0058170

DOE/RL-2000-57
Rev. 2

Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings

RECEIVED
NOV 05 2002
EDMC

United States
Department of Energy

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy and microfiche.

Available for a processing fee to U.S. Department of Energy and its contractors from:
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
(865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov
online ordering: http://www.doe.gov/bridge

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(800) 553-6847
fax: (703) 605.6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm

Printed in the United States of America

DISCLM-5.CHP (11/99)

DOE/RL-2000-57
Rev. 2
OU: 100-DR-1
100-DR-2
100-HR-1
100-HR-2
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title: Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings

Approvals: D. C. Smith, U.S. Department of Energy, Richland Operations Office, Environmental Restoration Division, Project Manager

Signature _____ Date 9/25/02

F. W. Bond, Washington State Department of Ecology, Nuclear Waste Program, Transition Project Manager

Signature _____ Date 9/25/02

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.

DOE/RL-2000-57
Rev. 2

Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings

September 2002

United States Department of Energy

P.O. Box 550, Richland, Washington 99352

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 PURPOSE AND OBJECTIVE OF THE REMOVAL ACTION WORK PLAN 1-1

1.2 SCOPE AND OBJECTIVES OF THE REMOVAL ACTION 1-3

1.3 FACILITY HISTORY AND DESCRIPTION 1-5

1.3.1 Facility History 1-5
1.3.2 Facility Descriptions 1-5

2.0 REMOVAL ACTION 2-1

2.1 REMOVAL ACTION WORK ACTIVITIES 2-1

2.1.1 Site Mobilization and Preparation Work 2-1
2.1.2 Characterization 2-2
2.1.3 Decontamination and Demolition 2-2
2.1.4 105-H Fuel Storage Basin 2-4
2.1.5 Safe Storage Enclosure Construction 2-5
2.1.6 Waste Disposal 2-7
2.1.7 Site Restoration 2-8
2.1.8 Demobilization 2-8

2.2 FACILITY HAZARDS 2-8

2.2.1 Hazardous Material Inventory 2-9
2.2.2 Radiological Material Inventory 2-9
2.2.3 Facility Hazard Classification 2-10

2.3 STRUCTURES, SYSTEMS, AND COMPONENTS THAT PROTECT FACILITY WORKERS 2-10

2.4 ELECTRICAL SYSTEMS 2-11

2.4.1 Surveillance (Pre-Interim Safe Storage and Preliminary Interim Safe Storage Activities) 2-11
2.4.2 Interim Safe Storage Project Decontamination and Decommissioning Activities 2-12
2.4.3 Safe Storage (Up to 75 Years) 2-12

3.0 SAFETY AND HEALTH MANAGEMENT AND CONTROLS 3-1

3.1 EMERGENCY MANAGEMENT 3-1

3.2 HEALTH AND SAFETY PROGRAM 3-1

3.2.1 Worker Safety Program 3-1
3.2.2 Site-Specific Health and Safety Plan and Activity Hazards Analysis 3-2
3.2.3 Radiological Controls and Protection 3-3

3.3 MAINTENANCE MANAGEMENT 3-3

4.0 ENVIRONMENTAL MANAGEMENT AND CONTROLS 4-1

4.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ... 4-1

4.1.1 Other Criteria, Advisories, or Guidance to be Considered for this Removal Action 4-4

4.2 WASTE MANAGEMENT 4-6

4.2.1 Waste Characterization and Designation 4-7
4.2.2 Waste Handling, Storage, and Packaging 4-8
4.2.3 Waste Treatment 4-10
4.2.4 Waste Transportation and Shipping 4-13
4.2.5 Disposal 4-13
4.2.6 Waste Management Strategy 4-14

4.3 CHARACTERIZATION 4-15

4.3.1 Sampling Documents 4-16

4.4 RESIDUAL RADIATION RELEASE CRITERIA 4-17

4.5 NATURAL AND CULTURAL RESOURCES PROTECTION 4-19

4.6 ADDITIONAL RELEVANT CONTROLS OR ACTIONS 4-20

4.6.1 Occupational Safety Controls 4-20
4.6.2 Special Controls 4-21

5.0 PROJECT MANAGEMENT AND ORGANIZATION 5-1

5.1 PROJECT SCHEDULE AND COST ESTIMATE 5-1

5.1.1 Project Cost and Schedule Tracking 5-2

5.2 CONDUCT OF OPERATIONS 5-2

5.3 CHANGE MANAGEMENT/CONFIGURATION CONTROL 5-3

5.4 PERSONNEL TRAINING AND QUALIFICATIONS 5-4

5.5 PLAN FOR READINESS 5-5

5.6 QUALITY ASSURANCE REQUIREMENTS 5-5

5.6.1 Quality Assurance Implementation 5-6
5.6.2 Responsibilities and Authority 5-6
5.6.3 Document Control 5-6
5.6.4 Quality Assurance Records 5-6
5.6.5 Audits/Assessments 5-6
5.6.6 Self-Assessments 5-6

5.7 PROJECT CLOSEOUT 5-6

6.0 REFERENCES 6-1

APPENDICES

A 105-D AND 105-H INTERIM SAFE STORAGE PROJECT SCHEDULE ..... A-i
B AIR MONITORING PLAN ..... B-i

FIGURES

1-1. Hanford Site Map. 1-6
1-2. Floor Plan Layout at Ground Level for the 105-D Facility. 1-8
1-3. Floor Plan Layout at Ground Level for the 105-H Facility. 1-9
1-4. Layout of the 105-D Facility (Module 1, Module 2, and Fuel Storage Basin). 1-10
1-5. Layout of the 105-H Reactor Building (Module 1, Module 2, and Fuel Storage Basin). 1-11
1-6. General Plan of the 105-D Safe Storage Enclosure at Ground Level. 1-13
1-7. General Plan of 105-H Safe Storage Enclosure at Ground Level. 1-14
1-8. Reactor Block Construction. 1-15
1-9. 105-H Fuel Storage Basin Area Layout. 1-18
1-10. 105-D Fuel Storage Basin Area Layout. 1-20
1-11. 100-D/DR Area. 1-22
1-12. 100-H Area. 1-23
2-1. Safe Storage Enclosure. 2-6
4-1. 105-D Waste Storage Areas. 4-11
4-2. 105-H Waste Storage Areas. 4-12

TABLE

1-1. Facilities and Potentially Impacted Waste Sites. 1-24

ACRONYMS

ACM	asbestos-containing material
AOC	area of contamination
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
BARCT	best available radionuclide control technology
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CWC	Central Waste Complex
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDPI	Engineering Department Project Instruction
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
FEIS	final environmental impact statement
FSB	fuel storage basin
HASP	health and safety plan
HCR	horizontal control rod
HEPA	high efficiency particulate air
ISMS	Integrated Environment, Safety, and Health Management System
ISOCS	In Situ Object Counting System
ISS	interim safe storage
JHA	job hazards analysis
LARADS	Laser-Assisted Ranging and Data System
MOC	Management of Change
MOU	memorandum of understanding
MTCA	*Model Toxics Control Act*
NEC	National Electrical Code
NEPA	*National Environmental Policy Act of 1969*
PCB	polychlorinated biphenyl
PHMC	Project Hanford Management Contractor
PMII	Project Manager's Implementing Instructions
PPE	personal protective equipment
QAPjP	quality assurance project plan
RCRA	*Resource Conservation and Recovery Act of 1976*
RESRAD	RESidual RADioactivity dose model

RL	U.S. Department of Energy, Richland Operations Office
RWP	radiological work permit
S&M	surveillance and maintenance
SAP	sampling and analysis plan
SS HASP	site-specific health and safety plan
SSE	safe storage enclosure
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSCA	*Toxic Substances Control Act of 1976*
VSR	vertical safety rod
WAC	*Washington Administrative Code*

METRIC CONVERSION CHART

Into Metric Units

If You Know	*Multiply By*	*To Get*
Length		
inches	25.4	Millimeters
inches	2.54	centimeters
feet	0.305	meters
yards	0.914	meters
miles	1.609	kilometers
Area		
sq. inches	6.452	sq. centimeters
sq. feet	0.093	sq. meters
sq. yards	0.0836	sq. meters
sq. miles	2.6	sq. kilometers
acres	0.405	hectares
Mass (weight)		
ounces	28.35	grams
pounds	0.454	kilograms
tons	0.907	metric tons
Volume		
teaspoons	5	milliliters
tablespoons	15	milliliters
fluid ounces	30	Milliliters
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 tons	1.102	tons
Volume		
milliliters	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 INTRODUCTION

This document contains the removal action work plan for the 105-D and 105-H Reactor buildings and ancillary facilities[1]. These buildings and facilities are located in the 100-D/DR and 100-H Areas of the Hanford Site, which is owned and operated by the U.S. Department of Energy (DOE), in Benton County, Washington. The 100 Areas (including the 100-D/DR and 100-H Areas) of the Hanford Site were placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The DOE has determined that hazardous substances in the 105-D and 105-H Reactor buildings and ancillary facilities present a potential threat to human health or the environment. The DOE has also determined that a non-time-critical removal action is warranted at these facilities.

