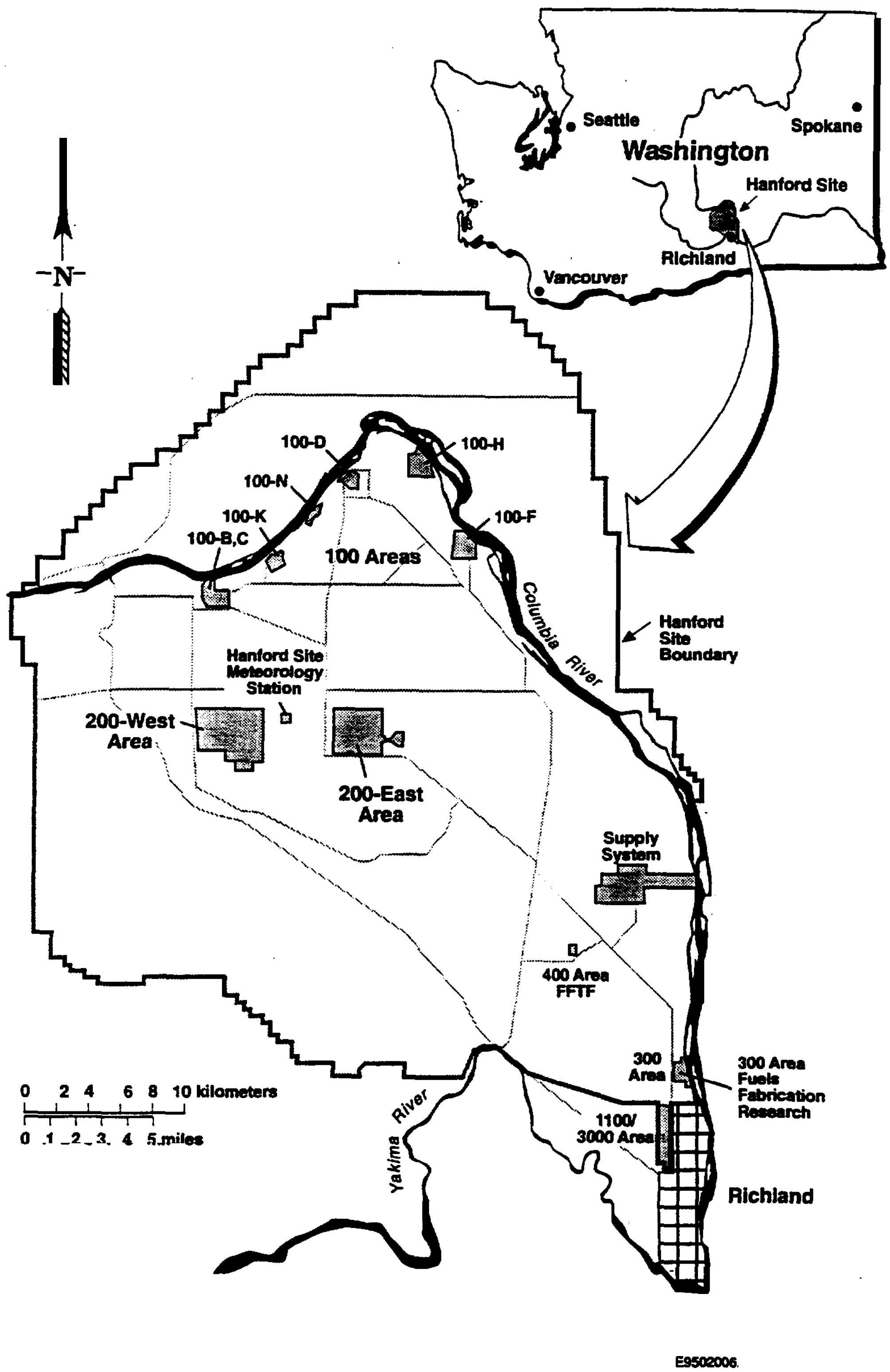
2.1 HISTORY

In 1942, the U.S. 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. The Hanford C Reactor facility is located in the 100-B/C Area of the Hanford Site, as shown in Figure 1. The design of the 105-C Reactor was started in March 1951, and construction was initiated on June 6, 1951. Initial startup of the 105-C Reactor was achieved on November 18, 1952, 17 months after ground breaking had occurred. The design of the facility was based on the earlier Hanford Site reactors, and drawings of the older facilities were modified to form the design drawings for the 105-C Reactor. The ***Summary of 100-B/C Reactor Operations and Resultant Wastes*** (WHC 1993) provides a complete history of the C Reactor.

The 105-C Reactor was shut down on April 25, 1969. Deactivation of the reactor was completed in early 1971 (DUN 1971 provides the radiological status report). In the years following deactivation, several significant cleanup efforts were completed at the C Reactor complex:

- On September 13, 1983, the C Reactor exhaust stack (116-C) was demolished, as described in a United Nuclear Industries, Inc. (UNI) project report (UNI 1986a).
- In 1985, the fuel storage basin (FSB), metal examination facility (MEF) basin, and all other adjoining basins were cleaned of sediment and the basin surfaces were stabilized with an asphalt emulsion to approximately 8 ft above the basin floor. The sediment was moved to the transfer pit (which is 5 ft deeper than the FSB) and capped with a plywood cover (UNI 1986b).
- In 1988, demolition work was completed on the adjoining 117-C Exhaust Filter Building (WHC 1989).
- In 1996, the 187-C high tanks were explosively demolished, and all 360 tons of steel was salvaged. In 1997, the associated foundations and valve pits leading to the tanks were demolished (BHI 1998g).

Figure 1. Hanford Site Map.



2.2 FACILITY DESCRIPTION

The 105-C Building is 106 m by 93 m by 30 m in height (346 ft by 305 ft by 98 ft). The lower levels of the building and the central portions surrounding the reactor are constructed of reinforced concrete. A floor plan layout at ground level is shown in Figure 2. The massive reinforced-concrete walls surrounding the reactor are 0.9- to 1.5-m thick (3 ft to 5 ft). The upper portion of the building and many of the at-grade ancillary rooms are steel-framed, enclosed with corrugated asbestos cement (transite). The roof is constructed of badly deteriorated poured-in-place gypsum, with felt paper and gravel roofing serving as the waterproof membrane. A pre-1996 aerial photo looking east is shown in Figure 3. A ground-level photo looking southwest (toward outer rod room and the rod rack) is shown in Figure 4.

2.3 DECOMMISSIONING DECISIONS

Since deactivation, the 105-C Reactor has been in a condition of minimum surveillance and maintenance (S&M) and significant deterioration has occurred, particularly in the roof sections over the fan room and work area. 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*** (DOE 1992). A Record of Decision (ROD) was issued by the U.S. Department of Energy (DOE) (58 FR 48509). The ROD states that the preferred alternative is to place the reactors into a safe storage condition for up to 75 years. After ISS, the reactors would be transported in one piece to a specially prepared burial facility in the 200 West Area of the Hanford Site.

The plan for the ISS of the C-Reactor includes removing all portions of the reactor facility outside of the reactor block shield walls. The areas to be removed included the FSB, MEF, outer rod room, control room, electrical room, switchgear room, lunch room, office space, fan supply and exhaust rooms, sample rooms, ready room, lift station, upper reactor framing and roofing, and other miscellaneous rooms and tunnels. The remaining portion of the reactor facility (the areas inside the concrete shield walls) is called the SSE and is discussed in depth in Section 8.0.

