BHI-01663
Rev. 0

105-DR 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.

100-DR-2

BHI-01663
Rev. 0
OU: N/A
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title: 105-DR Reactor Interim Safe Storage Project Final Report

Approval: M. A. Mihalic, Task Lead

M A Mihalic 1.15.03

Signature Date

R. P. Henckel, Project Manager

RP Henckel 1-15-03

Signature Date

BHI-DIS 1/20/2003 dmc

The approval signatures on this page indicate that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

BHI-01663
Rev. 0

105-DR Reactor Interim Safe Storage Project Final Report

Author

P. W. Griffin
Bechtel Hanford, Inc.

Date Published

January 2003

TABLE OF CONTENTS

Table of Contents

FIGURES

TABLES

Table of Contents

ACRONYMS

ALARA	as low as reasonably achievable
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CMU	concrete masonry unit
CVP	cleanup verification package
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQO	data quality objective
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
Ecology	Washington State Department of Ecology
FIG	field implementation guide
FSB	fuel storage basin
FY	fiscal year
ISS	interim safe storage
LSFF	105-DR Large Sodium Fire Facility
MITUS	Mobile Integrated Temporary Utility System
PCB	polychlorinated biphenyl
RCT	radiological control technician
RESRAD	RESidual RADioactivity dose model
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
S&M	surveillance and maintenance
SAP	sampling and analysis plan
SSE	safe storage enclosure
TSD	treatment, storage, and disposal
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
VAC	volt-alternating current

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 decontamination and decommissioning (D&D) of the 105-DR 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

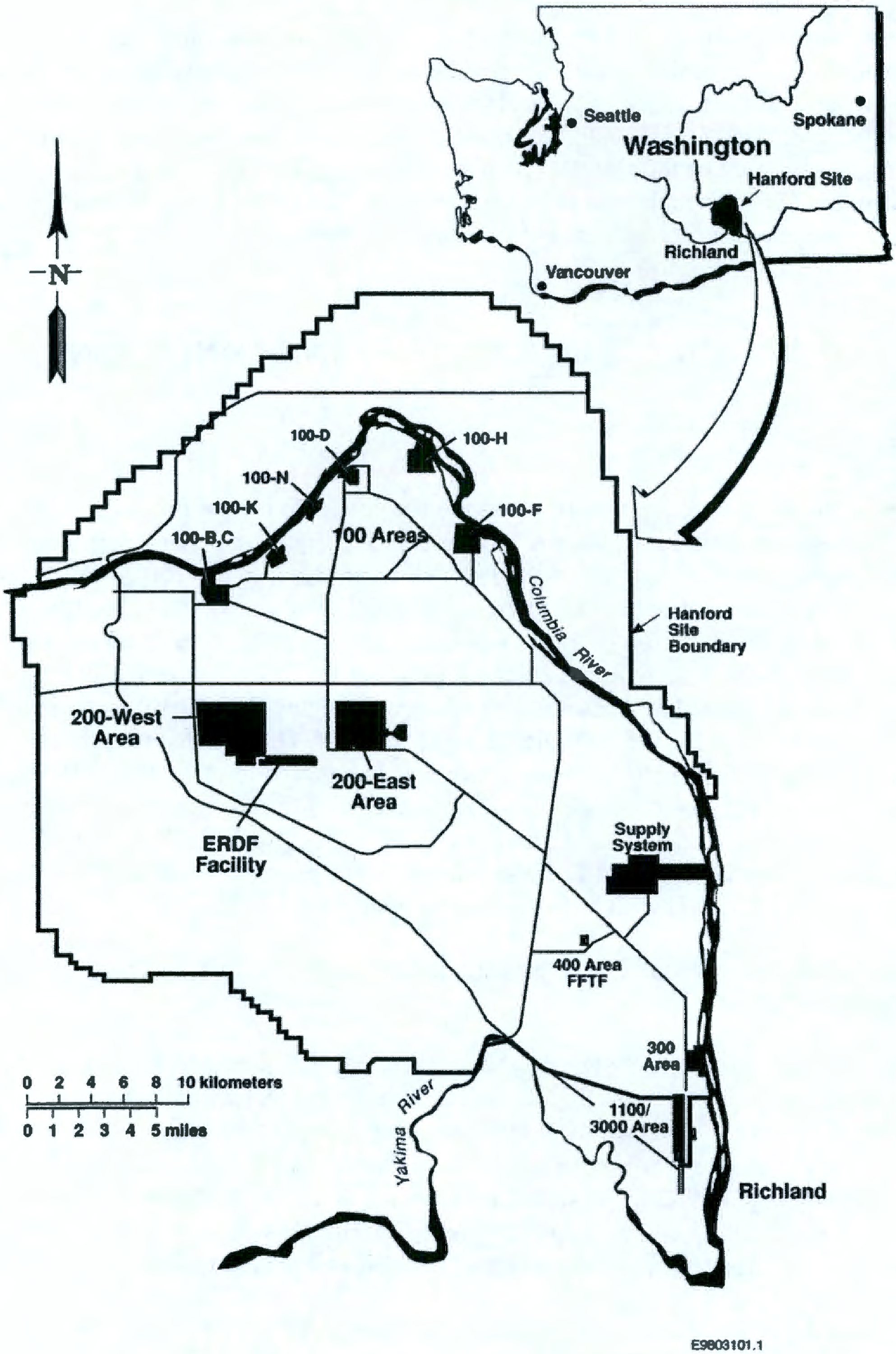
2.1 HISTORY

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 105-DR Reactor facility is located in the 100-D/DR Area of the Hanford Site, as shown in Figure 1. Construction of the 105-DR Reactor was initiated in December 1947. Initial startup of the 105-DR Reactor was achieved on October 3, 1950. 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-DR Reactor. The 105-DR Reactor was shut down on December 30, 1964. Deactivation of the reactor was completed in early 1971. Between 1972 and 1986, the southwest portion of the 105-DR Reactor building was used as a research laboratory known as the 105-DR Large Sodium Fire Facility (LSFF). The LSFF occupied the former ventilation supply fan room and was established to provide a means of investigating fire and safety aspects associated with large sodium or other metal alkali fires.

In the years following deactivation, several significant cleanup efforts were completed at the 105-DR Reactor complex:

- In 1985, the fuel storage basin (FSB) and all other adjoining basins were cleaned of sediment and the basin surfaces were stabilized with an asphalt emulsion to approximately 2.4 m (8 ft) above the basin floor. The sediment was removed at the 105-D and 105-DR FSBs for transport to the low-level waste disposal site in the 200 West Area. The 105-B and 105-C FSB sediment was moved to the transfer pit (which is 1.5 m [5 ft] deeper than the FSB) and capped with a plywood cover. The 105-F and 105-H FSB sediment was stabilized in place in 1970 with approximately 6 m (20 ft) of soil backfill and was left in place (UNI 1986).
- In 1995, the LSFF *Resource Conservation and Recovery Act of 1976* treatment, storage, and disposal (TSD) unit was partially clean closed as documented in *Revision 6 of the Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Hanford Site* (Ecology 2001).

Figure 1. Hanford Site Map.



- On August 14, 1999, the 105-DR Reactor exhaust stack (116-DR) was demolished including the 119-DR Exhaust Stack Air Sampling Building, as described in a Bechtel Hanford, Inc. (BHI) project report (BHI 1999d).
- In 2003, demolition work is planned on the adjoining 117-DR Exhaust Filter Building (as discussed in Section 4.1).

2.2 FACILITY DESCRIPTION

The 105-DR Building was 82.7 by 95.8 by 32 m (271.3 by 314.3 by 105 ft) in height. 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 Figures 2 and 3. The massive reinforced-concrete walls surrounding the reactor are 0.9 to 1.5 m (3 to 5 ft) thick. The upper portion of the building and many of the at-grade ancillary rooms were steel framed, enclosed with either sheet metal or concrete masonry unit (CMU) blocks. The existing roof panels were removed from the process area, D elevator, and front-face work area in 1994 and 1995 and were replaced with steel decking, secured to existing roof framing and concrete walls. The new steel roof decking was covered with foam and two applications of silicon rubber. An aerial photo looking southwest is shown in Figure 4. A ground-level photo looking northwest (toward the FSB, transfer bay, and ventilation fan room) is shown in Figure 5.

2.3 DECOMMISSIONING DECISIONS

Since deactivation, the 105-DR Reactor has been in a condition of minimum surveillance and maintenance (S&M). 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 *Federal Register* 48509). The ROD alternative selected 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 105-C Reactor was the first reactor to complete ISS in September 1998 (BHI 1998a). The 105-DR and 105-F Reactors were selected to be the next follow-on reactors to be placed in ISS to reduce the costly burden of maintaining and cleaning up inventory of the aging reactors.

The plan for the ISS of the 105-DR Reactor includes removing all portions of the reactor facility outside of the reactor block shield walls. The areas to be removed included the FSB, outer rod room, control room, electrical room, switchgear room, lunch room, office space, fan supply and exhaust rooms, sample rooms, ready room, 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 the design and construction is discussed in detail in Section 8.0.