Alternatives for conducting a non-time-critical removal action were evaluated in the *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facilities* (DOE-RL 2000a) and *Engineering Evaluation/Cost Analysis for the 105-H Reactor Facility and Ancillary Facilities* (DOE-RL 2000b). The engineering evaluation/cost analyses (EE/CAs) resulted in the recommendation to decontaminate and demolish the contaminated reactor buildings (except for the reactor blocks) and the ancillary facilities, and to construct a safe storage enclosure (SSE) over the reactor blocks. The recommendation was approved in an action memorandum (Ecology and DOE 2000) signed by the Washington State Department of Ecology (Ecology) and DOE. The DOE is the agency responsible for implementing the removal actions in the 105-D/DR and 105-H Areas. Ecology is the lead regulatory agency for facilities in the 100-D/DR Area and in the 100-H Area. The term "lead regulatory agency" hereinafter refers to this authority. This removal action work plan supports implementation of the non-time-critical removal action.

1.1 PURPOSE AND OBJECTIVE OF THE REMOVAL ACTION WORK PLAN

The purpose of this removal action work plan is to establish the methods and activities to perform the following removal action functions:

- Modify structures as necessary and construct interim safe storage (ISS) enclosures for the 105-D and 105-H Reactor buildings
- Complete decontamination and decommissioning (D&D) of the 103-D Unirradiated Fuel Element Storage Building

[1] The term "facilities" is used generically to encompass all the structures, buildings, tunnels, piping, etc., associated with the buildings. However, with regard to the reactor buildings (i.e., 105-H and 105-D), the reactor blocks are not included in the removal action.

- Complete D&D of the 190-DR Process Water Pumphouse
- Complete D&D of below-grade structures remaining from previous decommissioning of the 105-D water tower pedestals
- Complete D&D of the 1713-H Warehouse
- Complete D&D of the 1720-HA Arsenal
- Remediate waste sites within the reactor footprint or provide for deferral to the Remedial Action/Waste Disposal (RA/WD) Program (with approval from the lead regulatory agency)
- Manage and dispose of all waste generated during these actions.

This removal action work plan satisfies the requirement in the action memorandum (Ecology and DOE 2000) that DOE submit a removal action work plan outlining how compliance with applicable regulations (refer to Section 4.1) and enforceable schedule (refer to Section 5.1) will be achieved for ISS of the reactor buildings and demolition of ancillary buildings. Additionally, it serves as the decommissioning plan and project management plan for the 105-D and 105-H ISS projects and for the associated ancillary facilities. This removal action work plan was prepared in accordance with Section 7.2.4 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998).

In addition to this removal action work plan, the action memorandum (Ecology and DOE 2000) specifies other deliverables that must be submitted by DOE to the lead regulatory agency for review and approval. This removal action work plan describes the deliverables and provides a schedule for meeting the deliverables. The schedule includes interim actions that lead to completion of the associated Tri-Party Agreement Milestones M-93-17 (*Complete Interim Safe Storage of the 105-D Reactor Building by December 31, 2004*) and M-93-18 (*Complete Interim Safe Storage of the 105-H Reactor Building by December 31, 2005*) (refer to Appendix A). The deliverables specified in the action memorandum and discussed in this removal action work plan include the following:

- Waste management plan (Section 4.2)
- Sampling and analysis plan (SAP) for waste and soil characterization and disposal (Sections 4.2.1 and 4.3)
- Treatment plans if treatment is necessary prior to waste disposal in the Environmental Restoration Disposal Facility (ERDF) (Section 4.2.3)
- Verification SAP for soil and below-grade structures (Sections 4.3 and 5.7)
- Cleanup verification packages, including a final report (Section 5.7).

The intent of this removal action work plan 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 will be developed to direct work activities and instruct workers in the most safe, applicable work methods. Existing procedures (as well as specifically developed instructions) will be used to perform and control the facility removal and disposal actions.

The 105-D and 105-H ISS and ancillary building project schedule, which encompasses the work scope through project completion, presents the logical progression of events and estimated durations for each activity. The project schedule, included as Appendix A, is presented by fiscal year.

1.2 SCOPE AND OBJECTIVES OF THE REMOVAL ACTION

The primary goal of CERCLA removal actions is to minimize or eliminate threats to public health or the environment caused by the presence of hazardous substances. The EE/CAs for the 105-D and 105-H Reactor buildings and ancillary facilities (DOE-RL 2000a, 2000b) each present three alternative approaches for future facility management and the resulting levels of protection of public health and the environment that may be anticipated. Based on the evaluation, the ISS of the reactors and D&D of ancillary facilities were recommended as the most responsive approach to ensure protection of human health and the environment. The selection and approval of this approach are documented in the action memorandum (Ecology and DOE 2000) for the 105-D and 105-H Reactor buildings and ancillary facilities.

The scope of the approved removal action includes the 105-D and 105-H Reactor buildings (except for the reactor blocks) and the ancillary facilities and structures, all of which are described in Section 1.3.2. The 103-D Unirradiated Fuel Element Storage Building, the 190-DR Process Water Pumphouse, the below-grade structures associated with the 105-D water tower[1], the 1713-H Warehouse, and the 1720-HA Arsenal are included in this removal action. Although each of the ancillary facilities is addressed in this document, each facility has a separate budget within the 105-D and 105-H ISS project.

Stabilization, partial demolition, and disposal will reduce the potential hazards to public health or the environment that are currently posed by the 105-D and 105-H Reactor buildings and ancillary facilities. Waste products generated by the D&D and safe storage activities will be separated into a variety of waste streams, each of which will be disposed at appropriate disposal facilities.

Below-grade structures will be removed to a minimum of 0.9 m (3 ft) below surrounding grade, and the remaining portion will either be removed or left in place, depending on whether cleanup standards can be achieved (see Section 4.1.1). Portions of the below-grade structures and soils that are above cleanup levels will be removed. In the event that large volumes of contaminated soil are encountered or removal of contaminated soil inhibits reactor safe storage activities, with

[1] Although this structure was not included in the original EE/CA for this project, it has been included in this plan to provide a mechanism for cleanup of this legacy site.

concurrence of the lead regulatory agency, the removal of contaminated soils may be deferred to the RA/WD Program. The respective footprints[1] of the reactor buildings, ancillary facilities, and the affected surrounding terrain will be backfilled after completion of the removal action if the cleanup standards (see Sections 4.1 and 5.7) are met. Site restoration will be coordinated with remedial actions and 100-H, 100-D, and 100-DR Area restoration actions. Characterization information for these areas will be generated to document the status of conditions at the conclusion of this project.

Based on the selected alternative, the removal action objectives are 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 (ARARs)
- Protect workers from the hazards posed by these facilities
- Prevent adverse impact to cultural resources and threatened or endangered species
- Safely manage (i.e., treat or dispose) waste streams generated by the removal action
- Reduce or eliminate the need for future surveillance and maintenance (S&M) activities
- Place the 105-D and 105-H Reactors into ISS
- Demolish the 105-D and 105-H Reactors' ancillary facilities
- Coordinate with the Bechtel Hanford, Inc. (BHI) RA/WD Program to address waste sites or activities that may interfere with the disposition of the 105-D and 105-H Reactor buildings or ancillary facilities.

Section 1.3 provides a facility history and a description of each of the buildings and facilities covered by the removal action.

[1] The footprint of the building is defined as the area covered by the facility as seen from above, plus an additional 1.5 m (5 ft) out from the perimeter of the walls to account for building foundations and slabs.

1.3 FACILITY HISTORY AND DESCRIPTION

1.3.1 Facility History

The reactor buildings, designated as the 105-D (or D Reactor) and the 105-H (or H Reactor), were two of the nine water-cooled, graphite-moderated reactors constructed in the Hanford Site's 100 Areas (Figure 1-1) by the U.S. Government to support the plutonium-production effort initiated in 1942. The reactors were located along the southern bank of the Columbia River in southeastern Washington State. Construction of the 105-H Reactor began March 1948; operations began in October 1949, and the reactor was shut down in April 1965. Construction of the 105-D Reactor began in November 1943; operations began in December 1944, and the reactor was shut down in June 1967. The 105-H and 105-D Reactors were placed in final shutdown mode, declared as surplus by DOE, and D&D will be performed on each of the reactors.

On May 16, 1985, DOE published in the *Federal Register* (50 FR 20489) a "Notice of Intent to Prepare an Environmental Impact Statement on Decommissioning the Eight Shutdown Production Reactors Located at the Hanford Site Near Richland, Washington."