The planning process for the 105-C ISS Project was conducted jointly between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the U.S. Department of Energy, Richland Operations Office (RL). The up-front planning for the project allowed waste disposal to the Environmental Restoration Disposal Facility (ERDF) and streamlined the process for releasing DOE real property. The working relationships between DOE, EPA, and Ecology were greatly strengthened through open communication and cooperation for developing solutions to streamline the D&D planning process. The 105-C ISS Project was the first D&D job implementing the process for conducting decommissioning under the ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980*** (CERCLA) at the Hanford Site (which is a joint strategy between EPA and DOE). Additionally, ***the Hanford Federal Facility Agreement and Consent Order*** (Tri-Party Agreement) (Ecology et al. 1994) was revised to reflect the planning process employed by the 105-C ISS Project, including milestones for 105-C and the following reactors.

Figure 2. Floor Plan Layout at Ground Level.

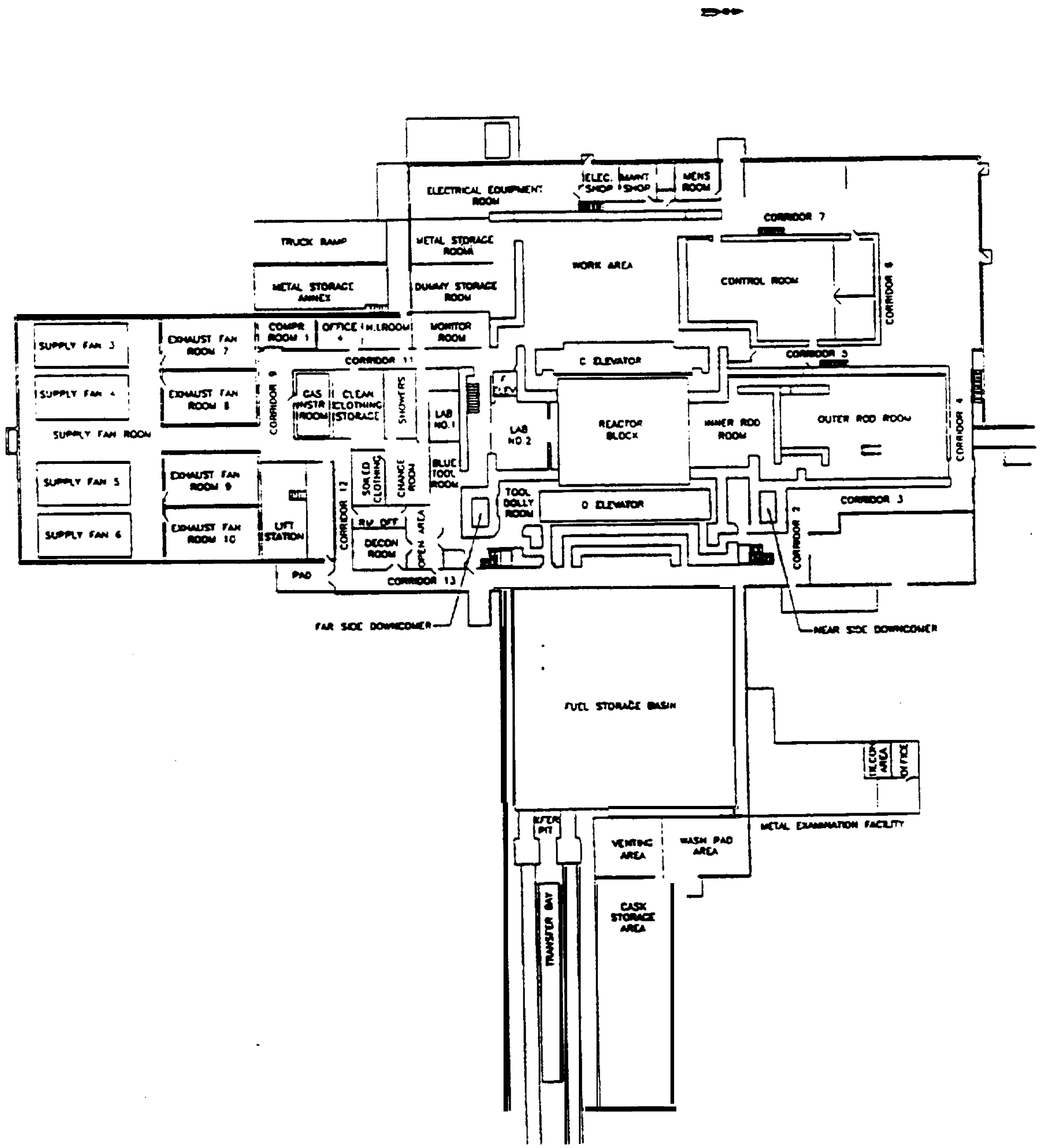


Figure 3. Pre-1996 Aerial Photo (Looking East).

Figure 4. Ground-Level Photo (Looking Southwest).

3.0 CHARACTERIZATION

Fiscal year (FY) 1994 activities included developing a characterization plan (CEES 1994a), characterizing the facility, completing sample and data analysis, and completing the characterization report. Characterization tasks included radiological surveys and sampling for hazardous and radiological contaminants. The characterization results are provided in CEES 1994b.

In FY 1997, the characterization plan and report was amended and reissued as DOE-RL 1997a and DOE-RL 1997b, respectively.

4.0 PROJECT ACTIVITIES

The D&D activities were conducted in accordance with the activities discussed in BHI 1997a.

4.1 ENGINEERING AND PERMITS

An engineering evaluation and cost analysis (EE/CA) was prepared to present results for final disposition for the 105-C Reactor waste and for five other facilities (DOE-RI 1996b). The EE/CA evaluated four alternatives for this removal action:

- No action
- Continued S&M
- D&D and disposal at the ERDF
- D&D and disposal at other Hanford Site facilities.

Based on overall effectiveness, implementability, and cost, the EE/CA states that the recommended removal alternative is to decontaminate, demolish, and dispose of the associated waste at the ERDF (for those wastes meeting the ERDF waste acceptance criteria). The EE/CA received a 30-day public comment and review period. An action memorandum (EPA 1997) provided approval for the EE/CA proposed removal action, subject to approval of additional waste streams not covered by the 105-C characterization report (DOE-RL 1997b) or waste streams not going to the ERDF. Approval for the additional waste streams was subsequently provided but will not be documented herein. The action memorandum also specifies the applicable or relevant and appropriate requirements (ARARs) with which the 105-C ISS Project D&D work must comply (EPA 1997).

Prior to the ISS Project, the 105-C Reactor was under the control of the S&M Projects group. The control of the building was temporarily assigned to D&D Projects to perform the ISS work. This change of control was accomplished by a memorandum of understanding (BHI 1996f).

A biological review (BHI 1996a) and a cultural resources review (BHI 1996b) were performed prior to mobilization at the 105-C Reactor site.

Plant Forces Work Reviews (PFWRs) were performed on the entire scope of work required to bring the C Reactor into its final state of ISS. The PFWRs are documented in BHI 1996c and BHI 1996d.