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

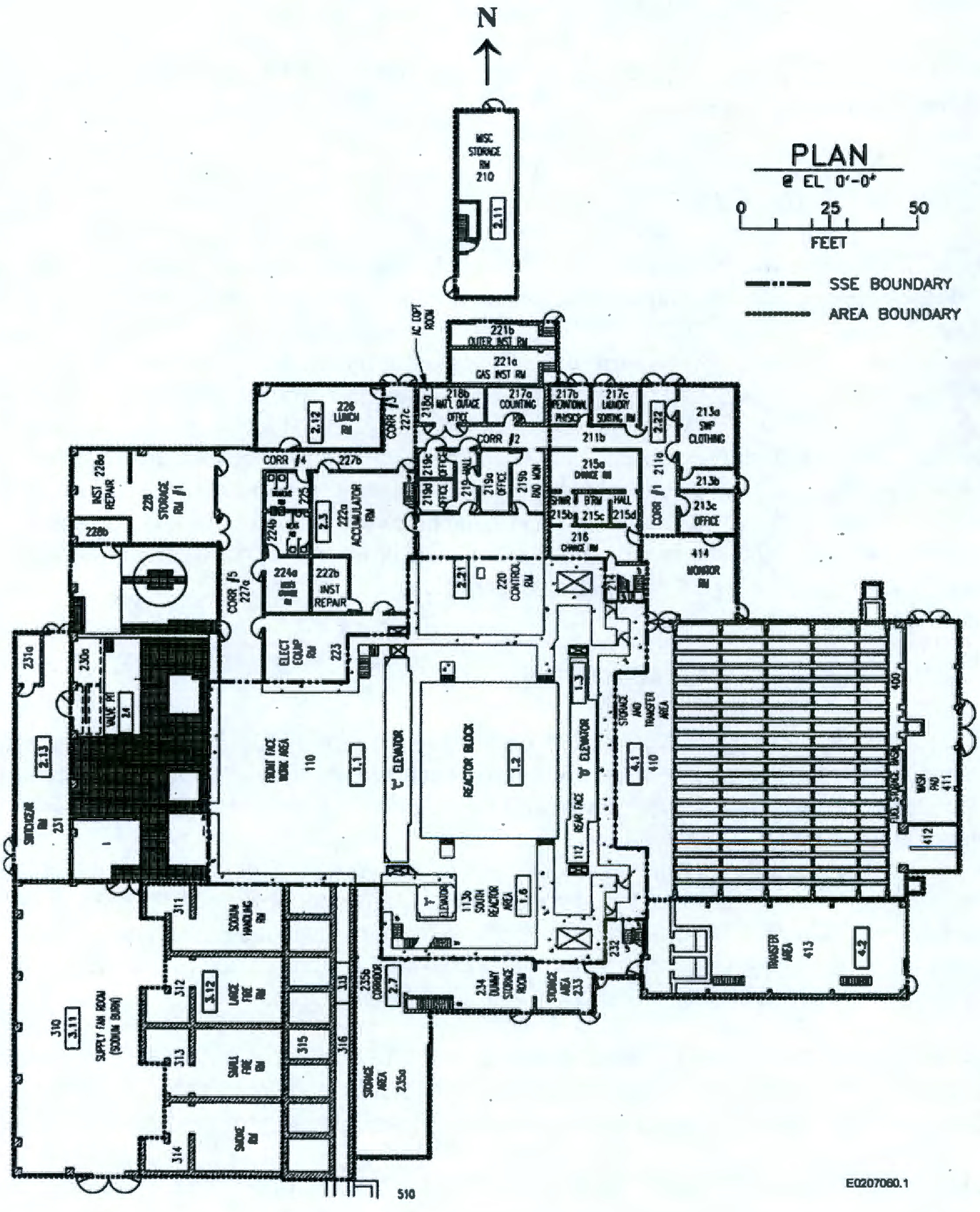
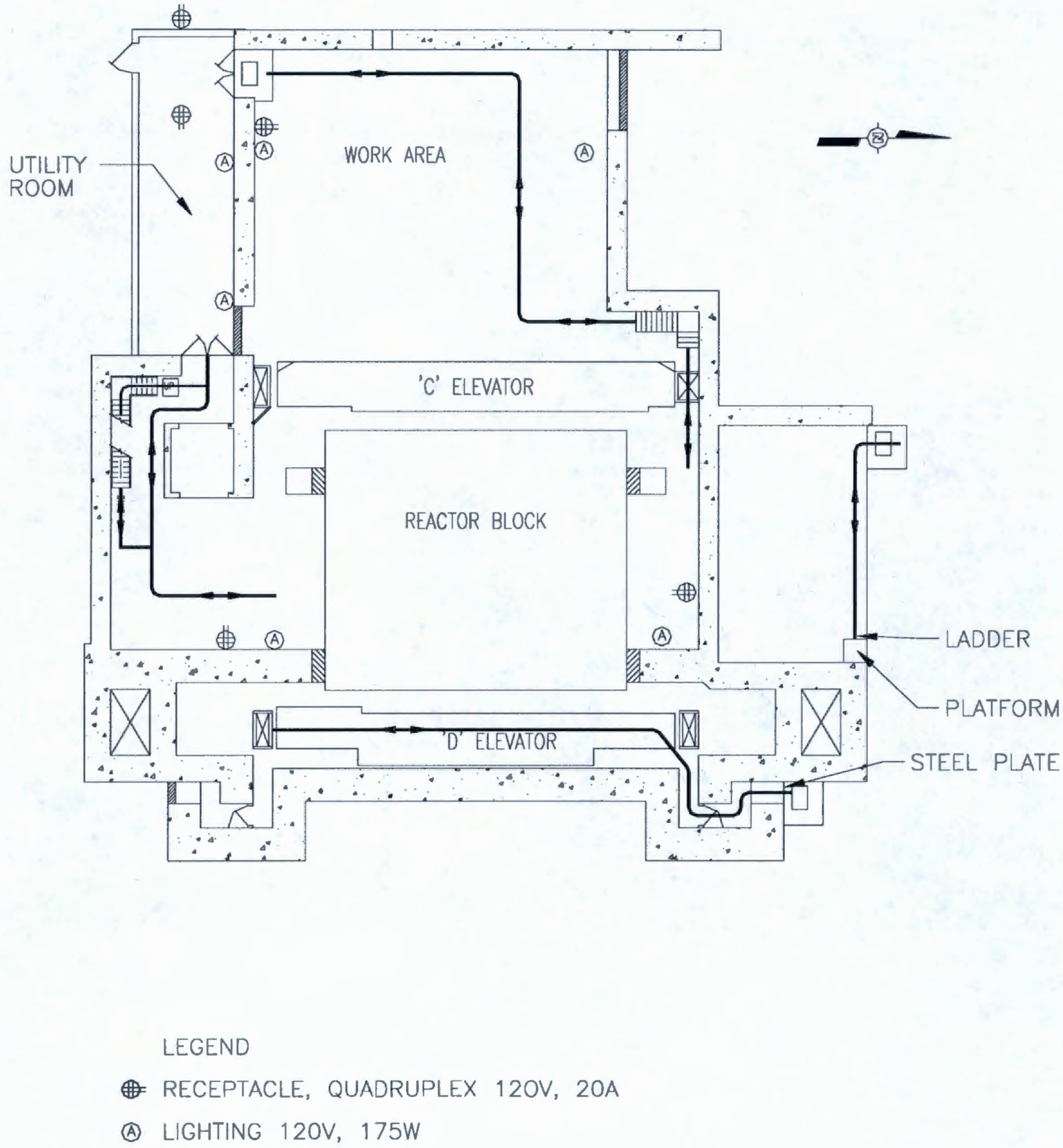


Figure 3. General Plan of 105-DR Safe Storage Enclosure at Ground Level.



G:\Figures\100DReactor0_0.dwg

Figure 4. Pre-1998 Aerial Photo (Looking Southwest).