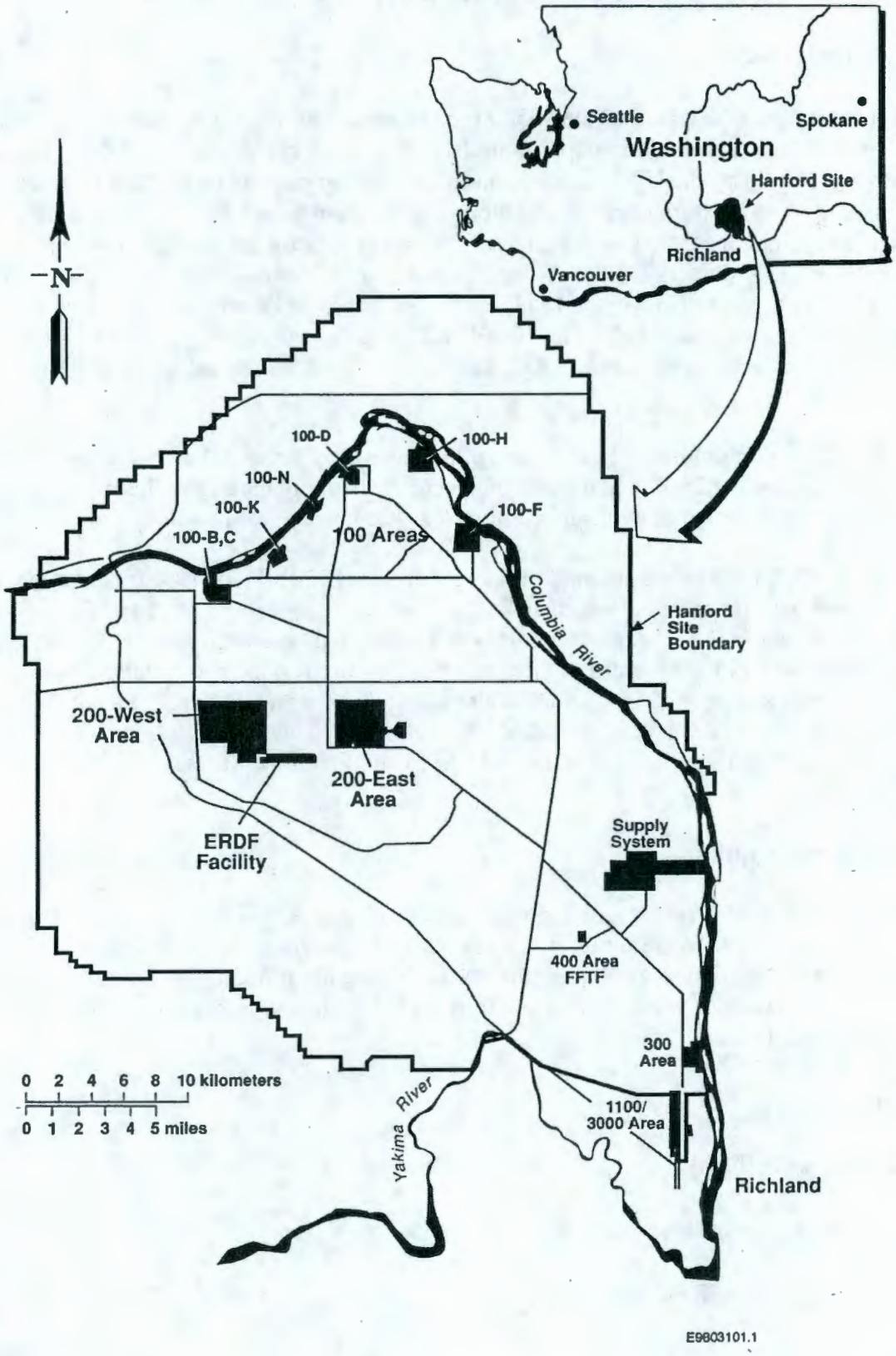
In December 1992, a final environmental impact statement (FEIS) (DOE 1992) was issued that analyzed five decommissioning alternatives for the eight shutdown reactors. The FEIS recommended safe storage of the reactors followed by deferred one-piece removal of the reactor blocks. In September 1993, a Record of Decision (ROD) (58 FR 48509) documented the selection of the safe storage/deferred removal alternative for all the 100 Areas' surplus production reactors, with the exception of the 105-N Reactor. The 105-N Reactor was shut down with no intent for reuse in 1991 (DOE-RL 1995) and therefore was not included in the FEIS (DOE 1992).

1.3.2 Facility Descriptions

1.3.2.1 105-D and 105-H Reactor Buildings. The 105-D and 105-H Reactor buildings are reinforced-concrete and concrete-block structures with steel framing. The lower levels of the buildings and central portions surrounding the reactor blocks are primarily constructed of reinforced-concrete walls, 0.9 to 1.5 m (3 to 4.9 ft) thick. Each reactor building includes the following components:

- Reactor block
- Fuel storage basin (FSB)
- Inner and outer horizontal control rod (HCR) rooms
- Vertical safety rod (VSR) winch level

Figure 1-1. Hanford Site Map.



- Front-face work area
- Fans and ducts for air ventilation and recirculating inert gas systems, including water-cooling systems
- Supporting offices, shops, and laboratories.

Figures 1-2 and 1-3 show the layout of the buildings at ground level, including some of the areas described above. The outside dimensions of the 105-H Reactor building are approximately 111 m by 91 m by 37 m (363 ft by 298 ft by 120 ft) high. The outside dimensions of the 105-D Reactor building are approximately 105 m by 78 m by 37 m (346 ft by 256 ft by 120 ft) high.

Roof construction of the 105-D Facility was primarily pre-cast concrete panels or poured insulating concrete. The majority of the roof (excluding the FSB) was replaced in 1995. The old pre-cast panels were removed (mainly above the process areas) because water infiltration had caused cracking and the rebar-to-concrete bond had disintegrated. The new roof consists of a 5-cm (2-in.) metal-fluted decking covered with 10 to 15 cm (3.9 to 5.9 in.) of urethane foam and two applications of silicon-based overcoat. The existing roof now meets the 22.7 kg/m^2 dead load and 13.6 kg/m^2 live load of the original 20-year life-span design capacity. The 105-H roof (including the FSB) was replaced with a similar roof in 1993 and 1994.

The internal layouts of retired 100 Areas' reactors are typically defined in terms of areas. The areas are identified as follows:

- Module 1 (the general ancillary area of the 105-H and 105-D Reactor buildings located outside of the shield walls)
- Module 2 (the area within the shield walls, including the reactor blocks)
- FSB areas
- Ancillary buildings.

Figures 1-4 and 1-5 provide the layout for the 105-D and 105-H Facilities, depicting the relationships of these four areas. A more detailed description follows.

1.3.2.1.1 Module 1. Module 1 provided ancillary support areas during former reactor operations. These support areas included office areas, the reactor control room, outer rod room, tool storage rooms, restrooms, cooling water influent areas, change rooms, ventilation equipment areas, electrical systems areas, and other infrastructure support.

Figure 1-2. Floor Plan Layout at Ground Level for the 105-D Facility.