The final hazard classification (FHC) and auditable safety analysis (ASA) for the 105-C ISS Project (BHI 1996e) summarizes the inventories of radioactive and hazardous materials present within the 105-C Reactor. The ASA/FHC also documents the operations associated with the ISS Project, which includes decontamination, demolition, and construction of the SSE. This document also identifies accident scenarios, performs bounding evaluation of the consequences of the potentially significant accident scenario, and establishes a hazard classification based on the bounding consequence evaluation. The result of the evaluation is that the FHC for the 105-C ISS Project is "Radiological."

The ASA/FHC also establishes safety functions and controls. Two special controls were established to ensure that conditions assumed in the FHC analysis are maintained:

- Any additions to the inventory of radioactive or hazardous materials in the facility shall be promptly analyzed to determine the impact on the hazard category and safety of the facility.
- Any activity that could selectively concentrate or remove fissile material from the transfer pit sediment shall be evaluated prior to initiation of the activity.

Based on the above controls and commitments, four conditions arose during the course of the project that required evaluation. The first two evaluations were unreviewed safety question (USQ) determinations. However, half way through the project, procedure revisions required that USQs are only for "Nuclear" facilities. Since the 105-C ISS Project is classified as "Radiological," the two initial USQs could have been management of change (MOC). The two later evaluations were handled as MOCs. Briefly, the USQs/MOCs were performed for the following:

Number	Reference	Description
USQD 0105C-US-N0001	BHI 1997e	Discovery of increased concentrations of radionuclides in transfer pit sediments
USQD 0105C-US-N0002	BHI 1997f	Monolith removal of the transfer pit sediments
MOC-98-0024	BHI 1998e	Demolition plan for transfer pit walls above the transfer pit monoliths
MOC-98-0030	BHI 1998f	Increase of lift height of transfer pit monoliths

The D&D process has the potential to generate radioactive air emissions. Prior to initiating work, a Notice of Construction (NOC) (DOE-RI 1996a) was prepared for submittal to EPA and the State of Washington Department of Health (DOH). Approval of the NOC was received from DOH (DOH 1996) and EPA (EPA 1996) prior to starting work.

4.2 MOBILIZATION

Mobilization activities in support of asbestos removal were initiated on October 1, 1996 (beginning of FY 1997). Initial activities consisted of setting up the engineering, field support, radiological control technician (RCT) and lunch trailers, and the associated electrical and phone systems. Parking areas were graded and graveled for the workers. Finally, two temporary septic holding tanks and a restroom trailer were installed after the permits were received. This completed mobilization activities outside the reactor fence.

Inside the fence, MODEC trailers and water trailers were set up for the asbestos workers and numerous trailers were set up for D&D equipment and supplies. The final step in mobilization was to set up a temporary power and lighting system to replace the inadequate, non-as-built, unsafe power and lighting inside the leaking building. The Mobile Integrated Temporary Utility System (MITUS) technology demonstration (see Section 9.0) was very efficiently and safely used to provide power and lighting throughout the course of the ISS Project. The MITUS technology used a trailer-mounted transformer and distribution panel that stepped down the incoming voltage from 13.8 kV to 480 V. International orange cable was used to feed 480 V power to individual kiosks throughout the facility. Selected kiosks then had the capability to step down the voltage to 240 V and 120 V. Lighting strings from each kiosk were then used to provide lighting. In addition to the power and lighting provided, each kiosk had a three-position paging system, emergency lights in case of power loss, and an alarm system. The alarm system would not only alert everyone in the building, but would also signal the central monitoring station outside the building. The central monitoring station could identify the exact kiosk where the alarm was sounded.

After the MITUS technology was functional, the entire old power and lighting system was disconnected. Electrical isolation was ensured by removing the main transformer. Additional zero-energy checks were made to ensure that an alternate electrical feed was not coming into the building from another source. Subsequently, all personnel were notified that the only power in the building was in orange or orange-marked cords (this streamlined electrical demolition throughout the course of the ISS Project).

4.3 READINESS ASSESSMENTS

The project manager determined that independent readiness assessments (IRAs) were to be conducted prior to initiating work at four stages of the ISS Project. The primary objectives of the assessments were to determine if (1) the project was ready to begin from an administrative standpoint, (2) all the required resources were available, and (3) all work activities would be accomplished safely. Briefly, the assessments were performed on the following areas:

IRA Number	Reference	Description
105C-ISS / FY97-01	BHI 1997b	Non-intrusive asbestos removal
105C-ISS / FY97-02	BHI 1997c	Radiological asbestos removal
105C-ISS / FY97-03	BHI 1997d	General housekeeping
BHI-RA-98-00005	BHI 1998d	Removal of the fuel transfer pits

The assessments concluded that the project was ready to proceed as scheduled, pending completion of specified pre-start and post-start construction punchlist items.

4.4 HAZARDOUS MATERIAL REMOVAL

The scope of the demolition project included removing and properly disposing of flammable and hazardous materials (e.g., oils, grease, asbestos-containing material [ACM], mercury, lead, and polychlorinated biphenyls [PCBs]). All of this material was removed inside and outside the SSE, with the exception of non-removable lead (as discussed below). All of the removed 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 was carefully removed during the demolition).

4.4.1 Asbestos (Excluding Transite)

Asbestos monitoring was performed in support of asbestos-removal activities. Removal work activities included the use of glovebags, a cut-and-wrap technique, and negative-pressure enclosures. Applicable areas were sprayed with lock-down 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 6,600 ft^3 of asbestos insulation was removed.

4.4.2 Transite (Cement Asbestos Board)

The exterior walls were constructed of double transite panels (exterior and interior). There were also double transite panels in most of the interior rooms. Approximately 500 tons of transite were removed. Many panels were radiologically released and were disposed of offsite. Radiologically contaminated transite was shipped to the ERDF for disposal.

4.4.3 Lead

Lead-based paint was originally used throughout the facility but was determined to be below regulatory limits. The majority of lead encountered during D&D was in the form of bricks; however, lead was encountered in additional forms:

- Bricks
- Sheet material

- Small lead balls
- Lead poured around piping and p-traps
- Poured into interior cavities of equipment (e.g., turrets)
- Lead joints from bell and spigot drain piping
- Light bulbs.

Appendix G of UNI 1987 provided a list of the lead inventory at the 105-C Reactor. The ISS Project could not remove the items listed below:

- Inside the reactor block (160,000 lbs)
- Rear shielding door (26,000 lbs)
- Experimental room 2 shielding door (500 lbs).

Appendix G of UNI 1987 provided a very under-estimated inventory of lead for the facility. In addition to the above documented items, there are three lead items that the ISS Project has identified as components that are not practical to remove. The locations and estimated weights are as follows:

• Upper viewing room	60,000 lbs (sandwiched around steel framing)
• Horizontal control rod shielding	19,000 lbs (attached to the rod rack)
• Experimental room 1 table	4,000 lbs (unsafe to carry downstairs).

UNI 1987 inventoried only 105 tons of lead. During D&D, 70 tons of lead was removed from the reactor building, and 133 tons of lead is inventoried above for a total quantity of 203 tons (twice the original estimate or five times the original estimate if the skewing weight of the reactor block is ignored). Approximately 40 tons of the 70 tons removed was recycled.