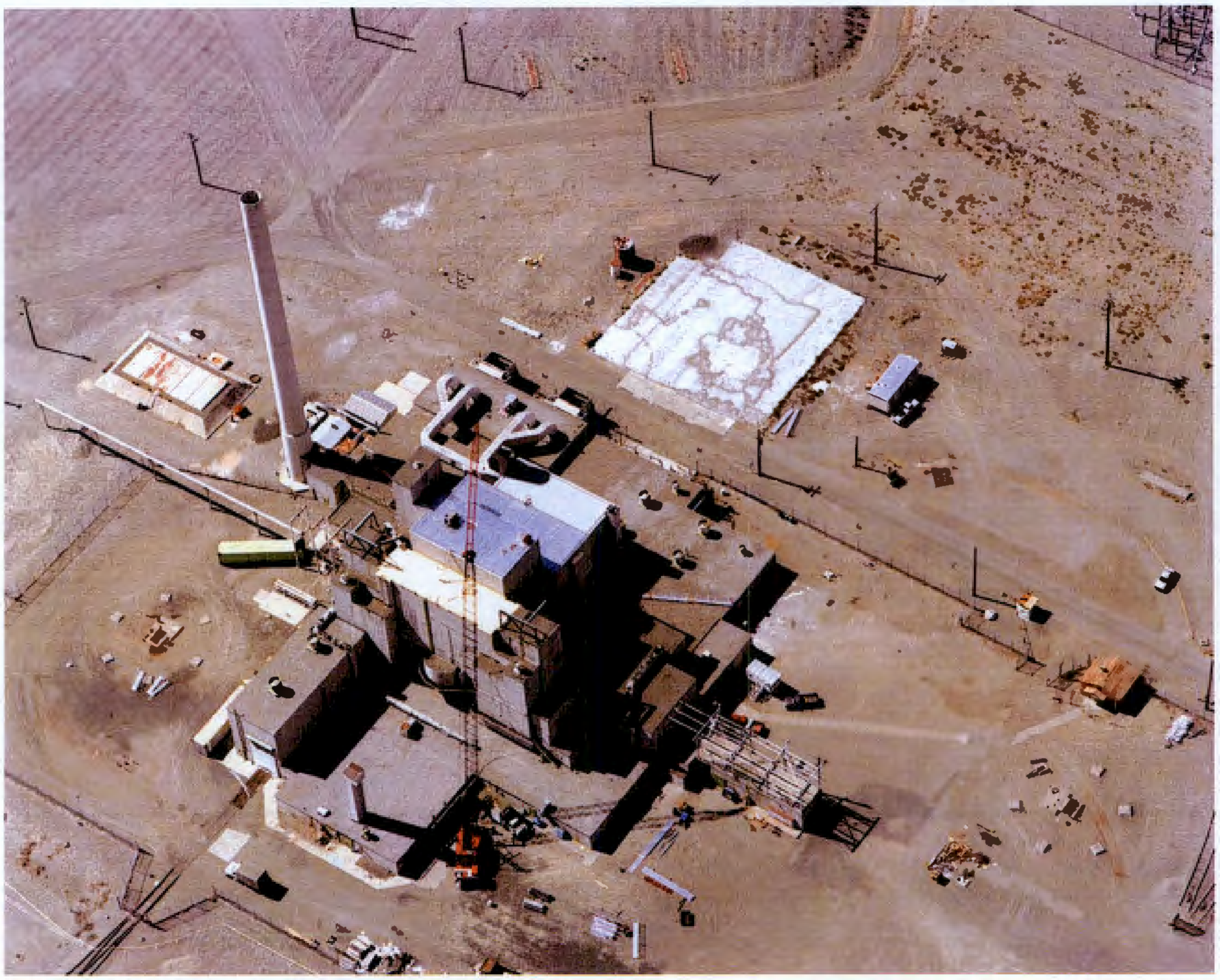


Figure 5. Pre-1998 Ground-Level Photo (Looking Northwest).

The planning process for the 105-DR 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-DR ISS Project was the second D&D Reactor 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. 1998b) was revised to reflect the planning process employed by the 105-DR ISS Project, including milestones for 105-DR and the follow-on reactors.

3.0 ENGINEERING EVALUATION/COST ANALYSIS

Fiscal year (FY) 1998 activities included developing an alternative for conducting a non-time-critical removal action evaluation in the *Engineering Evaluation/Cost Analysis for the 105-DR and 105-F Reactor Facilities and Ancillary Facilities* (DOE-RL 1998a). The engineering evaluation/cost analysis (EE/CA) resulted in the recommendation to decontaminate and demolish the contaminated reactor buildings (except for the reactor blocks and shield walls) and the ancillary facilities, and to construct a SSE over the reactor. The recommendation was approved in an action memorandum (Ecology et al. 1998a) signed by Ecology, EPA, and DOE. The DOE is the agency responsible for implementing the removal actions in the 105-D/DR and 105-F Areas. Ecology is the lead regulatory agency for facilities in the 100-D/DR Area, and EPA is the lead regulatory agency for facilities in the 105-F Area.

4.0 PROJECT ACTIVITIES

4.1 ENGINEERING AND PERMITS

A removal action work plan (DOE-RL 2002a) was prepared to satisfy the requirements in the action memorandum (Ecology et al. 1998a) outlining how compliance with and enforcement of applicable regulations will be achieved for cleanup of the 105-DR LSFF TSD unit, ancillary building demolition, and ISS of the reactor buildings. Additionally, it serves as the decommissioning plan and project management plan for the 105-DR and 105-F ISS Projects. The removal action work plan was prepared in accordance with Section 7.2.4 of the Tri-Party Agreement (Ecology et al. 1998b) and approved by DOE-RL and the regulators.

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

- Complete D&D of the four ancillary facilities
  - 116-D exhaust air stack
  - 116-DR exhaust air stack
  - 117-DR Exhaust Filter Building
  - 119-DR Exhaust Air Sample Building
- Complete closure of the 105-DR LSFF TSD unit
- Modify structures, as necessary, and construct ISS enclosures for the 105-DR and 105-F Reactor Buildings
- Remediate waste sites within the reactor footprint or provide for deferral to the Remedial Action Waste Disposal Program (with approval from the lead regulatory agency)
- Manage and dispose of all waste generated during these actions.

The action memorandum (Ecology et al. 1998a) specifies other deliverables that must be submitted by DOE to the lead regulatory agencies for review and approval. The removal action work plan describes the deliverables and provides a schedule for meeting the deliverables. The specific deliverables specified in the action memorandum and discussed in the removal action work plan include the following:

- Sampling and analysis plans (SAPs) for waste and soil characterization and disposal (DOE-RL 1998b, 1998c)
- Treatment plans if treatment is necessary prior to waste disposal in the ERDF
- Verification SAPs for soil and below-grade structures (see Section 4.9)
- Cleanup verification package (CVP) (planned for completion in FY 2003).

The intent of the removal action work plan (DOE-RL 2002a) 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-DR and 105-F ISS and ancillary building project schedule, which encompasses the workscope through project completion, presents the logical progression of events and estimated durations for each activity.

The removal action objectives were as follows:

- To the extent practicable, reduce potential future releases of hazardous substances contained within facilities to acceptable protection levels established in applicable or relevant and appropriate requirements
- Protect workers from the hazards posed by these facilities
- Prevent adverse impact to cultural resources and threatened or endangered species
- Safely manage (e.g., treat or dispose) waste streams generated by the removal action
- Reduce or eliminate the need for future S&M activities
- Coordinate clean closure of the TSD unit at the 105-DR Reactor Building, and place the 105-DR Reactor Building into ISS
- Place the 105-F Reactor Building into ISS
- Coordinate with the BHI Remedial Action Waste Disposal Program to address waste sites or activities that may interfere with the disposition of the 105-DR and 105-F Reactor Buildings or ancillary facilities.

Prior to the ISS Project, the 105-DR Reactor was under the control of the Surveillance/ Maintenance and Transition Projects group. The control of the building was temporarily assigned to D&D Projects to perform the ISS work. A memorandum of understanding (BHI 1998d) accomplished this change of control.

A biological review and a cultural resources review (BHI 1998b) were performed prior to mobilization at the 105-DR Reactor site.

The findings of the ecological review (BHI 1998b) for the 105-DR Reactor Building revealed the presence of bats using the facility for roosting. Two live specimens of small-footed Myotis bats were found within the reactor building, and numerous small deposits of scattered feces were found throughout. The small-footed Myotis is a former Federal candidate species for threatened and endangered status and is currently listed by the State of Washington as a priority species where it occurs in natural breeding areas and other communal roosts. No evidence of a communal roost or large aggregation of bats was found within the reactor building. However, a communal roost was found within the process water tunnel that enters the reactor from the 190-D (now demolished) water plant.

The review concluded that the bats using the 190-D and 190-DR process water tunnels for roost sites would be impacted and the habitat would be lost because the project would isolate the tunnels from the reactor, thereby closing off access to the tunnels. Therefore, a mitigation plan was proposed and implemented that preserves the tunnels for habitat by creating an alternate opening at one of the existing surface hatches of each tunnel and installing "bat gates" that would allow access to the bats and exclude access to people and other animals. Other mitigation strategies will be evaluated and implemented, as appropriate, throughout the life of the project. No other species of concern were identified either inside or in areas surrounding the 105-DR Reactor Building.

Plant forces work reviews were performed on the entire scope of work required to bring the 105-DR Reactor into its final state of ISS. The plant forces work reviews are documented in BHI (1995) and BHI (1998e, 1998f).

The final hazard classification and auditable safety analysis for the 105-DR ISS Project (BHI 1998c) summarizes the inventories of radioactive and hazardous materials present within the 105-DR Reactor. The auditable safety analysis/final hazard classification 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 final hazard classification for the 105-DR ISS Project is "Radiological."

4.2 MOBILIZATION

Site mobilization activities in support of pre-demolition house cleaning, asbestos and hazardous material removal, and liquid pipe checks were initiated in January 1998 (FY 1998). Initial activities consisted of setting up the engineering, field support, radiological control technician (RCT) and lunch trailers, and the associated electrical and telephone systems. Parking areas were graded and graveled for the workers. Finally, two temporary septic holding tanks, drain field, 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 building. The Mobile Integrated Temporary Utility System (MITUS) technology was very efficiently and safely used to provide power and lighting throughout the course of the ISS Project. The MITUS used a trailer-mounted transformer and distribution panel that stepped down the incoming voltage from 13.8 kV to 480V. International orange cable was used to feed 480V power to individual kiosks throughout the facility. Selected kiosks then had the capability to step down the voltage to 240V and 120V. Lighting strings from each kiosk were then used to provide lighting.