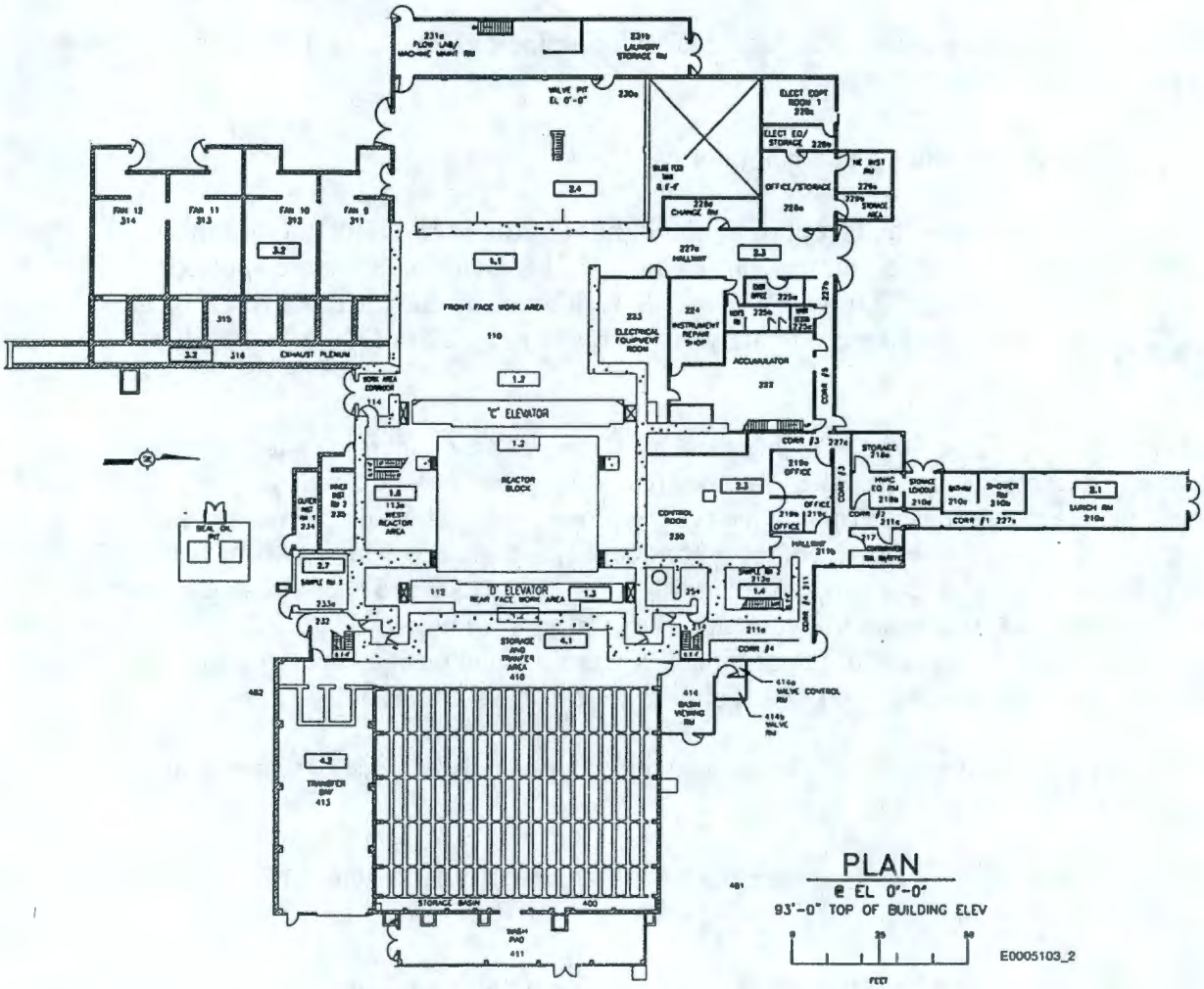


Figure 1-3. Floor Plan Layout at Ground Level for the 105-H Facility.

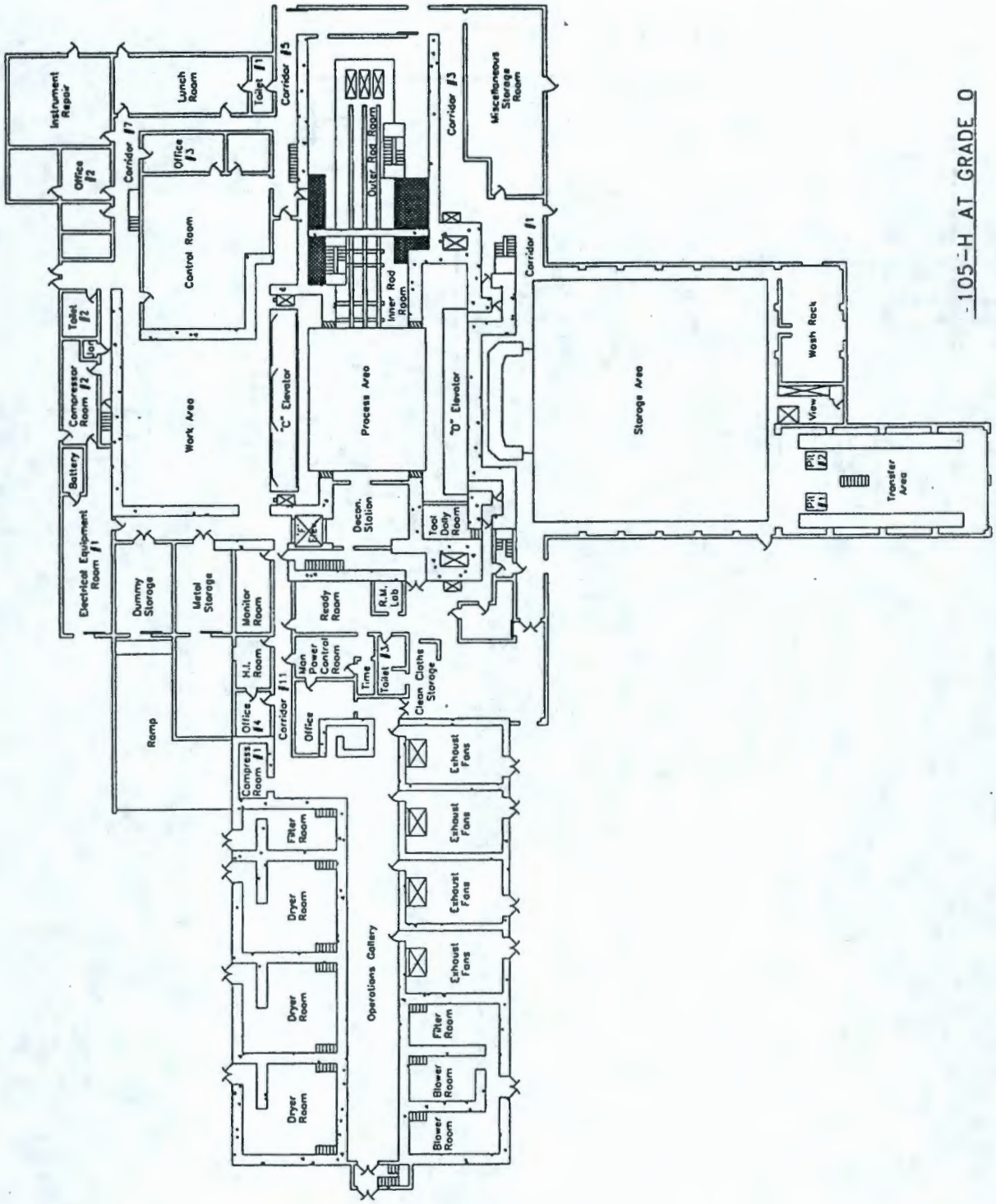


Figure 1-4. Layout of the 105-D Facility (Module 1, Module 2, and Fuel Storage Basin).