4.4.4 Mercury

Mercury was found in numerous switches, manometers and instruments. Approximately one gallon of mercury was collected and was recycled.

4.4.5 Polychlorinated Biphenyls

No regulated quantities of PCBs were found in any of the grease or oil. The main transformer was the property of the Hanford Utility Group, so they handled the disposal. Light ballasts were the only PCB waste stream requiring 105-C ISS Project disposal

4.5 EQUIPMENT REMOVAL

Some of the major equipment removed during the ISS Project included the following:

Description	Location
45 vertical safety rod (VSR) drives	Upper reactor
VSR drive crane	Upper reactor

Description	Location
Ball 3X elevator and delivery system	Upper reactor
Rear face elevator drive equipment and counterweights	Upper reactor
Front face elevator drive equipment and counterweights	Upper reactor
Horizontal control rods (HCR) drives and cooling equipment	Outer rod room
HCR drive shafts	Inner rod room
Fuel examination equipment	Metal examination facility
Control room equipment	Control room
Leak detection turrets	Sample rooms
Fan equipment	Fan supply and exhaust rooms
Fuel loading equipment	Metal storage room
3 pumps	Lift station
2 ion exchangers	Transfer bay
Heat exchanger	Transfer bay
Cask crane	Transfer bay
Compressor	Compressor room
Vacuum receiver	Vacuum system room
Gas piping	Gas tunnel 13
Water supply piping	North and south water tunnels
F elevator (personnel)	All levels
Electrical equipment	Upper electrical room
Switchgear equipment	Switchgear room.

The reactor block itself was disturbed as little as possible.

- During deactivation, the 15 HCRs and the 45 VSRs were placed in the “full-in” position into the reactor (WHC 1993). The ISS Project did not touch the rods, but their drive shafts and cables were disconnected and removed.
- Also during deactivation, all 2,004 process tubes were emptied and a “plastic noodle” was placed through the tube to verify that the tube was empty (WHC 1993). The ISS project did not remove any process tube caps on the front or rear face.
- The Ball 3X system had the balls removed after deactivation. The Ball 3X system was left intact because there are 90 pathways into the reactor (45 in the top and 45 in the

bottom of the reactor block), but it was necessary to remove the Ball 3X elevator that extended above the top of the reactor. The elevator was disconnected directly above the top of the inner rod room, and all upper components were removed and disposed. A sheet metal cover was placed over the top of the elevator to provide isolation.

- Concrete pourbacks (18-in. thick) were placed in the gas tunnel in line with the remainder of the SSE shield wall. Thus, the gas tunnel piping was severed inside of this pourback, and the pipes were foamed to close the openings.

4.6 DEMOLITION OF ABOVE-GRADE STRUCTURES

After the hazardous materials and isolations were performed (as discussed in Sections 4.4 and 4.5), the above grade structures were ready for demolition. Demolition was performed based on whether the areas were relatively radiologically "clean" or contaminated.

Many areas of the reactor (e.g., fan supply room, office spaces, control room, and electrical rooms) had very little radiological contamination. For these areas, surveys were performed and local contamination was removed. These areas were then ready for clean demolition and the resulting waste could be recycled or sent offsite for disposal (e.g., the gypsum roofs were sent to municipal landfills). Figure 5 shows the completed demolition of the fan supply room. Figure 6 shows demolition on the control room in progress.

For contaminated areas of the building, 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. Figure 7 shows demolition in progress on the outer rod room.

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 reactor building was 5,528 m^2 (59,500 ft^2). The final footprint area of the SSE is 1,059 m^2 (11,400 ft^2). Thus, the footprint area of the reactor was reduced by 81%. The footprint area is strictly the at-grade area and does not include the square footage of any above-grade rooms (e.g., sample rooms, ready room, upper electrical room, or exhaust plenums) or below-grade rooms/tunnels to avoid confusion.

The front and rear face elevators were shimmed in place (steel shims placed between the elevator frame and the concrete walls) so the elevator floor could serve as a working platform to access the front and rear faces of the reactor block. The rear face elevator is part of the path for performing surveillance.

The roofs to the north and south water tunnels, gas tunnel, vacuum system room, and the compressor room were removed prior to performing the surveys and sampling discussed in Section 4.9. The piping and equipment in these areas was also removed. This was required due to the extreme congestion and unsafe conditions in the tunnels and the high background in the gas tunnel, vacuum system room, and the compressor room. After the piping, equipment, and debris were removed, these areas were available for the surveying and sampling (as discussed in Section 4.9).

Figure 5. Aerial Photo Showing Fan Supply Room Demolition Completion.

Figure 6. Aerial Photo Showing Control Room Demolition in Progress.

Figure 7. Photo Showing Outer Rod Room Demolition in Progress.

4.7 UTILITY AND DRAIN ISOLATION

4.7.1 Electrical System

The power supply to the entire reactor complex was disconnected in the early stages of the ISS Project. The Hanford Utility Group disconnected the main feed and removed the transformer that had been feeding the building. Temporary power and lighting needs during the project were provided by the MITUS technology, which is one of the technologies demonstrated during the project. MITUS also provided a paging system, emergency lighting, and an alarm system. Figures 5 and 6 show the MITUS trailer and the central monitoring station.

4.7.2 Water Systems

All Hanford Site water supply lines have been isolated to the 105-C Reactor SSE. The two fire hydrants inside the C Reactor fence are still active.

4.7.3 Equipment and Floor Drains

All operations at the 105-C Reactor have been shutdown for many years, and the 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 have been sealed as part of the SSE modifications.

Floors were drained to either the lift station or the pluto crib. Floor drains were checked for liquid and mercury, and the floor drains have been sealed to provide isolation. There were no sanitary sewers inside the SSE. The lift station has been demolished, and the pluto crib (located outside the reactor building) will be demolished during remedial action.

4.8 SAFE STORAGE ENCLOSURE DEMOLITION

Demolition work on the reactor complex was divided between plant forces and the SSE subcontractor per the requirements of BHI 1996c and 1996d. The SSE subcontractor performed the structural demolition on the portions of the reactor complex inside the SSE concrete shield walls. This structure was mainly composed of several levels of steel framing with transite siding (see Figure 8). The SSE subcontractor was also required to remove any large equipment required to place the reactor block into its final SSE configuration. Thus, all the upper reactor equipment listed in Section 4.5 and the F elevator were removed by the SSE subcontractor.

After the elevators were shimmed into place by plant forces (see Section 4.6), the chains, cables, upper drive units, and synchronizing shafts were disconnected and removed. The rear face elevator (D elevator) counterweights were removed and recycled. It was not safe to remove the front face elevator (C elevator) counterweights, so the weights were lowered to the bottom of their shafts (to the water tunnel floor).

Figure 8. Aerial Photo Showing Upper Reactor Roof Demolition in Progress.

Since much of the demolition work by the SSE subcontractor was performed directly above the reactor, the top and front face of the reactor had to be protected from falling debris. This was accomplished by building a wood barrier over the entire set of 45 VSRs and ball hoppers. Scaffolding was built-up to within a few feet of each floor and planking installed to serve as a working platform for demolition and served as additional protection for the reactor (see Figure 9).