After the MITUS 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 the Reactor ISS Projects following C Reactor ISS would conduct the pre-work demolition activities "readiness evaluation" using a graded approach in accordance with the requirements of BHI-MA-02, *ERC Project Procedures*, Procedure 8.2, "Readiness Assessments." The F Reactor was the first to commence follow-on ISS demolition activities. The readiness evaluation used the standard field support construction checklist (with modifications) as the basis for the remedial assessment. The readiness evaluation was conducted prior to initiating work on the F and DR Reactor ISS Projects (BHI 1998g). The primary objectives of the pre-work readiness evaluation was to determine if (1) the projects were ready to begin from an administrative standpoint, (2) all the required resources were available, and (3) all work activities would be accomplished safely.

The readiness evaluation concluded that the projects were ready to proceed as scheduled, pending completion of specified pre-start and post-start construction punchlist items (BHI 1998h).

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, mercury, lead, and polychlorinated biphenyls [PCBs]). All of this material was removed inside and outside the SSE, with the exception of nonremovable 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). There are five large lead shield blocks left in place in the SSE around a rod tip storage block located near the ball hoppers northwest corner.

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 187 m^3 (6,600 ft^3) of asbestos insulation was removed.

4.4.2 Transite (Cement Asbestos Board)

There were double transite panels in most of the interior rooms. 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 resultant concentration were 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, as follows:

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

Appendix G of the *Radionuclide Inventory and Source Terms for the Production Reactors at Hanford* (UNI 1987) provided a list of the lead inventory at the 105-DR Reactor. The ISS Project could not remove the following items:

- Inside the reactor block (72,575 kg [160,000 lb])
- Rear shielding door (11,793 kg [26,000 lb])
- Experimental room (two shielding doors, 227 kg [500 lb]).

Appendix G of UNI (1987) provided an estimated inventory of lead for the facility. In addition to the above documented items, the ISS Project has identified six lead items as components that are not practical to remove. The locations and estimated weights are as follows:

Upper viewing room	27,216 kg (60,000 lb) (sandwiched around steel framing)
Horizontal control rod shielding	8,618 kg (19,000 lb) (attached to the rod rack)
Vertical rod tip shield block	11,340 kg (25,000 lb) (not practical to remove)
Dolly room shielding	10,433 kg (23,000 lb) (attached to walls and door)
Neutron shield PIG (south laboratory)	5,443 kg (12,000 lb) (estimated weight)
"C" elevator overhead lights	11 kg (25 lb) (attached to work area ceiling)

UNI (1987) inventoried 95 metric tons (105 tons) of lead. During D&D, 8 metric tons (9 tons) of lead was removed from the reactor building and macroencapsulated at ERDF.

4.4.4 Mercury

Mercury was found in numerous switches, manometers, and instruments. Approximately 3.8 L (1 gal) of mercury was collected and amalgamated for disposal in the ERDF.

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, who handled its disposal. Light ballasts and some applied dried paints were the only PCB waste stream requiring 105-DR ISS Project disposal.

4.5 EQUIPMENT REMOVAL

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

Table 1. Major Equipment Removed During the ISS Project.

Description	Location
29 vertical safety rod drives	Upper reactor
Vertical safety rod drive crane	Upper reactor
Ball 3X delivery system	Upper reactor
Rear-face elevator drive equipment and counterweights	Upper reactor
Front-face elevator drive equipment and counterweights	Upper reactor
Horizontal control rod drives and cooling equipment	Outer rod room
Control room equipment	Control room
Leak detection turrets	Sample rooms
Fan equipment	Fan supply and exhaust rooms
Fuel loading equipment	Metal storage room
Heat exchanger	Valve pit
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 drive equipment	Shaft above 56 ft removed
Electrical equipment	Upper electrical room
Switchgear equipment	Switchgear room

The reactor block itself was disturbed as little as possible.

- During deactivation, the 9 horizontal control rods and the 29 vertical safety rods were placed in the "full-in" position into the reactor (GE 1965). 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 (GE 1965). The ISS Project did not remove any process tube caps on the front or rear face.

- The Ball 3X System has the ball-hoppers full of boron-steel balls. The Ball 3X System was left intact and each of the 29 hoppers contains about 544 kg (1,200 lb) of balls.

- Concrete pourbacks (61 cm [24 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.

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, electrical room) 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. The 105-DR LSFF supply and exhaust fan room was cleaned closed via the RCRA closure plan prior to the ISS demolition (Figures 6 and 7). Figures 8 and 9 show the fan supply and exhaust room demolition in progress and the completed demolition.

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 10 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 approximately 4,013 m^2 (43,200 ft^2). The final footprint area of the SSE is 892 m^2 (9,600 ft^2). Thus, the footprint area of the reactor was reduced by 78%. 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 secured in place by shimming and/or blocking in place 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 "F" elevator rests on the stops located about 0.3 m (1 ft) below floor level (step down) and the screens are in the full down position and upper level doors are shut.

Figure 6. 105-DR Safe Storage Enclosure as Related to Demolished Facility Module 1, Module 2, and Fuel Storage Basin (Ancillary Buildings is a Separate Demolition).

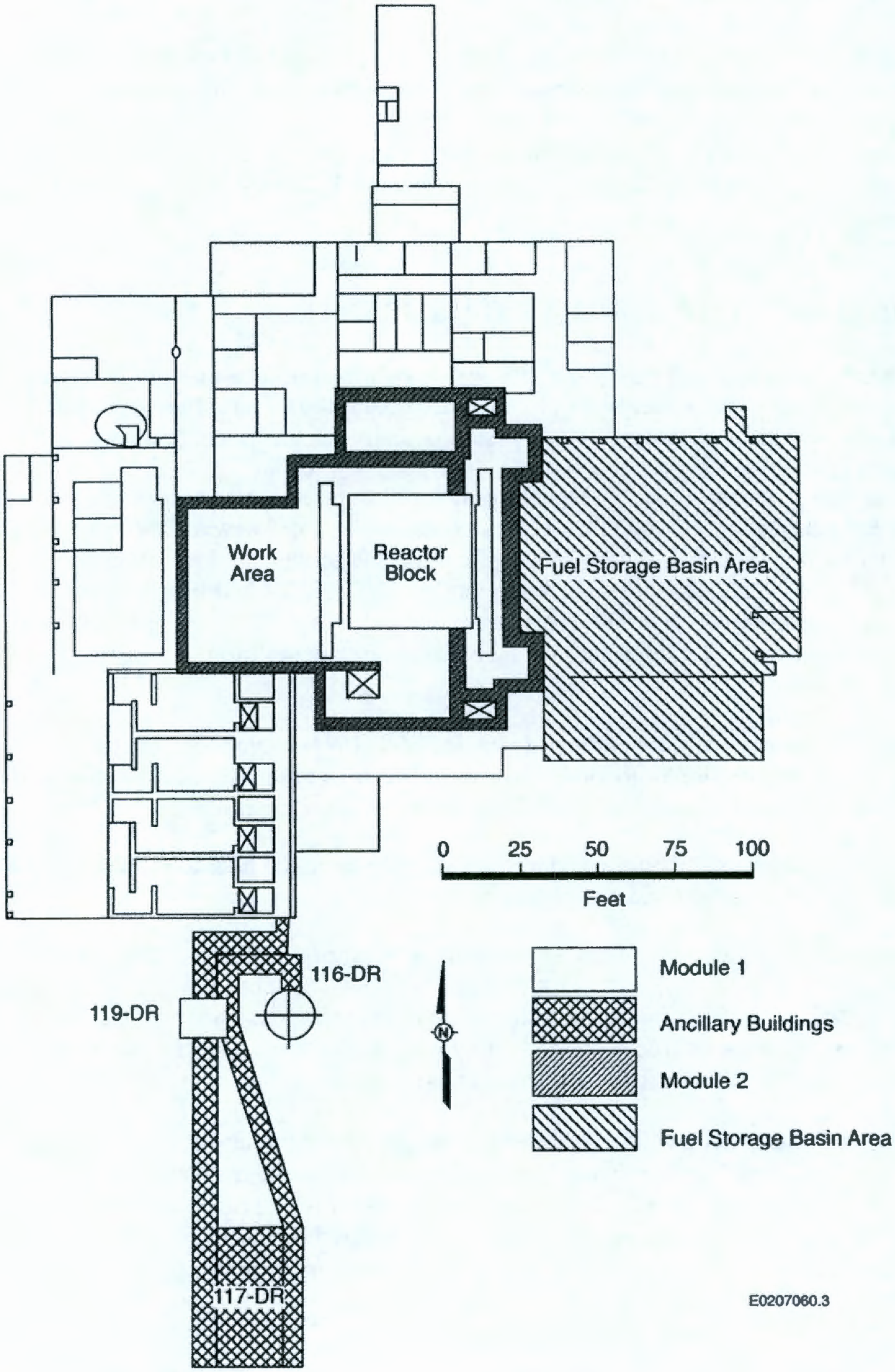


Figure 7. 105-DR Large Sodium Fire Facility Treatment, Storage, and Disposal Unit Boundary.