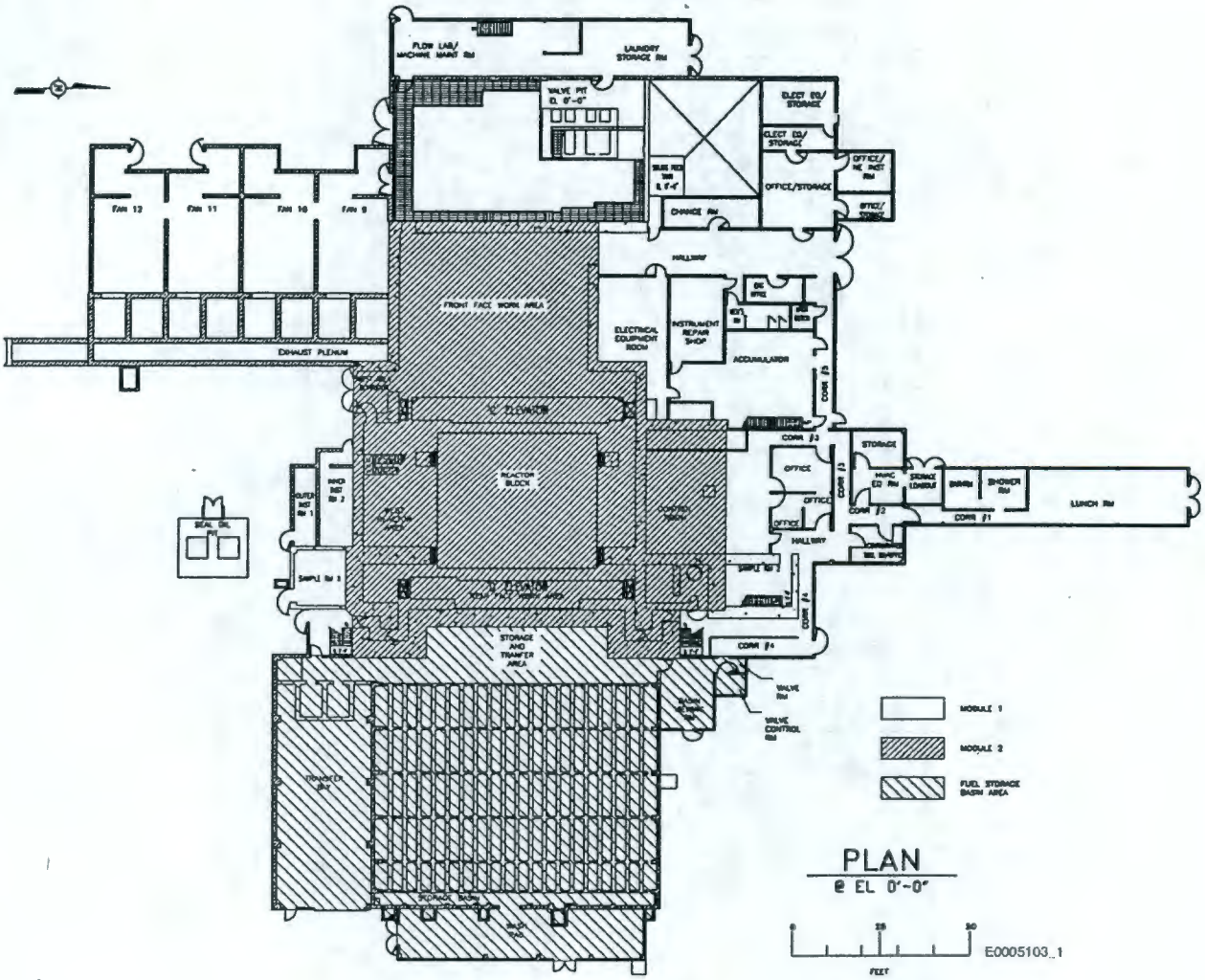
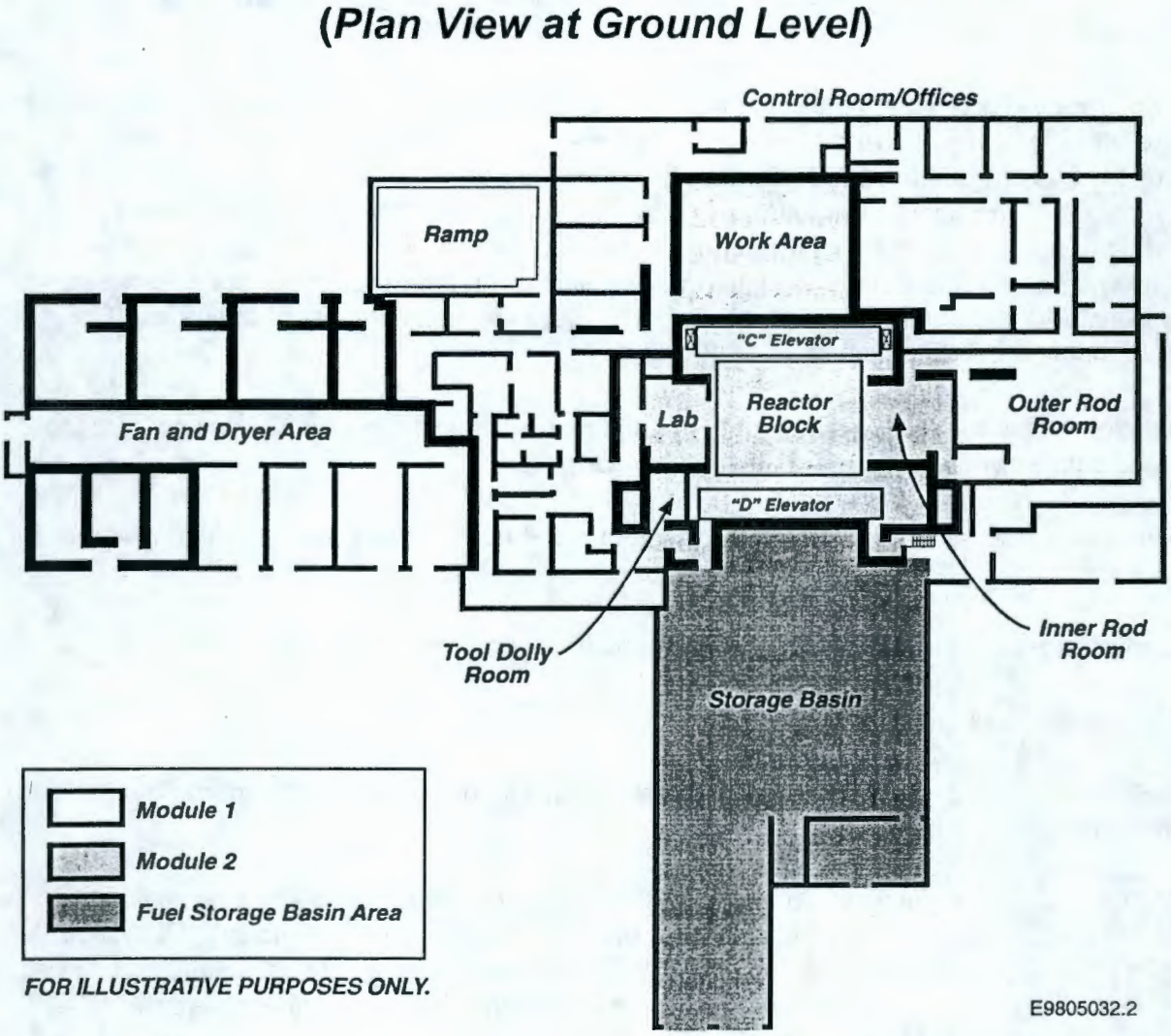


Figure 1-5. Layout of the 105-H Reactor Building (Module 1, Module 2, and Fuel Storage Basin).



1.3.2.2 Module 2. Module 2 is the area located inside the shield walls, including the reactor blocks. Figures 1-6 and 1-7 provide a plan view of Module 2 and what will subsequently be the SSEs. In addition to the reactor blocks, areas and rooms within Module 2 include the inner rod rooms, front face work areas, ball 3X systems, VSR winch assembly mechanism areas, laboratories, and other support areas.

Reactor Blocks. The reactor blocks are located near the center of the buildings within Module 2. Each reactor block consists of a 11-m-high by 11-m-wide by 8.5-m-deep (36-ft-high by 36-ft-wide by 28-ft-deep) graphite moderator stack, encased in a 20.3- to 25.4-cm (8- to 10-in.)-thick overlapping cast-iron thermal shielding; 132-cm (52-in.)-thick welded biological shields consisting of alternating layers of masonite and steel on the four sides (excluding the bottom of the stacks); and unwelded, stair-step labyrinth seal shields on top. Figure 1-8 provides a three-dimensional illustration of the reactor blocks. The blocks rest on concrete foundations. The main components of each block are as follows:

- Reactor moderator stack (an assembly of graphite blocks cored to provide channels for the process tubes, control rods, and other equipment)
- Aluminum process tubes that held the uranium metal fuel elements and provided channels for cooling water
- Control rods, gun barrels, monitoring equipment, experimental test holes, etc.
- Thermal and biological shields
- Welded steel-plate box that enclosed the biological shield and served to confine the inert gas atmosphere within the reactor.

The HCRs entered the reactors from the left side (when facing the reactor front face), and the VSRs and ball 3X system penetrations entered the reactors from the top. The ball 3X system was an emergency shutdown system consisting of neutron-absorbing balls that could be released into the core from hoppers above the reactors. The HCRs had inner and outer rod rooms. The inner rod rooms are located within the massive shield walls of the buildings; the walls provided protection to workers when the rods were removed from the reactors during operation. Fuel discharge and storage areas are located directly behind the rear of the reactors.

All penetrations through the outer shielding of the blocks (e.g., the process tubes, HCR/VSR/3X ball channels, and instrumentation/experimental channels) are provided with cover-gas-seal-designed tubes/sleeves/thimbles to maintain cover-gas containment. The channel tubes, if left sealed and intact, eliminated outside pathways to the inner graphite stack areas.

Figure 1-6. General Plan of the 105-D Safe Storage Enclosure at Ground Level.