4.9 BELOW-GRADE VERIFICATION SURVEYING AND SAMPLING

The goal of the data quality objective (DQO) process is to establish the sampling and analysis design strategy to support decontamination and closeout decisions. The historical information for the 105-C 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. This process along with the closeout criteria and procedures is documented in the DQO summary report (BHI 1998a).

Using the DQO summary report as the basis, a sampling and analysis plan (SAP) (DOE-RL 1997c) 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 (ERC) team develop the SAP. The significant aspects of the SAP include the following:

- Sampling the concrete and underlying soil of the fuel storage basin as the Phase I step in a graded approach to validate and, as necessary, to refine the SAP assumptions
- Shallow and deep zone distinctions for both structures (real property) and soil
- Three alternatives for dispositioning the FSB
  - Demolish and dispose of the entire FSB
  - Demolish the FSB walls to 15 ft below grade
  - Decontaminate the inside surfaces of the FSB.
- The ARARs are consistent with the 100 Area ROD (15 mrem/yr above background and ***Model Toxics Control Act*** [MCTA] for residual contamination levels in structures and soils)
- A distinction is made between "real property" and "non-real property."

For the actual implementation of the SAP, two field implementation guides (FIGs) were developed to provide a clear, concise set of instructions to the radiological survey personnel and samplers in the field. FIG 0100C-IG-G0002 (BHI 1998b) provides the instructions for performing the Phase I sampling in the FSB and the radiological surveys in the remainder of the below-grade structures. FIG 0100C-IG-G0003 (BHI 1998c) provides the instructions for the Phase II sampling in all non-FSB below-grade structures.

Figure 9. Photo Showing Upper Reactor Roof Demolition in Progress.

The survey results and sample analysis results are subjected to a data quality assessment (DQA) to verify that the objectives of the DQO have been satisfied. The data were then used in the Residual Radioactivity Dose Model (RESRAD) and RESRAD-BUILD computer model to verify that cleanup criteria are satisfied. A brief summary of the data and the analysis results are included in a cleanup verification package (CVP) (BHI 1998i). This package is a brief report that summarizes and compares the results against the cleanup criteria. The CVP concludes that the residual contamination in the soil and the below-grade structures is less than the required cleanup standards. There is voluminous data to back up the CVP, and it is included in a technical memorandum and a calculation to the CVP.

4.10 BELOW-GRADE DEMOLITION

Prior to any below-grade demolition, the results of the RESRAD and RESRAD-BUILD analyses discussed in Section 4.9 had to show that the subject below-grade structure was below the cleanup criteria. Figure 10 shows the ceilings of the gas tunnel, compressor room, and vacuum system room demolished (the floors and walls ready for radiological surveys and sampling). Following radiological surveying, sampling, and analysis in the below-grade structures, the facility outside the SSE was demolished to 1 m below grade. The basement structure, located greater than 1 m below grade, was left in place only if the cleanup criteria were satisfied. All below-grade areas were backfilled to eliminate future subsidence.

4.11 FUEL STORAGE BASIN DEMOLITION AND TRANSFER PIT REMOVAL

In 1985, the sediment in the FSB and MEF was moved to the two transfer pits (UNI 1986b). The FSB and MEF walls and floor were cleaned and coated with asphalt emulsion, the sediment was de-watered, and the sediment in the transfer pits were covered with plywood covers (see Figure 11). In 1997, the ISS Project removed the plywood cover from each pit to expose the top surface of the sediment. For as low as reasonably achievable (ALARA) and cost reasons, the Project decided that the sediment should remain in the pits and should be removed as two large monoliths in lieu of vacuuming the sediment into 55-gallon barrels (see Sections 7.2 and 10.0).

To achieve this objective, grout caps were placed over the sediment, and sand was placed over the grout cap to protect the grout cap from falling debris.

Figure 12 is an old photograph depicting the wood planking and monorail system in the FSB. After the transfer pit grout cap and protective sand were in place, the above-grade FSB and MEF were demolished. The contamination levels on the FSB and MEF walls were too high to satisfy the cleanup criteria in the SAP; therefore, the walls had to be decontaminated or demolished. Cost, safety, and ALARA comparisons clearly demonstrated that demolition of the FSB and MEF walls to the -15-ft elevation was the preferred alternative. Thus, all walls were demolished to a minimum of 15 ft below grade. See Figure 13 for FSB below-grade demolition in progress. Two areas were demolished to the bottom of their foundations:

- The four MEF sumps
- The east wall of the FSB (for better access to the transfer pits).

Figure 10. Photo Showing Below-Grade Structure Roof Demolition.

Figure 11. 1985 Photo of Transfer Pit Protective Cover.

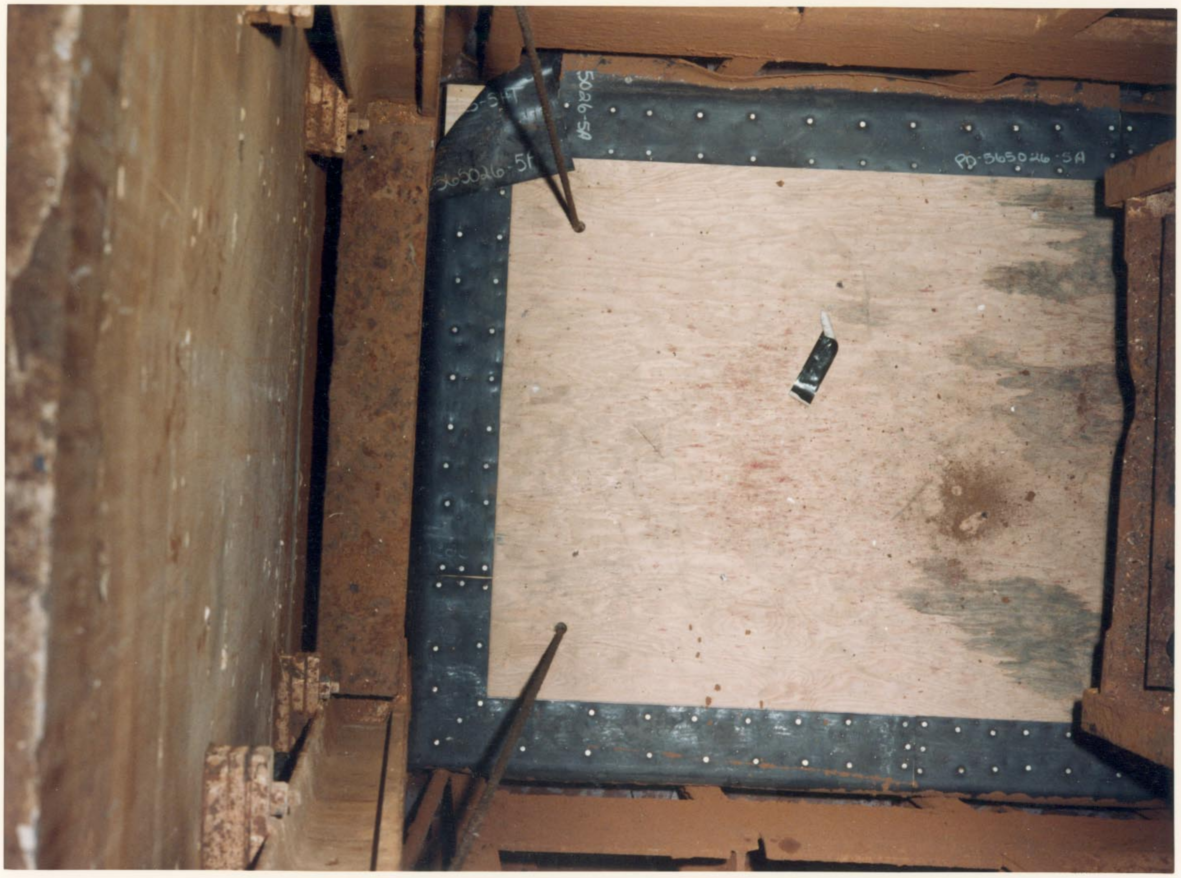


Figure 12. Old Photo Showing the FSB Wood Planking and Monorail System.