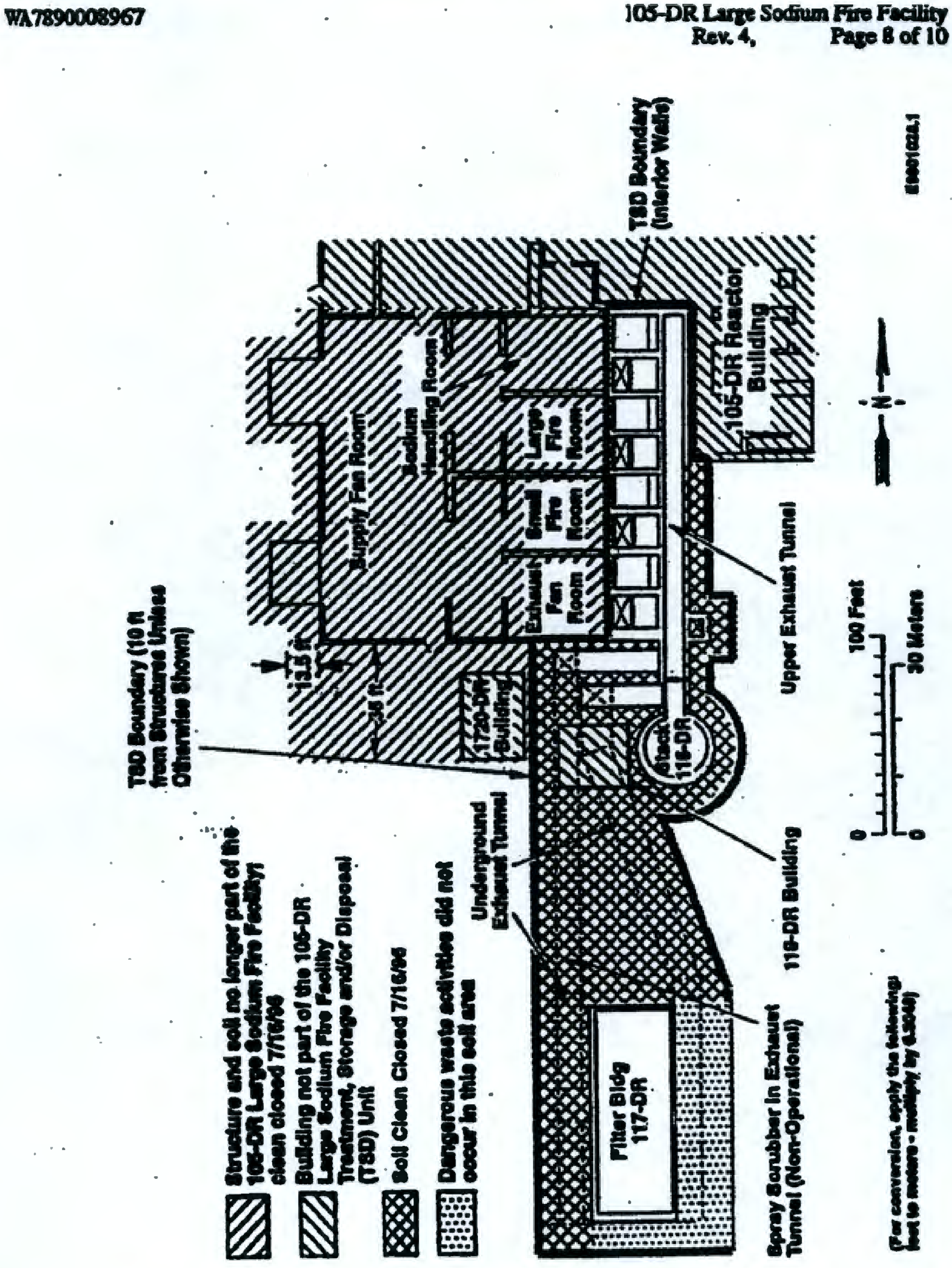


Figure 8. Aerial Photo Showing Fan Supply Room, Valve Pit, Control Room, Outer Rod Room, Miscellaneous Storage, Offices, and Shops Demolition Completion.

Figure 9. Aerial Photo Showing Exhaust Fan Room and Exhaust Tunnels Demolition in Progress.

Figure 10. Photo Showing Outer Rod Room Demolition in Progress.

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).

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.

4.7.2 Water Systems

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

4.7.3 Equipment and Floor Drains

All operations at the 105-DR Reactor have been shut down since December 30, 1964, 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 in the past to either the 1608-DR lift station (demolished in 1987) 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 and the pluto crib are located outside the reactor building, and the crib 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 Plant Forces Work Reviews 8850-021-98 and 8850-019-98 (BHI 1998e, 1998f). 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 CMU block walls (see Figure 11). The SSE subcontractor was also required to remove any large equipment required to place the reactor block into its final SSE configuration. Thus, the SSE subcontractor removed all the upper reactor equipment listed in Section 4.5 and the F elevator mechanism.

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

Figure 11. Photo Showing Upper Reactor Roof Demolition in Progress.

Because 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 plywood deflector barriers attached to the perimeter handrails to deflect any demolition debris from coming in contact with the top of the reactor (see Figure 12).

Figure 12. Photo Showing Upper Reactor Equipment Removal in Progress.

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-DR 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 1999a).

Using the DQO summary report as the basis, the *Sampling and Analysis Plan for the 105-F and 105-DR Phase III Below-Grade Structures and Underlying Soils* (DOE-RL 2000) was developed to present the rationale and strategies for the sampling, field measurements, and analyses of the below-grade concrete and soil. The regulators (e.g., EPA, 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, refine the SAP assumptions

- Shallow and deep zone distinctions for both structures (real property) and soil

- Three alternatives for dispositioning the FSB are as follows:

  - Demolish and dispose of the entire FSB
  - Demolish the FSB walls to 4.6 m (15 ft) below grade
  - Decontaminate the inside surfaces of the FSB.

- The applicable or relevant and appropriate requirements are consistent with the 100 Area ROD (EPA 1999) (15 mrem/yr above background and *Model Toxics Control Act* (WAC 173-340) for residual contamination levels in structures and soils).

- A distinction is made between "real property" and "nonreal 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 0100F-IG-G0002 (BHI 1999b) provides the instructions for performing the Phase III, Stage 1 sampling and surveys in the FSB and the radiological surveys in the remainder of the below-grade structures. FIG 0100F-IG-G0003 (BHI 1999c) provides the instructions for the Phase III, Stage 2 sampling and surveys in all non-FSB below-grade structures.

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 a CVP that will be completed after the remaining LSFF ancillaries have been clean closed. The CVP is a brief report that summarizes and compares the results against the cleanup criteria.

4.10 BELOW-GRADE DEMOLITION

Figure 13 shows the supply water tunnel entrances and valve pit 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. Some of the valve pit concrete walls and floor areas shown in Figure 13 required removal for disposal because of chromium contamination.

4.11 FUEL STORAGE BASIN DEMOLITION AND TRANSFER PIT REMOVAL

In 1985, the FSB walls and floor were cleaned and coated with asphalt emulsion, the sediment was dewatered, and the sediment was transported for disposal in the 200 West Burial Facility as low-level waste (UNI 1986).

Figure 14 is an old photograph depicting the wood planking and monorail system in the FSB. The contamination levels on the FSB walls were too high to satisfy the cleanup criteria in the SAP for the shallow zone (<4.5 m [<15 ft] below grade); therefore, the walls had to be decontaminated or demolished. Cost, safety, and as low as reasonably achievable (ALARA) comparisons clearly demonstrated that demolition of the FSB walls to the -15-ft elevation was the preferred alternative. The floor and remaining walls were confirmed to meet the deep zone cleanup criteria in the SAP. Thus, all walls were demolished to a minimum of 4.5 m (15 ft) below grade. Figure 15 shows FSB (at rear of building) and valve pit (at front of building) below-grade demolition in progress.