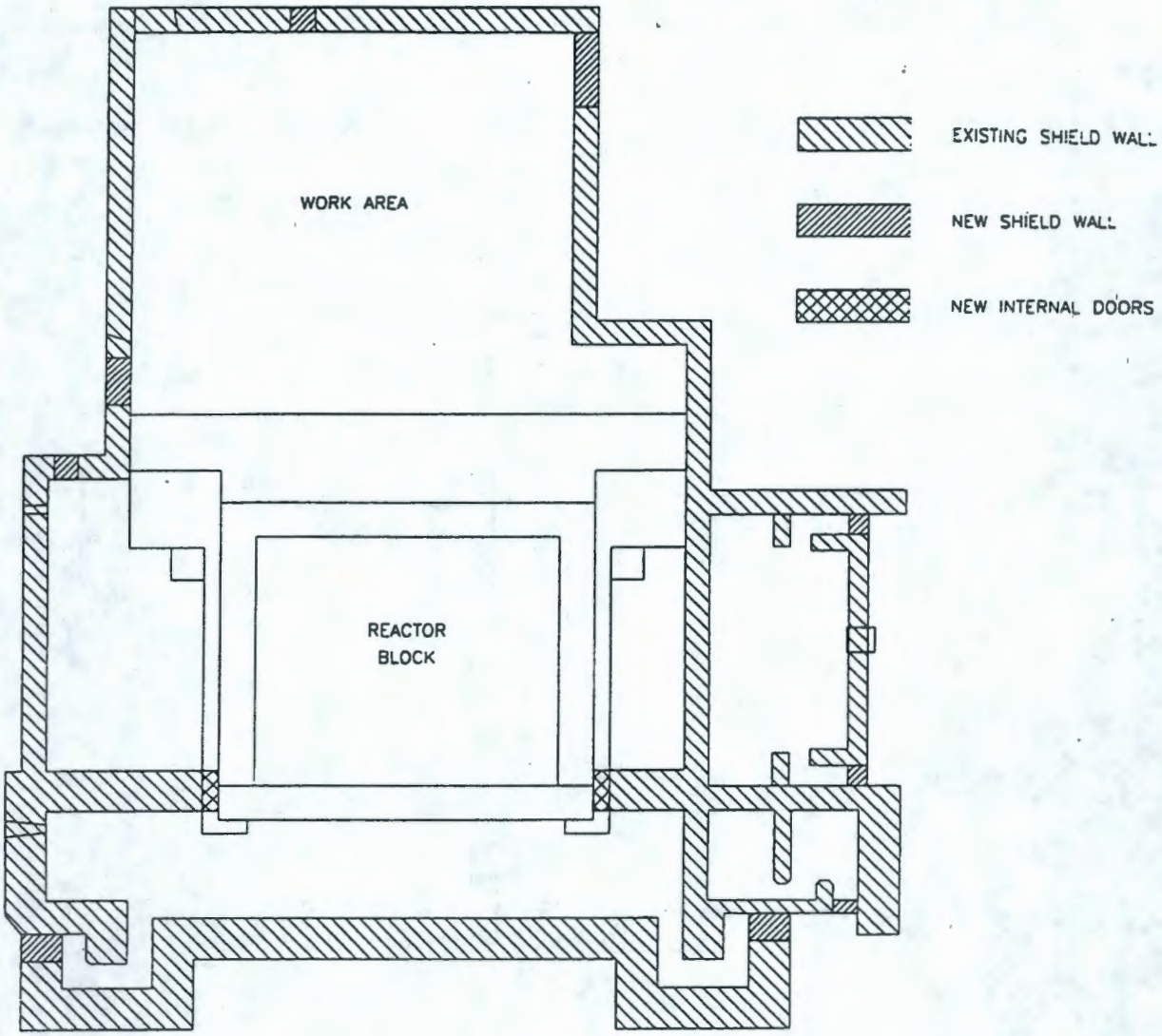
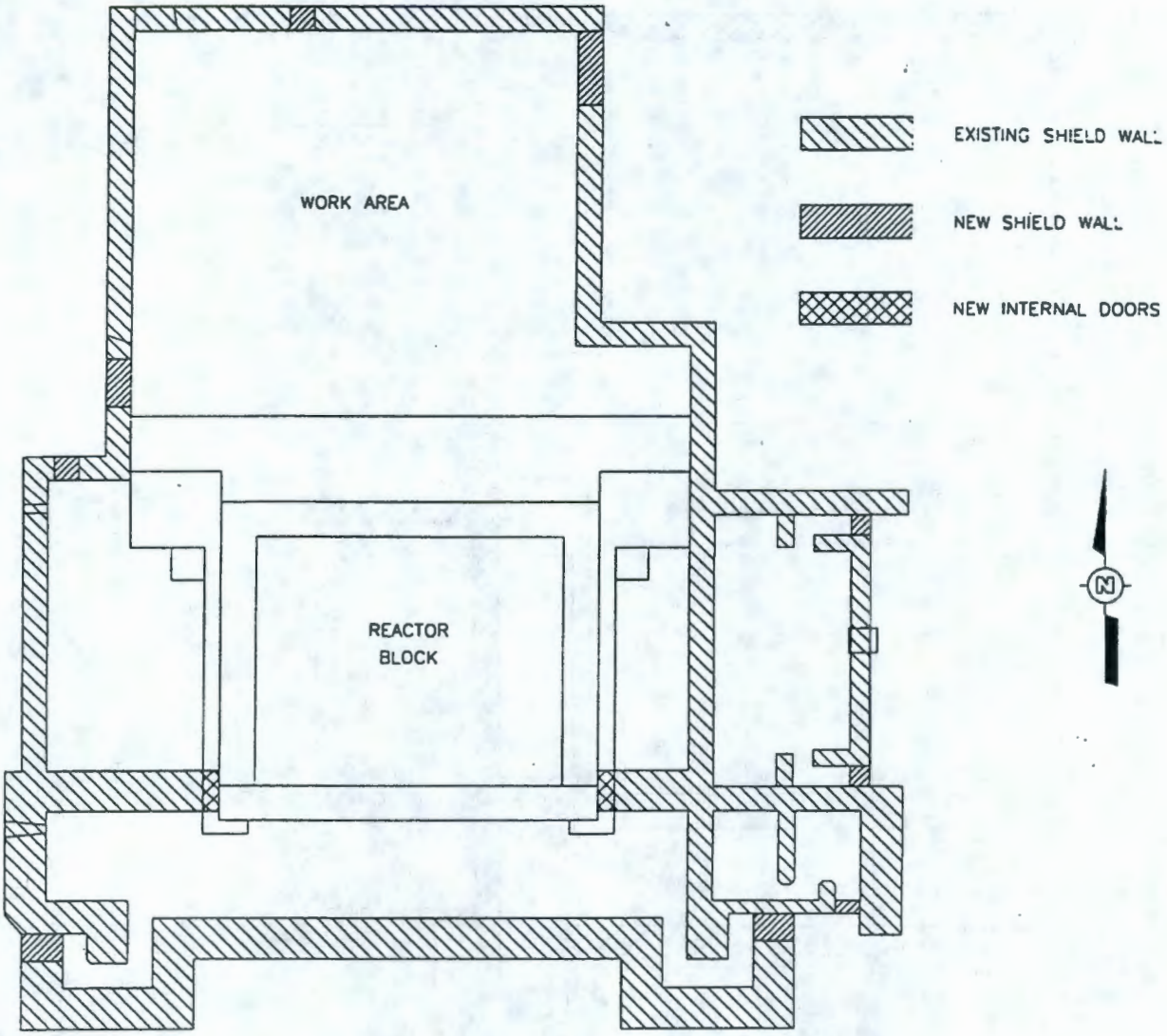


Figure 1-7. General Plan of 105-H Safe Storage Enclosure at Ground Level.



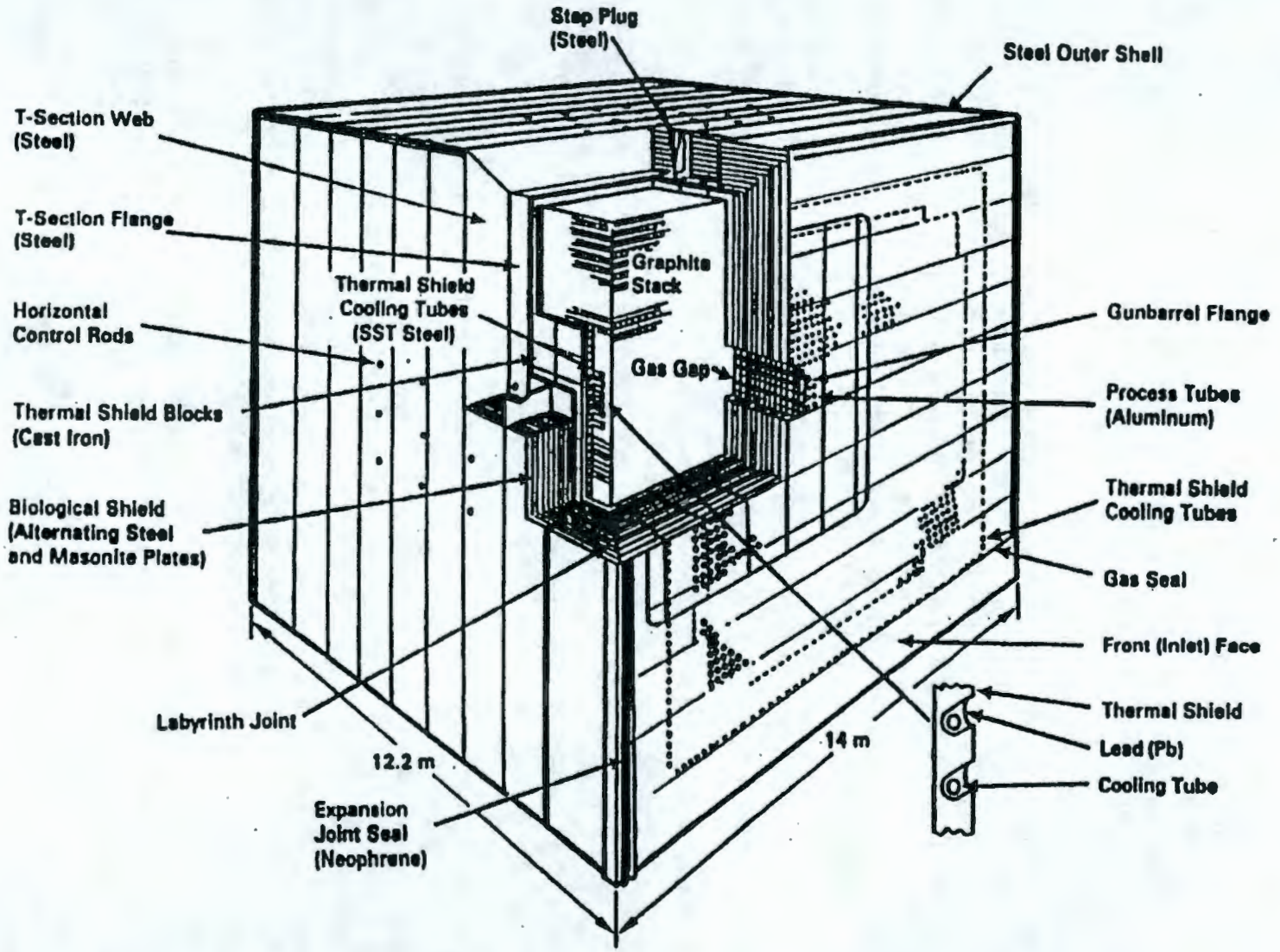


Figure 1-8. Reactor Block Construction.