Figure 13. Photo of FSB Below-Grade Demolition in Progress.

After the east wall of the FSB was demolished with heavy equipment, the upper walls of the transfer pits were demolished down to the top of the protective sand layer. Diamond wire concrete cutting was then used to cut the transfer pits down to the final monolith size. Both monoliths were painted to fix any loose contamination that may exist. The monoliths were lifted using an FMC LinkBelt Model LS-518 crane and were transported to the ERDF one at a time (see Figure 14). At the ERDF, each monolith was pulled off the transport with a D8 Cat using specially prepared lubricated skid plates and a prepared disposal pad.

4.12 INTERFACE AT THE 190-C TO 105-C WATER TUNNELS

In preparation of the 105-C Reactor below grade demolition, the water tunnel piping and conduit running from 190-C to 105-C were severed at the first pipe support west of the 105-C Building. Following backfill operations, the backfill in each water tunnel was stabilized with 5 yd^3 of concrete to prevent possible future subsidence in this area.

4.13 SITE RESTORATION

Upon completion of the demolition activities, the area was backfilled with a minimum of 1-m-thick soil/aggregate surface layer placed over the footprint of the facility and graded to match the surrounding terrain. The backfill was obtained from the 100-B Area and 100 Area Fire Station borrow pits. Figures 15 and 16 show views of the site after all site restoration activities were completed.

4.14 INTERFACE WITH REMEDIAL ACTION

Meetings were held with the 100-B/C Remedial Action Project to coordinate the interface point between the D&D and remedial action projects. In general, it was agreed that D&D would remove drain lines to approximately 1 m outside the boundary of the building, and the two process sewers (effluent lines) would be removed up to the expansion box (approximately 10 ft from the building edge). Additionally, drain/effluent piping exposed during excavations would be removed by the 105-C ISS Project (this resulted in significantly more pipe being removed than originally anticipated). An interoffice memorandum (BHI 1998k) provides the final interface points for the Remedial Action Project.

4.15 INTERFACE WITH SURVEILLANCE AND MAINTENANCE

During the ISS Project, the 105-C Reactor was temporarily under the control of the D&D Projects to perform the ISS work. At the completion of the ISS Project and the completion of the endpoint criteria, the 105-C Reactor was reassigned to the S&M Project. This change of control was accomplished by a memorandum of understanding (BHI 1998h).

Figure 14. Photo of FSB Transfer Pit Monolith Lift.

Figure 15. Aerial Photo of Completed SSE (Looking Northeast).

Figure 16. Aerial Photo of Completed SSE (Looking North).

A S&M plan (DOE-RL 1998) was developed as one of the endpoint criteria. The S&M Project has estimated that their cost will be $5,000 per year for yearly radiological surveys and tumbleweed removal. Every fifth year the S&M cost will be $16,000 in order to perform the surveillance of the 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).

4.16 DEMOBILIZATION

Trailers, tools, equipment, and miscellaneous items were removed from the project site during demobilization activities that occurred in September 1998.

5.0 COST AND SCHEDULE

5.1 SCHEDULE

Some key dates for the 105-C ISS Project include the following:

• Trailer mobilization initiated	August 1996
• D&D work started	October 1996
• Awarded SSE subcontract	December 1997
• FSB disposition letter to EPA	December 1997 (Tri-Party Agreement Milestone)
• Completed 20 technology demonstrations	March 1998
• Regulator SAP approval	May 1998
• Completed SSE roof	June 26, 1998
• Provided S&M plan to regulators	July 30, 1998 (Tri-Party Agreement Milestone)
• Transfer pit monoliths removed	September 2, 1998
• ISS work completed	September 30, 1998 (Tri-Party Agreement Milestone)

5.2 COST

The total ISS Project cost (exclusive of the 1994 characterization task) is summarized by fiscal year. The tasks associated with each fiscal year are briefly described in Section 5.1. Approximately $7 million of the total cost summarized below was related to the technology demonstration effort:

N 1996	4,042K
N 1997	10,500K
N 1998	12,791K
N 1999	453K (estimate at completion)
	$27,786K

The SSE subcontractor's costs associated with FY 1998 and 1999 are summarized below:

N 1998	2,426K
N 1999	3 19K (estimate at completion)
	$2,745K

6.0 RECYCLED MATERIAL AND WASTE DISPOSAL

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

6.1 RECYCLING AND WASTE MINIMIZATION

Materials listed below were recycled during the 105-C Reactor ISS Project:

Steel	400 tons
Non-ferrous material	5,000 lbs
Lead	40 tons
Mercury	1 gallon
Wood	Re-used or sent to the City of Richland landfill for composting
Exhauster	Recycled from the 200 East Area (to be used for future exhausting of the reactor SSEs, as required)
Miscellaneous equipment and tools	Transferred to the 105-B Reactor (to be used for B Reactor Museum displays)
Load centers	20 recycled from Washington Public Power Supply System Reactor #1, modified, and used in the kiosks

The 105-C Reactor field crew loaded material into recycle trucks, which was then sold for salvage. The project has successfully demonstrated good waste minimization practices where applicable.

6.2 WASTE DISPOSAL

Approximately 15,600 tons of low-level waste was disposed of at the ERDF. The two 70-ton transfer pit monoliths are included in this total.

The deteriorating roofs had significant in-leakage from precipitation. Additionally, water was used throughout the project as a dust suppression method (this water drained to the lift station). A total of 215,000 gallons of water was pumped out of the lift station during various pump-out campaigns and was shipped to the Effluent Treatment Facility for disposal.

Nonradiologically contaminated asbestos was disposed of at the Roosevelt, Washington, landfill.

7.0 OCCUPATIONAL EXPOSURES

7.1 PERSONNEL INJURIES

During the duration of the project there were 0 lost work days and 14 Occupational Safety and Health Administration recordable cases. A total of approximately 276,300 hours (manual and non-manual) were spent on the entire project.

7.2 PERSONNEL RADIOLOGICAL EXPOSURES

There were no personnel skin contaminations to personnel during the entire project. This was achieved, in part, due to the technology demonstrations performed on disposable seam-sealed sack suits (see Section 9.3). Seven suits (6 disposable and 1 baseline cotton) were evaluated and two of the suits' (one for winter wear and one for summer wear) were judged superior and deployed on all remaining work. The evaluation was based on a wide range of criteria (three of the criteria included radiological effectiveness, toughness, and worker comfort).