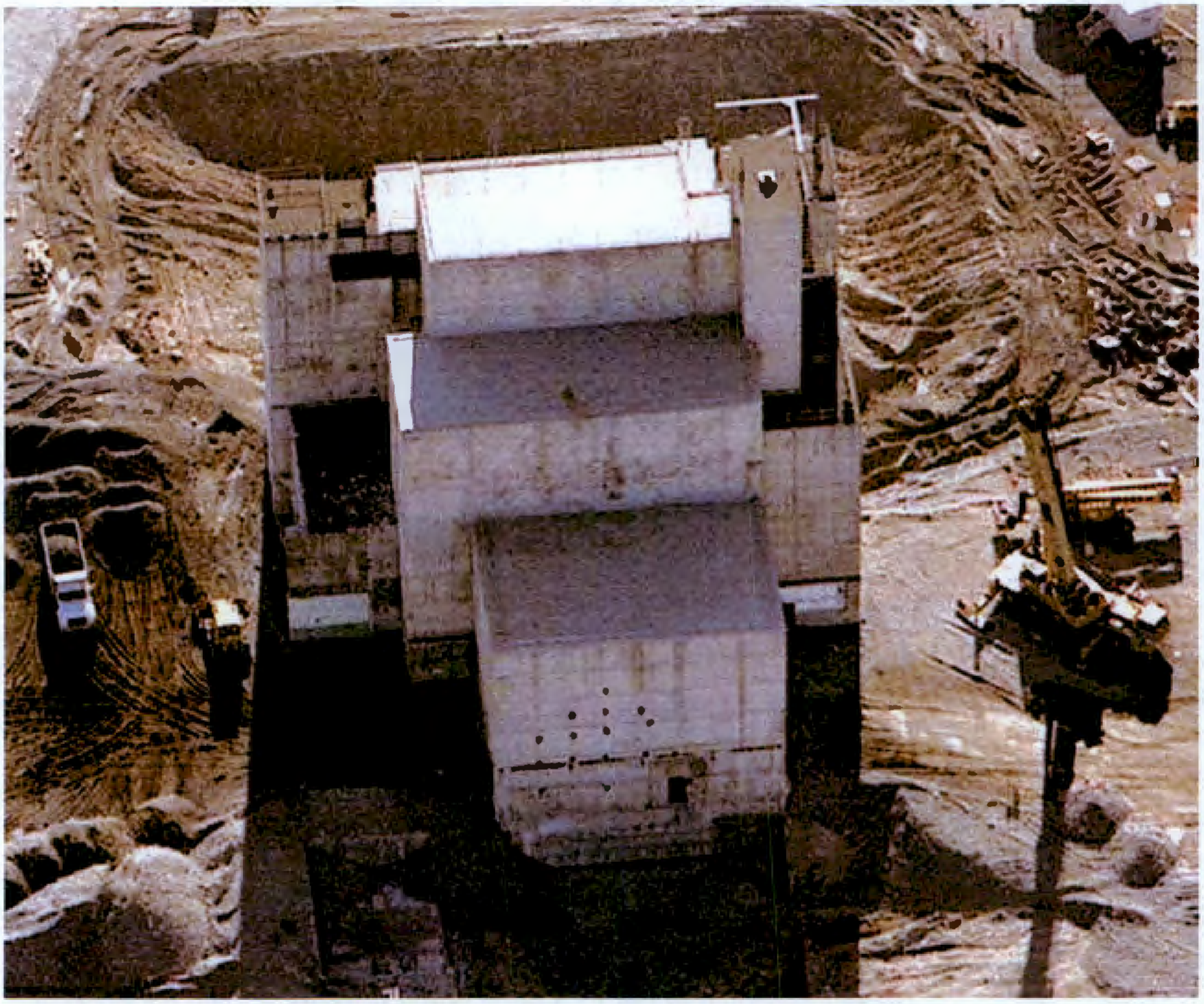
4.12 INTERFACE AT THE 105-DR WATER TUNNELS

In preparation of the 105-DR Reactor below-grade demolition, the water tunnel piping and conduit running from 190-DR to 105-DR were severed at the first pipe support west of the 105-DR Building. Following backfill operations, the backfill in each water tunnel was stabilized with 3.8 m^3 (5 yd^3) of concrete to prevent possible future subsidence in this area.

Figure 13. Photo Showing Below-Grade Demolition.

Figure 14. Old Photo Showing the Fuel Storage Basin Wood Planking and Monorail System.

Figure 15. Photo of Fuel Storage Basin and Valve Pit Below-Grade Demolition in Progress.



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-D Area borrow pit. Figures 16 and 17 show views of the site after all site restoration activities were completed.

4.14 INTERFACE WITH REMEDIAL ACTION

Meetings were held with the 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 3 m [10 ft] from the building edge). Additionally, drain/effluent piping exposed during excavations would be removed by the 105-DR ISS Project (this resulted in significantly more pipe being removed than originally anticipated).

4.15 INTERFACE WITH SURVEILLANCE AND MAINTENANCE

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

An S&M plan (DOE-RL 2002b) was developed as one of the endpoint criteria. The S&M Project has estimated that its 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 2002.

Figure 16. Photo of Completed Safe Storage Enclosure (Looking South West).

Figure 17. Photo of Completed Safe Storage Enclosure (Looking North).

5.0 COST AND SCHEDULE

5.1 SCHEDULE

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

• Trailer mobilization initiated	January 1998
• Initiated DR Reactor characterization and design (originally 10/02)	March 1998 (Tri-Party Agreement Milestone)
• D&D work started	April 1998
• Regulator SAP approval (Phase I)	June 1998
• Initiated structure demolition	August 1998
• Stack demolition	August 1999
• Regulator SAP approval (Phase II)	October 1999
• Awarded SSE subcontract	May 2001
• Completed SSE roof	September 2002
• ISS work completed	September 2002
• S&M Plan to regulators January 2003	(Target completion February 2003)
• 105-DR returned to Surveillance/Maintenance and Transition	January 2003

5.2 COST

The total ISS Project cost of $14,929K (exclusive of the 1997 characterization task) is summarized by fiscal year. The tasks associated with each fiscal year are briefly described in Section 5.1.

FY 1998	2,518K
FY 1999	3,171K
FY 2000	4,131K
FY 2001	1,006K
FY 2002	1,342K
FY 2003	261K (estimate at completion)
	$12,429K

The SSE subcontractor's costs associated with FY 2001 and 2002 are summarized below:

FY 2001	200K
FY 2002	2,300K
	$2,500K

6.0 RECYCLED MATERIAL AND WASTE DISPOSAL

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

6.1 RECYCLING AND WASTE MINIMIZATION

The 105-DR Reactor field crew loaded material into recycle trucks, and the material was then sold for salvage. The project has successfully demonstrated good waste minimization practices where applicable. Materials listed in Table 2 were recycled during the 105-DR Reactor ISS Project.

Table 2. Recycle/Redistribution Log. (2 Pages)

Area	Description of Material	Amount (lb or gal)	Date	Vendor
105-DR	Miscellaneous scrap steel (E-32,200/F-56,800)	24,600 lb	4/15/99	Pacific (105)
105-DR	Miscellaneous scrap steel (E-30,740/F-53,580)	22,840 lb	4/20/99	Pacific
105-DR	Wood scrap	1,200 lb	4/22/99	Cascade Pallet
105-DR	Wood scrap	1,330 lb	4/23/99	Cascade Pallet
105-DR	Miscellaneous scrap steel (E-39,180/F-55,640)	16,460 lb	4/28/99	Pacific
105-DR	Miscellaneous scrap steel (E-31,700/F-66,060)	34,360 lb	5/12/99	Pacific
105-DR	Wood scrap	1,160 lb	5/18/99	Cascade Pallet
105-DR	Compressed gas tanks (24 in. diameter x 25 ft long) 4-each (E-32,720/F-44,460)	11,740 lb	10/20/99	Pacific
105-DR	Alkaline batteries - 100D-00-0037 various AAA, AA, and D cell	65 lb	2/07/00	Consolidation Center 2/7/00
105-DR	Fluorescent tubes - 100D-99-0069	140 tubes (540 linear ft)	2/07/00	Consolidation Center 2/7/00
105-DR	Oil - 100D-98-0007 shipped for energy recovery	55 gal	3/02/00	Offsite through PHMC
105-DR	Alkaline batteries - 100D-00-0067 various AAA, AA, and D cell	100 lb	8/23/00	Consolidation Center 8/23/00

Table 2. Recycle/Redistribution Log. (2 Pages)

105-DR	Contaminated water	5,000 gal	10/25/00	Shipped to ETF
105-DR	Contaminated water	1,500 gal	11/1/00	Shipped to ETF
105-DR	Nonregulated oil for energy recovery (3 drums)	100 gal	11/2/00	Offsite through PHMC
105-DR	Unpainted masonry block removed for roof prep.	667,160 lb	3/28/02 - 4/8/02	183-H Clearwell

ETF = Effluent Treatment Facility
PHMC = Project Hanford Management Contractor

6.2 WASTE DISPOSAL

Approximately 1,140 bulk containers of low-level debris were shipped to ERDF, accounting for approximately 15,422 metric tons (17,000 tons) (about 13,608 kg [30,000 lb] average per container), and more than 300 m^3 of asbestos tiles, lagging, and transite. 946 L (250 gal) of mixed (radioactive and dangerous) waste oil went to Central Waste Complex. More than 757 L (200 gal) of oil went offsite for energy recovery. Also, 14 kg (30 lb) of mercury was treated (amalgamated) at ERDF, and over 8,165 kg (18,000 lb) of lead (primarily shot and bricks) was macroencapsulated at ERDF. The ERC team also shipped over 340 kg (750 lb) of PCB ballasts to ERDF.

7.0 OCCUPATIONAL EXPOSURES

7.1 PERSONNEL INJURIES

During the duration of the project there were 0 lost workdays and 4 Occupational Safety and Health Administration recordable cases. A total of approximately 143,302 hours (manual and nonmanual) were spent by the ERC team on the entire project. In addition the subcontractor spent a total of 29,649 hours in construction of the SSE.

7.2 PERSONNEL RADIOLOGICAL EXPOSURES

There were no clothing or skin contaminations during the demolition of the ancillary sections of the 105-DR Reactor by the plant forces. One personnel clothing contamination (subcontractor worker's clothing contaminated by laundered protective clothing) occurred during the construction of the SEE roof.

All work was performed based on the ALARA objective. The dose goal for the entire 105-DR Reactor ISS Project was based on Radiological Engineering quarterly dose estimates for upcoming work of 480 mrem.

The total combined dose of all 105-DR Reactor personnel was approximately 418 person-mrem for the entire project duration (87% 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.