Reactor Block Shutdown. The complete discharge of fuel from the reactor was carried out over a number of days, with caution being exercised that the changing hydraulics of the reactor as the fuel discharge progresses did not result in the "starving" of those tubes that still contained fuel. Following the discharge, all tubes were probed to ensure that positively that no fuel pieces were left in any reactor tube. Cooling water to the reactor was shut off shortly thereafter, and all process tubes were blown clear of water and recapped. The air blow was not sufficient to dry the inside of the tubes completely; however, the wetness that remained has caused no apparent continuing corrosion damage to the aluminum tubes (DUN 1969).

As water was removed from the reactor, the temperature of the graphite moderator was monitored carefully to ensure that no unknown source of fission product activity in the moderator would cause graphite heating. As a further precautionary measure, an available water supply was maintained for a period of time so coolant could be returned to the reactor in the event of an unexpected graphite temperature condition. As the moderator temperature leveled out a few degrees above building ambient temperature, the "backup" water system was deactivated. Procedural control and adequate signs were then installed to prohibit introduction of a heat source into the moderator (DUN 1969).

The HCRs (which are aluminum structures) and the boron steel VSRs are stored in their respective channels in the reactor. There was no incentive or reason to remove them for disposal (DUN 1969).

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. The original decommissioning report (GE 1965) provides more detailed descriptions of the shutdown/deactivation procedures for the 105-H, 105-F, and 105-DR Reactors. Numerous personnel interviews with experienced Hanford Site reactor personnel have confirmed that the same procedures were performed on the 105-D, 105-C, and 105-B Reactors. A discussion of these procedures follows.

After confirmation that all the process tubes were discharged, end caps were installed at the front and rear. The cross-header valves were tagged closed. After all the cover-process gas lines were drained, the drain valves were closed. All process gas sample lines were closed at the first valve of the primary system and at the inlet and outlet sample chambers. All water lines were drained, and all HCRs and VSRs were left in the "full-in" position. The balls were vacuumed from the hoppers and the majority of these were stored in metal containers with desiccant added. Position indicators and temperature indicators were isolated and pressure-sensing lines were drained and blown dry. The line valves were closed, capped, or plugged.

Special samples were discharged from six test holes in the reactor block. Test holes with water were drained and purged with air until the water was removed. Shielding was reinstalled in any experimental channels.

Several areas of the reactor block require additional protective measures to ensure 75 years of safe storage. These areas were identified as the VSR gaskets, HCR openings, and the front- and rear-face component joining flanges. These areas will be stabilized using appropriate and approved design methods.

1.3.2.2.1 Fuel Storage Basin Areas.

105-H Fuel Storage Basin. The 105-H FSB area, located on the south side of the 105-H Reactor building, served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor (Figure 1-9). The FSB area consists of the fuel element discharge pickup area, which is located adjacent to the reactor rear face; the fuel storage area, which is the basin proper; the fuel transfer area, which includes the fuel transfer pits; and the wash pad area used to decontaminate fuel-handling equipment. The FSB is approximately 22 m long by 25 m wide by 6.1 m deep (72.2 ft long by 82 ft wide by 20 ft deep). The transfer bay is located south of the FSB and served as a railcar cask-loading area for transferring fuel from the FSB.

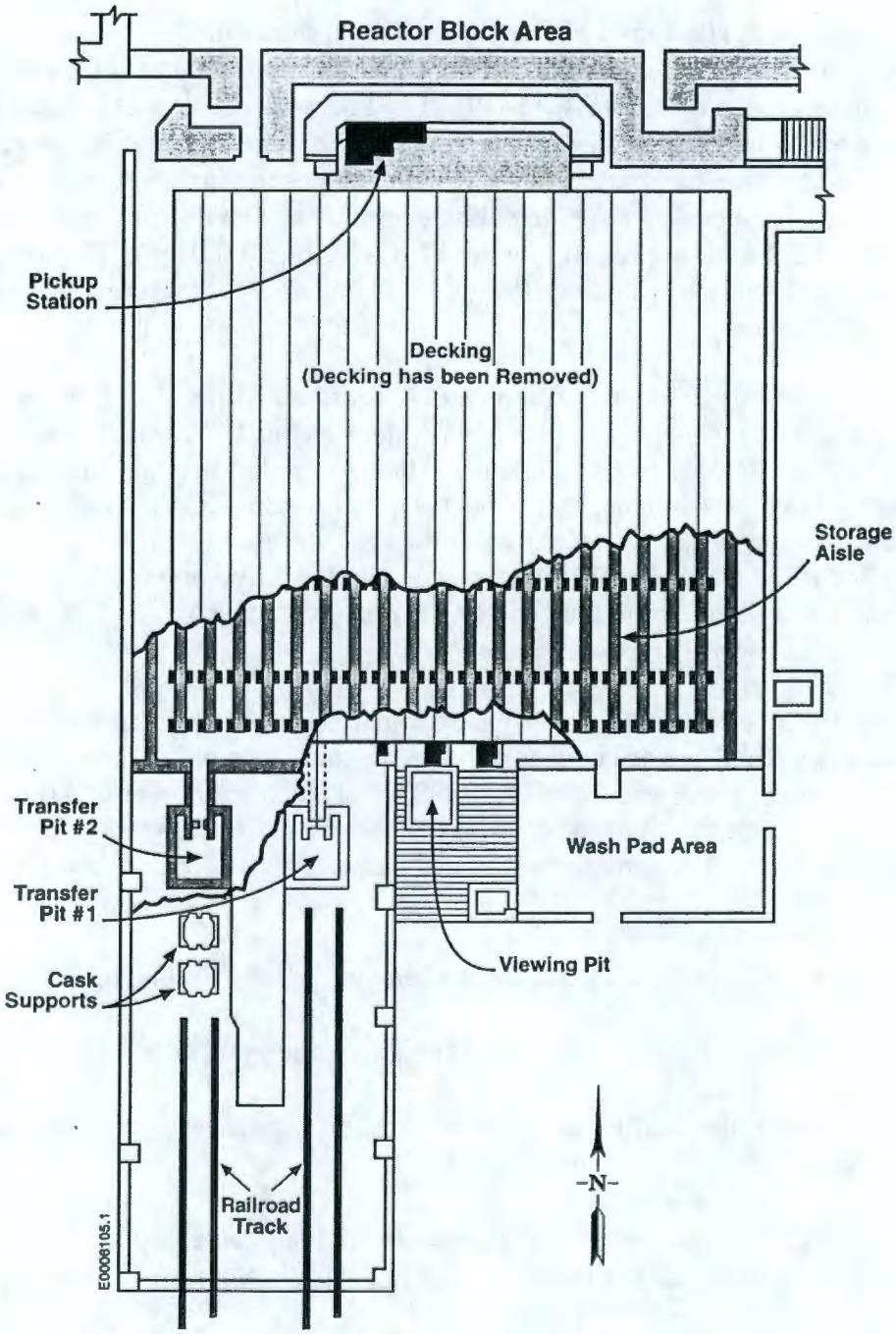
The 105-H FSB was partially drained and completely backfilled with soil in 1970. Liquid was pumped from the basin until about 1.1 m (3.5 ft) of water remained. Within this bottom 1.1 m (3.5 ft) of water, sediment/sludge and miscellaneous items were left behind. Items known to have been left behind in the basin include fuel buckets, fuel spacers, process tubes, tongs, wooden floor decking, and monorail pieces. After the FSB was partially drained, fine stream-bed sand and river-cobble backfill were placed into the remaining 6.1 m (20 ft) of the basin. The backfill material placed in the 105-H FSB was obtained from the local area (the specific borrow pit is unknown) and was not compacted.

In the early to mid-1980s, pieces of fuel rods where found during cleanout of the 105-B FSB and 105-C FSB. These discoveries raised concerns that there could also be fuel rods or fuel rod pieces in the bottom of the 105-F and 105-H FSBs. Two characterization efforts (one in 1989 and one in 1991) determined the characteristics of the backfill material, water content, radiological constituents, and dangerous waste constituents. The two characterization efforts concluded the following:

- Approximately 152,000 L (40,000 gal) of water remains in the FSB (WHC 1989).
- The top 3.1 m (10.2 ft) of backfill has minimal contamination (WHC 1991).
- The next 2.1 m (6.9 ft) of backfill is suspected to be radiologically contaminated in some locations (WHC 1991).
- The bottom 0.9 m (3 ft) of backfill is contaminated with material, equipment, sediment layer, and possibly fuel elements, mainly residing close to the basin floor (WHC 1991).

The 105-H FSB inventory is described in greater detail in the *Final Hazard Classification and Auditable Safety Analysis for the 105-H Reactor Interim Safe Storage Project* (BHI 2000c).

Figure 1-9. 105-H Fuel Storage Basin Area Layout.