All work was performed based on the ALARA objective. The dose goal for the entire 105-C Reactor ISS Project was based on Radiological Engineering quarterly dose estimates of upcoming work:

Dose goal (excluding the transfer pits)	7.2 person rem
Dose goal (transfer pits)	15.2 person rem
Total Project goal	22.4 person rem

The total combined dose of all 105-C Reactor personnel was approximately 3.4 person rem for the entire project duration (15% of the goal). This goal was achieved through the excellent

ALARA work of the entire Project team, with special credit to the radiological engineer, RCT supervisors and leads, RCTs, and D&D workers. The Project team also implemented an innovative method for handling the high-dose sediment in the FSB transfer pits (see Section 4.11). Vacuuming the sediment into drums was the original baseline method for removing the sediment from the pits. Following a plutonium uptake incident (see Section 10.0). The Project team had a meeting to discuss possible ways to remove the sediment. Three alternatives were evaluated for both cost and dose, and the monolith option was the clear choice based on both cost and dose. The estimated doses for each of the three options were as follow:

•	Vacuum the sediment into drums	113.5 person rem
·	Shovel sediment into drums with vacuum assist	71.0 person rem
·	Removal of the pits as one-piece monoliths	15.2 person rem.

8.0 SAFE STORAGE ENCLOSURE

The Hanford Site's 105-C Reactor was chosen as the first reactor to be placed into long-term safe storage due to advanced deterioration on roof sections of the reactor building that would require major maintenance expenditure. The primary objective of the 105-C Reactor ISS Project is to provide storage up to 75 years with minimal maintenance required. Design objectives are summarized as follow:

- Safe storage for up to 75 years
- No credible releases of radionuclides to the environment under normal design conditions
- Interim inspection required only on a five-year frequency
- SSE configuration will not preclude or significantly increase cost of any final decommissioning alternative.

8.1 ROOF

After the upper reactor demolition was completed, new anchor bolts were grouted into the top of the concrete shield walls and new structural framing was installed. Galvalum-coated steel roofing (22-gauge) and siding (24-gauge) was then attached to the framework. Galvalum (also referred to as 55% Al-Zn) is a coating that contains 55% aluminum and 45% zinc. The excellent corrosion resistance of galvalum is achieved by combining the barrier protection of an aluminum coating with the galvanic protection of a zinc coating. Refer to Section 11.1 for structural concrete, steel, and roofing/siding drawings.

8.2 ELECTRICAL SYSTEM

The 105-C Reactor SSE has permanent lighting installed along the surveillance route located on the lower level, at-grade, and upper levels and stairwells. All facility personnel and visitors must carry a light source for SSE rooms that are unlit and for egress if the lighting system should fail.

The 1 10-volt-alternating current (VAC) receptacles are located inside and outside the SSE utility room and at all levels inside the SSE from the basement at an elevation of –17.5 ft, up to the top of the reactor at elevation 45 ft. Refer to Section 11.2 for power and lighting drawings.

8.3 REMOTE MONITORING SYSTEM

The 105-C Reactor SSE is configured with two temperature sensors (resistance temperature detectors) and a flooding sensor (float switch), plus installed spares for each sensor.
A temperature sensor is located at grade level on the south side of the front face work area, near the reactor front face. The second temperature sensor is located at the south side of the 45-ft level (top of the reactor) near the F elevator. The flooding sensor is located at the south side of the -17.5 ft basement level near the stairwell. Refer to Section 11.3 for instrumentation drawings.

The 105-C Reactor remote monitoring system sensors are controlled through a programmable logic controller (PLC) powered from a utility room distribution panel. Signals are transmitted (via modem and a dedicated phone line) and continuously displayed at the operation supervisors workstation (located in the 27 1-U Building).

A loss of continuity to a resistance temperature detector will result in a loss of signal to the monitoring station in the 27 1-U Building. The flooding sensor is normally closed circuit, so a loss of continuity failure will result in a flooding alarm at the monitoring station at the 271-U Building. The flooding circuit is directly wired to the PLC. The temperature monitoring circuits operate on a 4-20 mA current loop from transmitters. The transmitters are supplied with 120 VAC for operating power. In the event of instrument failure, monitoring for both the temperature sensors and the flooding sensor can be manually switched to previously installed spares from the SSE utility room, eliminating the need to make a special entry into the SSE. The sensors inside the SSE are reliable, but if replacements are necessary, they can be accomplished during regularly scheduled surveillance periods.

8.4 VENTILATION

The 105-C Reactor SSE is a deactivated facility that is uninhabited and locked during storage, except during S&M activities. Many of the reactor's components were removed as part of the stabilization effort for SSE. Remaining equipment and components that contain radiological inventory have been sealed during the implementation of the SSE Project. Many accessible areas of the building's interior have had a fixative applied to limit the spread of contamination.

No mechanical ventilation of the building is necessary either during normal storage or during periodic surveillance. A provision has been made to ventilate the facility with exhaust fans for entry and/or maintenance. The 105-C Reactor SSE has been designed to use a 9,000-ft^3/min portable exhauster for building exhaust ventilation for non-routine maintenance. If building exhaust ventilation is required, the interior access door to the SSE shall be placed in the open position. Air is drawn into the SSE through the utility room vents. The size of these openings is sufficient to provide proper flow even when the exterior door to the SSE utility room is closed.

A ventilation system flow diagram can be found on drawing 0100C-DD-M0032 (see Section 11.4). The exhauster draws air through flanged, stainless-steel vent openings located on the north side of the SSE. When the portable exhauster is not connected, the connection point is sealed with bolted flanges. Additionally, welded stainless-steel security bars are provided behind the bolted flanges if the flanges should have been removed maliciously.

8.5 SECURITY

The access to the 105-C Reactor SSE is through the utility room. During periods of storage, the door to the SSE (located inside the utility room) will be locked and spot welded shut. The door to the utility room will be locked except during routine S&M activities. The SSE is entered only for periodic S&M activities. The 3- to 5-ft-thick concrete walls and the welded door provide the security barrier for the facility; therefore, a locked fence around the SSE is not required. There are no intrusion alarms or routine security patrols for the 105-C Reactor SSE. The Hanford Patrol continues to provide routine security patrols in the vicinity as part of their patrol throughout the 100 Areas. There are two other welded doors into the SSE (the inner rod room and the rear face) to allow greater flexibility if maintenance is required, but these doors will not be used as entrances for typical surveillance activities.

9.0 INNOVATIVE TECHNOLOGY DEMONSTRATION

9.1 OVERVIEW AND OBJECTIVES

A partnering of DOE Environmental Restoration (EM-40) and Science and Technology (EM-50) funded the 105-C Reactor ISS Project. Thus, the 105-C Reactor ISS Project became one of three large-scale technology demonstration and deployment projects (LSDDP) selected by the U.S. Department of Energy-Headquarters (DOE-HQ) D&D focus area (DDFA). A major goal of this project is to identify and demonstrate new and innovative D&D technologies that will benefit cost, schedule, and safety, and have potential for general use at many DOE facilities.

The LSDDP concept is designed to demonstrate the benefits of using a suite of improved D&D technologies to deactivate and/or decommission facilities owned by EM-40 and EM-60 using the following criteria:

- The large-scale demonstration should have a significant visible impact, such as removal of a building or structure.
- The large-scale demonstration should prove significant benefits of using a suite of improved technologies compared to baseline technologies.