8.0 SAFE STORAGE ENCLOSURE

The Hanford Site's 105-DR Reactor was chosen as the second 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-DR 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 75 years
- No credible releases of radionuclides to the environment under normal design conditions
- Interim inspection required only on a 5-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, a combination of existing structural steel and 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 10.1 for structural concrete, steel, and roofing/siding drawings.

8.2 ELECTRICAL SYSTEM

Electrical power for the SSE facility is 120/240 volt-alternating current (VAC), 1 Phase, and is supplied from a 13.8-kV line. From a pole-mounted 13.8kV/120V/240V transformer, the power cables are connected to distribution panel (DP-1). DP-1 feeds a distribution panel (DP-3) located inside the SSE utility room. DP-3 provides power for lighting, power receptacles, and the instrumentation system. Backup power capability to these loads is not provided. Refer to Section 10.2 for power and lighting drawings.

The 105-DR SSE has permanent lighting installed along the surveillance route located on the lower level, grade, and upper levels and stairwells. In the interest of safety, all facility personnel and visitors must carry a spare light source that will be used for egress if the lighting system should fail during entry.

110-VAC receptacles are located at the –2.7-m (–9-ft) level in the passage leading to the lower instrument room and tunnels. Several are located at the 0-ft level along the surveillance route and in the SSE access room. Additional receptacles are located on the 4-m (13-ft) level, 7.3-m (24-ft) level, 12.8-m (42-ft) level, and 24.4-m (80-ft) level.

NOTE: See Section 8.4 for portable generator for powering portable ventilation exhauster.

8.3 REMOTE MONITORING SYSTEM

The 105-DR SSE is configured with two sets of temperature sensors (resistance temperature detectors) and a set of flooding sensors (float switch), which include the installed spares for each sensor. Temperature sensors are located at grade level on the west side of the reactor near the F elevator. Temperature sensors are also located at the 24.4-m 13.3-cm (80-ft 5.25-in.) level near the center of the attic space. The flooding sensors are located at the west side of the-2.7-m (–9-ft) level near the F elevator.

The remote sensors are controlled through a programmable logic controller powered from DP-3. Signals are transmitted (via modem and a dedicated phone line) and continuously monitored at the operation supervisor workstation currently located in the 1112-N Building. When an alarm comes in at the remote monitoring station, personnel will evaluate the alarm and if required will go to the 105-DR Reactor and take appropriate corrective actions.

Due to the need for changes in the location of the remote monitoring station, the system is portable and if required can be relocated.

A loss of continuity to a resistance temperature detector will result in a loss of signal to the monitoring station. The flooding sensor is normally closed circuit so that a loss of continuity failure will result in a flooding alarm at the monitoring station. The flooding circuit is directly wired to the programmable logic controller. 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 an 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. Instrument replacements will normally be accomplished during regularly scheduled surveillance periods.

8.4 VENTILATION

The 105-DR 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-DR Reactor SSE has been designed to use a 255-m^3/min (9,000-ft^3/min) portable exhauster for building exhaust ventilation for nonroutine 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 separate ventilation system is provided for the inner rod room through the steel door exhaust ventilation flange connection and a door makeup air vent that is accessed from the platform inside the north side sheet-metal enclosure.

A ventilation system flow diagram can be found on drawing 0100X-DD-M0012 (see Section 10.4). 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 should the flanges be removed maliciously.

8.5 SECURITY

The access to the 105-DR 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 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 0.9- to 1.5-m (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-DR Reactor SSE. The Hanford Patrol continues to provide routine security patrols in the vicinity as part of its 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 LESSONS LEARNED AND RECOMMENDATIONS

The 105-DR Reactor was the second ISS project to complete placement of the reactor core into a SSE. Work was accomplished without any significant problems because of lessons learned from the 105-C Reactor ISS project. Minor delays and efficiency improvement are noted for future projects, which include the following examples.

- A SSE design/build subcontract was used for the first time on the 105-DR ISS Project. The design/build worked well for the subcontractor expediently correcting its error within its system, but it makes it more difficult for the prime contractor to incorporate better design engineering through the builder into its design group.

- Completing the plant force ISS building demolition at 105-DR prior to starting the SSE subcontractor construction resulted in no claims of work delays caused by BHI interface. This was an effective implementation of a lesson-learned recommendation from the C ISS Project (first reactor to complete ISS).

- The subcontractor needs to ensure qualification of equipment operators and training qualification on the specific heavy equipment it will operate (e.g., cranes). This lesson learned was the result of a crane operator who lacked proper training for the crane being used releasing the hook and headache ball into free fall and striking the ground next to 105-DR.

- Subcontractor CMU block removal by skiff/crane was the original planned removal method. The interior walls of the CMU were surveyed and down posted from a contamination area to an radiological buffer area. This improved work efficiency and allowed for a more efficient method of dropping the blocks directly into a secured collection area.

- Installing permanent safety handrails in the S&M SSE inspection routes initially, where it will not interfere with construction access, without the need for later replacement versus putting up temporary handrails for construction work will serve both purposes and will save material and labor in the overall operation.

10.0 DRAWINGS

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

10.1 STRUCTURAL

Type	Number	Cross-Reference Number	Subject
DWG	100DR-DD-C0025	H-1-87172	105DR BELOW-GRADE DEMOLITION ZONE
DWG	0100D-DD-C0187	H-1-85515 SHT01	GENERAL STRUCTURAL NOTES & SPECIFICATIONS - 105DR-DD-S001.0
DWG	0100D-DD-C0188	H-1-85516 SHT01	105DR-DD-S001.8 - FOUNDATION PLAN
DWG	0100D-DD-C0190	H-1-85518 SHT01	105DR-DD-S001.10 - ROOF FRAMING PLAN
DWG	0100D-DD-C0191	H-1-85519 SHT01	105DR-DD-S001.11 - EAST ELEVATION VIEW
DWG	0100D-DD-C0192	H-1-85520 SHT01	105DR-DD-S001.12 - NORTH ELEVATION VIEW
DWG	0100D-DD-C0193	H-1-85521 SHT01	0105DR-DD-S001.13 - WEST ELEVATION VIEW

Type	Number	Cross-Reference Number	Subject
DWG	0100D-DD-C0194	H-1-85522 SHT01	0105DR-DD-S001.14 - SOUTH ELEVATION VIEW
DWG	0100D-DD-C0195	H-1-85523 SHT01	0105DR-DD-S001.15 - LONGITUDINAL BUILDING SECTION VIEW
DWG	0100D-DD-C0196	H-1-85524 SHT01	0105DR-DD-S001.16 - TRANSVERSE BUILDING SECTION VIEW AT GRID 11
DWG	0100D-DD-C0197	H-1-85525 SHT01	0105DR-DD-S001.17 - TRANSVERSE BUILDING SECTION VIEW AT GRID 8
DWG	0100D-DD-C0198	H-1-85526 SHT01	0105DR-DD-S001.18 - TRANSVERSE BUILDING SECTION VIEW AT GRID 13
DWG	0100D-DD-C0199	H-1-85527 SHT01	0105DR-DD-S002.1 - CONCRETE & FOUNDATION DETAILS
DWG	0100D-DD-C0200	H-1-85528 SHT01	0105DR-DD-S002.2 - CONCRETE & FOUNDATION DETAILS
DWG	0100D-DD-C0201	H-1-85529 SHT01	0105DR-DD-S002.3 - CONCRETE & FOUNDATION DETAILS
DWG	0100D-DD-C0202	H-1-85530 SHT01	0105DR-DD-S003.1 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0203	H-1-85531 SHT01	0105DR-DD-S003.2 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0204	H-1-85532 SHT01	0105DR-DD-S003.3 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0205	H-1-85533 SHT01	0105DR-DD-S003.4 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0206	H-1-85534 SHT01	0105DR-DD-S003.5 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0207	H-1-85535 SHT01	0105DR-DD-S003.6 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0208	H-1-85536 SHT01	0105DR-DD-S003.7 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0209	H-1-85537 SHT01	0105DR-DD-S003.8 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0210	H-1-85538 SHT01	0105DR-DD-S003.9 - STRUCTURAL STEEL ELEVATION VIEWS
DWG	0100D-DD-C0211	H-1-85539 SHT01	0105DR-DD-S004.1 - STRUCTURAL SECTION VIEWS
DWG	0100D-DD-C0212	H-1-85540 SHT01	0105DR-DD-S004.2 - STRUCTURAL SECTION VIEWS
DWG	0100D-DD-C0213	H-1-85541 SHT01	0105DR-DD-S004.3 - STRUCTURAL SECTION VIEWS
DWG	0100D-DD-C0214	H-1-85542 SHT01	0105DR-DD-S005.1 - STEEL PURLIN & GIRT CONNECTION DETAILS
DWG	0100D-DD-C0215	H-1-85543 SHT01	0105DR-DD-S005.2 - STEEL PURLIN & GIRT CONNECTION DETAILS
DWG	0100D-DD-C0216	H-1-85544 SHT01	0105DR-DD-S005.3 - STEEL PURLIN & GIRT CONNECTION DETAILS
DWG	0100D-DD-C0217	H-1-85545 SHT01	0105DR-DD-S006.1 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0218	H-1-85546 SHT01	0105DR-DD-S006.2 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0219	H-1-85547 SHT01	0105DR-DD-S006.3 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0220	H-1-85548 SHT01	0105DR-DD-S006.4 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0221	H-1-85549 SHT01	0105DR-DD-S006.5 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0222	H-1-85550 SHT01	0105DR-DD-S006.6 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0223	H-1-85551 SHT01	0105DR-DD-S006.7 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0224	H-1-85552 SHT01	0105DR-DD-S006.8 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0225	H-1-85553 SHT01	0105DR-DD-S006.9 - STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0226	H-1-85554 SHT01	0105DR-DD-S006.10 – STRUCTURAL STEEL FRAMING DETAILS
DWG	0100D-DD-C0227	H-1-85555 SHT01	0105DR-DD-S007.2 - ROOF/WALL FLASHING & CONNECTION DETAILS