- The large-scale demonstration should be conducted at a scale that is convincing to potential users.

- The large-scale demonstration project should assist DOE in accomplishing its ongoing and planned deactivation and decommissioning activities.

- Each of the large-scale demonstration projects should be managed and conducted by D&D integrating contractor who will transfer the experience and expertise gained to similar D&D jobs at other DOE facilities and commercial jobs.

The 105-C Reactor ISS Project provides an excellent resource for accomplishing the intent of EM-50 and for demonstrating improved technologies. The objectives are to evaluate, demonstrate, and select preferred technologies that will lower life-cycle costs, health and safety risks, detrimental risk to the environment, quantity of waste requiring disposal, secondary waste, and worker exposure during the ISS Project and future S&M activities. The goal is to allow for one baseline and one or more new/improved technologies that will facilitate a given scope of work and not unduly impact the cost or schedule for completion of the project.

These demonstrations provide performance evaluations of new and emerging technologies against current (baseline) technical approaches, and establish partnerships with private industry to develop further new technologies and technical approaches to cost-effectively manage DOE D&D legacy.

It was proposed that this new approach be accompanied by the intensive demonstration and use of innovative D&D technologies to lower the life-cycle costs, accelerate schedules, reduce worker exposure, and other benefits. The type of technologies associated with phases of this new approach include characterization, decontamination, dismantlement, demolition, waste minimization, facility monitoring and surveillance, and safety enhancements.

9.2 LARGE SCALE TECHNOLOGY DEMONSTRATION AND DEPLOYMENT PROJECT PURPOSE

The purpose of the LSDDP was to integrate a major Hanford Site ISS project with demonstrations of more than 20 new technologies to identify the best available technologies for D&D of the 105-C Reactor and the remaining seven Hanford Site reactors. This integrated safe storage and technology demonstration project will provide DOE a major opportunity to achieve real progress at the Hanford Site in accomplishing highly visible D&D activities. The new D&D technologies can be categorized as follow:

- Characterization
- Decontamination
- Demolition
- Waste disposal and minimization
- Facility stabilization
- Worker health and safety.

This deployment project provides the clear identification of technologies that will be optimal for preparing the remaining seven surplus production reactors at the Hanford Site for similar low-cost ISS, or for D&D tasks at other DOE complex facilities and commercial sites.

9.3 TECHNOLOGY DEMONSTRATION RESULTS

The objectives of the LSDDP were to demonstrate the benefits of 20 improved D&D technologies to deactivate and/or D&D facilities that are owned by EM-40 and the Nuclear Material and Facility Stabilization Division (EM-60). The 20 technology demonstrations included the following:

- Laser-Assisted Ranging and Data (LARADS)
- Gamma-Ray Imaging
- Position-Sensitive Radiation Detector
- Self-Contained Pipe Cutting Shears
- Mobile Integrated Temporary Utility System (MITUS)
- STREAM
- Heat Stress Monitoring System
- Seam-Sealed Sack Suit
- Wireless Remote Monitoring
- 2-D Linear Motion System
- High-Speed Clam Shell Pipe Cutter
- Concrete Shaving
- Concrete Diamond Grinder
- Concrete Spaller
- Reactor Stabilization
- Automatic Dust Suppression System
- RESRAD-BUILD
- Nitrogen Cooled Diamond Wire Cutting
- Compact Subsurface Discreet Sampler
- Lead Decontamination (Chemical).

Thirteen of the above technologies have shown to be successful and have been added to the D&D toolbox. Brief summaries and results can be obtained from the technology factsheets. For in-depth evaluations, refer to the Innovative Technology Summary Reports. The following Internet sites provide information on the technologies performed during the 105-C Reactor ISS Project and other technologies demonstrated across the DOE complex:

ERC Home Page	http://www.bhi-erc.com
ERC Home Page	http://ftp.bhi-erc.com
FETC Home Page	http://www.fetc.doe.gov.

10.0 LESSONS LEARNED AND RECOMMENDATIONS

A plutonium uptake occurred during the removal of the south plywood cover in the FSB transfer pits (BHI 1997i). One D&D worker was assigned a final internal dose for 1997 of 120 mrem committed effective dose equivalent. A similar occurrence at Building 224-B resulted in Preliminary Notice of Violation (PNOV) EA-97-08 (DOE 1997). The violations associated with these events were classified as Severity Level III, which is the lowest of the three levels because of the small exposures involved, but the incidents could have been much worse if greater quantities of nuclear material were involved. The PNOV EA-97-08 reply (BHI 1997g) resulted in several actions and lessons learned, as summarized in BHI 1997h.

One of the main lessons learned during the 105-C Reactor ISS Project is that the D&D work conducted inside and outside the SSE should have been essentially completed prior to the SSE subcontractor starting work in the field. It may be necessary to have the D&D work essentially completed prior to the pre-bid walkdown so the bidders have a clear understanding of the remaining scope of work. For a complete list of lessons learned during the 105-C Reactor ISS Project, refer to BHI 1998j.

11.0 DRAWINGS

The following drawings show the as-built configurations for the 105-C Reactor SSE.

11.1 STRUCTURAL

Drawing No.	Title
0100C-DD-C0001	Structural Concrete, Plan Below El. 0'-0"
0100C-DD-C0002	Structural Concrete, Plan at El. 0'-0"
0100C-DD-C0003	Structural Concrete, Plan at El. 15'-0"
0100C-DD-C0004	Structural Concrete, Plan at El. 40'-0"

The following vendor drawings show the SSE framing and roofing/siding:

Roof System Design Drawings:
0105C-SC-G0022-05-003-01 through –09

Framing Shop Detail Drawings:
0105C-SC-G0022-06-001-01 through –43

Joist and Girder Shop Detail Drawings:
0105C-SC-G0022-07-001-01

Roofing and Siding Shop Detail Drawings:
0105C-SC-G0022-08-001-01 through –30

11.2 ELECTRICAL

Drawing No.	Title
0100C-DD-E0019	SSE Permanent Power and Lighting System, One-Line Diagram
0100C-DD-E0022	SSE Power and Lighting System, Electrical Arrangement
0100C-DD-E0023	SSE Power and Lighting System, Electrical Arrangement
0100C-DD-E0027	Permanent Electrical Distribution System Plan, Section and Details
0100C-DD-E0081	100-C Area 13.8 KV Overhead Line and Service Distribution Transformer & Cut Out Pole Details
0100C-DD-E0088	100-C Area 13.8 KV Overhead Line and Service Distribution Center Layout
0100C-DD-E0089	100-C Area 13.8 KV Overhead Line and Service Distribution Electrical, One-Line Diagram

11.3 INSTRUMENTATION

Drawing No.	Title
0100C-DD-J0021	SSE Control and Monitoring System, Field Device List and Loop Diagram
1000C-DD-J0044	SSE Control and Monitoring System, Instrument Location Plan

11.4 MECHANICAL

Drawing No.	Title
0100C-DD-M0032	SSE Ventilation System, Flow Diagram
0100C-DD-M0038	Reactor Ball Hopper Vent, Mechanical

12.0 REFERENCES

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