Type	Number	Cross-Reference Number	Subject
DWG	0100D-DD-C0228	H-1-85556 SHT01	0105DR-DD-S007.3 - ROOF/WALL FLASHING & CONNECTION DETAILS
DWG	0100D-DD-C0229	H-1-85557 SHT01	0105DR-DD-S008.1 - MISCELLANEOUS STRUCTURAL DETAILS
DWG	0100D-DD-C0230	H-1-85558 SHT01	0105DR-DD-S008.2 - MISCELLANEOUS STRUCTURAL DETAILS

10.2 ELECTRICAL

Type	Number	Cross-Reference Number	Subject
DWG	100DR-DD-E0001	H-1-83652 SHT01	SSE PERMANENT POWER & LIGHTING SYSTEM ONE LINE DIAGRAM
DWG	100DR-DD-E0002	H-1-83653 SHT01	SSE POWER AND LIGHTING SYSTEM ELECTRICAL ARRANGEMENT - (-) GRADE / GRADE LVL
DWG	100DR-DD-E0003	H-1-83654 SHT01	SSE POWER AND LIGHTING SYSTEM ELECTRICAL ARRANGEMENT - ABOVE GRADE LVL
DWG	100DR-DD-E0004	H-1-83655 SHT01	PERMANENT ELECTRICAL DISTRIBUTION SYSTEM GROUNDING PLAN, ELEVATIONS AND DETAILS
DWG	100DR-DD-E0005	H-1-83656 SHT01	PERMANENT ELECTRICAL DISTRIBUTION SYSTEM XFMR & CUTOUT POLE DETAILS
DWG	100DR-DD-E0006	H-1-83657 SHT01	13.8KV - POLE DOWN GUY ASSEMBLY - DETAILS

10.3 INSTRUMENTATION

Type	Number	Cross-Reference Number	Subject
DWG	100DR-DD-E0001	H-1-83652 SHT01	SSE PERMANENT POWER & LIGHTING SYSTEM ONE LINE DIAGRAM
DWG	100DR-DD-E0002	H-1-83653 SHT01	SSE POWER AND LIGHTING SYSTEM ELECTRICAL ARRANGEMENT - (-) GRADE / GRADE LVL
DWG	100DR-DD-E0003	H-1-83654 SHT01	SSE POWER AND LIGHTING SYSTEM ELECTRICAL ARRANGEMENT - ABOVE GRADE LVL
DWG	100DR-DD-E0004	H-1-83655 SHT01	PERMANENT ELECTRICAL DISTRIBUTION SYSTEM GROUNDING PLAN, ELEVATIONS AND DETAILS
DWG	100DR-DD-E0005	H-1-83656 SHT01	PERMANENT ELECTRICAL DISTRIBUTION SYSTEM XFMR & CUTOUT POLE DETAILS
DWG	100DR-DD-E0006	H-1-83657 SHT01	13.8KV - POLE DOWN GUY ASSEMBLY - DETAILS

10.4 MECHANICAL

Type	Number	Cross-Reference Number	Subject
DWG	0100X-DD-M0011	H-1-85187 SHT01	SSE CONSTRUCTION AT 105-F/105-DR REACTOR BUILDINGS VENTILATION DETAILS
DWG	0100X-DD-M0012	H-1-85512 SHT01	105 DR/F AREAS SSE VENTILATION SYSTEM FLOW DIAGRAM

11.0 REFERENCES

58 FR 48509, "Record of Decision: Eight Surplus Production Reactors at the Hanford Site, Richland, Washington," *Federal Register*, Vol. 58, pp. 48509 (September 16).

BHI, 1995, *Plant Forces Work Review -- 8850-012-95*, dated August 17, 1995, CCN 019757, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998a, *105-C Reactor Interim Safe Storage Project Final Report*, BHI-01231, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998b, *Ecological and Cultural Review of the Surrounding 105-F and 105-DR Reactors (98-ER-003)*, CCN 057036, dated March 3, 1998, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998c, *Final Hazard Classification and Auditable Safety Analysis for the 105-DR Reactor Interim Safe Storage Project*, BHI-01150, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998d, *Memorandum of Understanding for the 105-F and 105-DR*, CCN 054600, dated February 10, 1998, and Revised, CCN 059294, dated July 14, 1998, and Revision 2, CCN 070891, July 13, 1999, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998e, *Plant Forces Work Review -- 8850-021-98*, dated November 21, 1997, CCN 055649, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998f, *Plant Forces Work Review -- 8850-019-98*, dated January 13, 1998, CCN 055383, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998g, *Pre-Work Activity Evaluation for the 105-F Exhaust Fan Room Demolition Report Summary*, CCN 061993, dated September 8,1998, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998h, *Pre-Work Activity Evaluation for the 105-F Exhaust Fan Room Demolition Report Summary*, CCN 064576, dated December 30,1998, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1999a, *Data Quality Objectives Summary Report for the 105-F and 105-DR Phase III Below-Grade Structures and Underlying Soils*, BHI-01273, Rev.0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1999b, *Field Instruction Guide for Verification Sampling of the 105-F/105-DR Phase III, Stage 1 Below-Grade Structures and Underlying Soils*, Field Instruction Guide 0100-IG-G0002, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1999c, *Field Instruction Guide for Verification Sampling of the 105-F/105-DR Phase III, Stage 2 Below-Grade Structures and Underlying Soils*, Field Instruction Guide 0100-IG-G0003, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1999d, *Final Decommissioning Report for the 116-D and 116-DR Exhaust Stacks, 119-DR Air Sampling Building, and Associated Above Grade Exhaust Ducting*, BHI-01335, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-MA-02, *ERC Project Procedures*, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE, 1992, *Final Environmental Impact Statement, Decommissioning of the Eight Surplus Production Reactors at the Hanford Site*, DOE/EIS-0119F, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1995, *Closure Report for the N Reactor Facility*, DOE/RL-94-152, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998a, *Engineering Evaluation/Cost Analysis for the 105-DR and 105-F Reactor Facilities and Ancillary Facilities*, DOE-RL-98-23, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998b, *105-F and DR Phase I Sampling and Analysis Plan,* DOE-RL-98-43, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998c, *105-F and DR Phase II Sampling and Analysis Plan,* DOE-RL-98-57, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000, *Sampling and Analysis Plan for the105-F and 105-DR Phase III Below-Grade Structures and Underlying Soils,* DOE-RL-99-35, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002a, *Removal Action Work Plan for 105-DR and 105-F Building Interim Safe Storage Projects and Ancillary Buildings*, DOE/RL-98-37, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002b, *Surveillance and Maintenance Plan for the 105-DR Reactor Safe Storage Enclosure,* DOE-RL-02-28, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 2001, *Revision 6 of the Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Hanford Site*, Permit No. WA7890008967, Rev. 6, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1998a, "Action Memorandum for the 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington," (CCN 059850), approved July 14, 1998, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Ecology, EPA, and DOE, 1998b, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units (Remaining Sites ROD), Hanford Site, Benton County, Washington, July 1999*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

GE, 1965, *Reactor Plant Deactivation History, 100-DR, H, and F Areas*, RL-REA 2686, Hanford Atomic Products Operation, General Electric Company, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

UNI, 1986, *Fuel Storage Basin Cleanup and Stabilization Project Report*, UNI-3958, United Nuclear Industries, Inc., Richland, Washington.

UNI, 1987, *Radionuclide Inventory and Source Terms for the Production Reactors at Hanford*, UNI-3714, Rev. 1, United Nuclear Industries, Inc., Richland, Washington.

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, as amended.

DISTRIBUTION

U.S. Department of Energy
Richland Operations Office

J. D. Goodenough	A3-04
D. C. Smith	A3-04
J. P. Sands	A3-04

ERC Team

T. N. Draper, BHI	X5-50
D. W. Eckert, BHI	X7-75
R. G. Egge, BHI	X5-50
P.W. Griffin, BHI	X9-05
R. P. Henckel, BHI	X9-08
M. A. Mihalic, BHI	X9-08
J. J. McGuire, BHI	H0-21
M.R. Morton, BHI	X9-05
R. R. Nielson, BHI	X9-08
S. E. Vukelich	X9-08
P. J. Woods, BHI	H0-21
S/M&T Project Files	X5-50
D&D Project Files	X9-08

Document and Information Services (3)	H0-09
DOE-RL Public Reading Room	H2-53
Hanford Technical Library	P8-55