105-D Fuel Storage Basin. The 105-D FSB area, located on the east side of the 105-D Reactor building, served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor (Figure 1-10). The FSB area consists of the fuel element discharge pickup area, located adjacent to the reactor rear face; the fuel storage area; the basin proper; the fuel transfer area, including the fuel transfer pits; and the wash pad area used to decontaminate fuel-handling equipment. The storage area dimensions are approximately 22 m by 24.7 m by 6.1 m (72.2 ft by 81 ft by 20 ft) deep. The FSB and the fuel transfer pits have been drained and cleared of debris and sediment, and a fixative has been applied to the lower portions of the contaminated surfaces (UNI 1986). An asphalt emulsion fixative was applied on the bottom 2.44 m (8 ft) of the FSB walls and the FSB floor. The FSB is covered with fire-resistant-coated wood planking (UNI 1986).

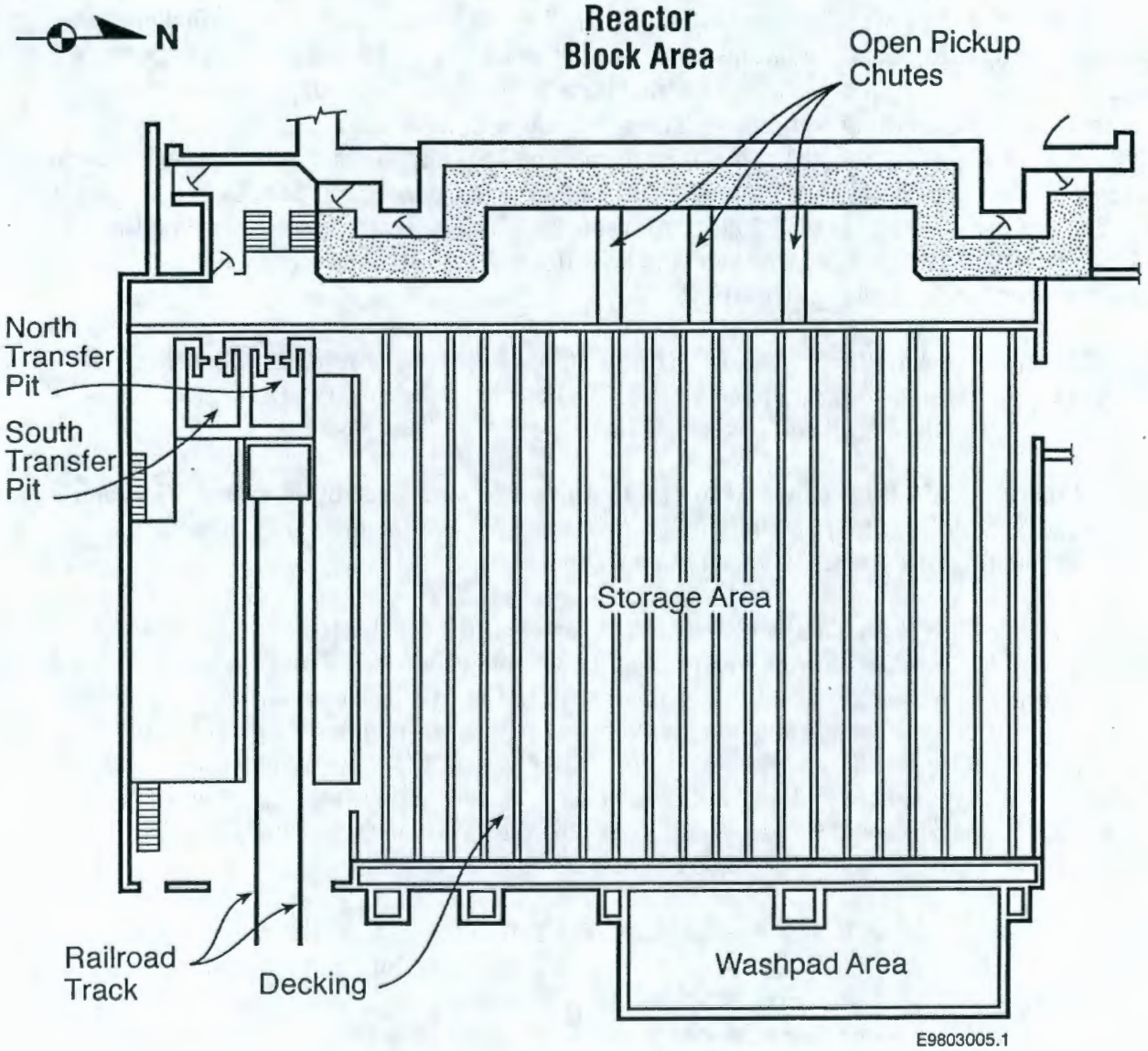
1.3.2.2.2 Buildings Ancillary to the 105-H and 105-D Reactor Buildings. All ancillary facilities (except those discussed in Section 1.3.2.2) have been previously demolished. These include the exhaust stacks, lift stations, guard shacks, etc.

1.3.2.3 Ancillary Buildings Covered by the Removal Action. In addition to the 105-H and 105-D Reactor buildings, four ancillary buildings and associated facilities (e.g., underground tunnels and ducting) are covered by the removal action.

1.3.2.3.1 103-D Unirradiated Fuel Element Storage Building. The 103-D Building was originally used for pallet storage of unirradiated fuel elements before the fuel elements were used in the reactor. The building was subsequently used to store miscellaneous items. The building is a one-story, reinforced-concrete and concrete-block structure with dimensions of 16 m by 8 m by 4 m (53 ft by 27 ft by 14.5 ft) and a total area of 133 m^2 (1,431 ft^2). The building has a concrete foundation and floor, concrete-block walls, and a concrete roof with a built-up tar and gravel surface. One end of the building has a reinforced-concrete, floor-level loading platform. The building was demolished in February 2001.

1.3.2.3.2 190-DR Process Water Pumphouse. The 190-DR Building originally supplied treated water to the reactor and other equipment for cooling. The building measures approximately 128.1 m by 36.6 m (420.3 ft by 120.1 ft) and is a single-story, steel-frame structure on a concrete foundation with concrete floors, pressed steel and transite siding, and a concrete roof with tar and gravel surfacing. The building is energized and is currently used as a warehouse to store surplus office furniture and 105-B Museum exhibits. The building is also used to store plastic-wrapped tools that became contaminated during decontamination and demolition; consequently, there is a potential for low-level radiological contamination. Demolition will not be planned until the facility is no longer required for storage.

Figure 1-10. 105-D Fuel Storage Basin Area Layout.



1.3.2.3.3 1713-H Warehouse. The 1713-H Warehouse is an "L"-shaped, single-story, steel-frame structure with corrugated transite sides. The dimensions are 47.5 m by 18.9 m (155.8 ft by 62 ft) and 21.9 m by 18.3 m (71.9 ft by 60 ft). Approximately 1,208 m^2 (12,998 ft^2) of storage space is available in the building. The northern end of the building is currently used for the 100-H Area groundwater pump-and-treat system, which is expected to complete operation in 2004. Demolition would not be planned until the pump-and-treat system is no longer needed. The foundation and floor are concrete, and the facility was re-roofed in 1987. Potential exists for radioactive contamination from past warehouse storage operations.

1.3.2.3.4 1720-HA Arsenal. The 1720-HA Arsenal/Warehouse was used for central storage of ammunition used by the Hanford Security Patrol and was most recently used to store explosives for demolition work. The 1720-HA Arsenal/Warehouse is a 1.8-m by 2.4-m (5.9-ft by 7.9-ft) concrete structure. It is the only building on the Hanford Site used to store explosives. There is no expectation that any of this material still exists in the building; however, prior to demolition, the building and the surrounding area will be inspected by a munitions expert for confirmation. This building contains no radioactive materials and has no electrical service.

1.3.2.3.5 105-D Water Tower Pedestals. The 105-D water tower was previously demolished. However, the five concrete support pedestals were left in place and were demolished as part of this removal action in July 2002.

1.3.2.3.6 Other Impacted Sites and Facilities. Several inactive waste disposal sites located near the 105-D and 105-H Facilities will be integrated with this removal action. Figures 1-11 and 1-12 show the locations of these additional impacted sites in the 100-D/DR and 100-H Areas, respectively. Table 1-1 identifies the facilities and the specific waste disposal sites located near each facility. Additional waste sites (e.g., french drains and pipelines) may be discovered or encountered during demolition. These sites will be recorded and mapped, as necessary, and integrated with the RA/WD Program during the removal action to avoid the need for future re-excavation. The sites listed in Table 1-1 within the footprint of the ISS project will be removed and disposed. Other sites listed will be deferred to the RA/WD Program for future removal.

Alternatives to remediate these waste sites were evaluated and approved in other CERCLA documents (EPA et al. 1999). Table 1-1 also identifies the ROD for each waste site. The selected remedy for all of the sites was to remove contaminated soil and structures, treat as appropriate, and dispose, except for waste site 126-DR-1. The 126-DR-1 waste site is a burial ground that underwent a CERCLA evaluation with the alternatives being remove, treat, and dispose and containment. The selection of the preferred alternative for this burial ground is documented in a ROD issued in September 2000 (EPA et al. 2000).

Tunnels between the 105-D and the 190-D/DR Buildings serve as habitat for bats on the Hanford Site, and will remain in place after installing below-grade isolations under the removal action.

Figure 1-11. 100-D/DR Area.

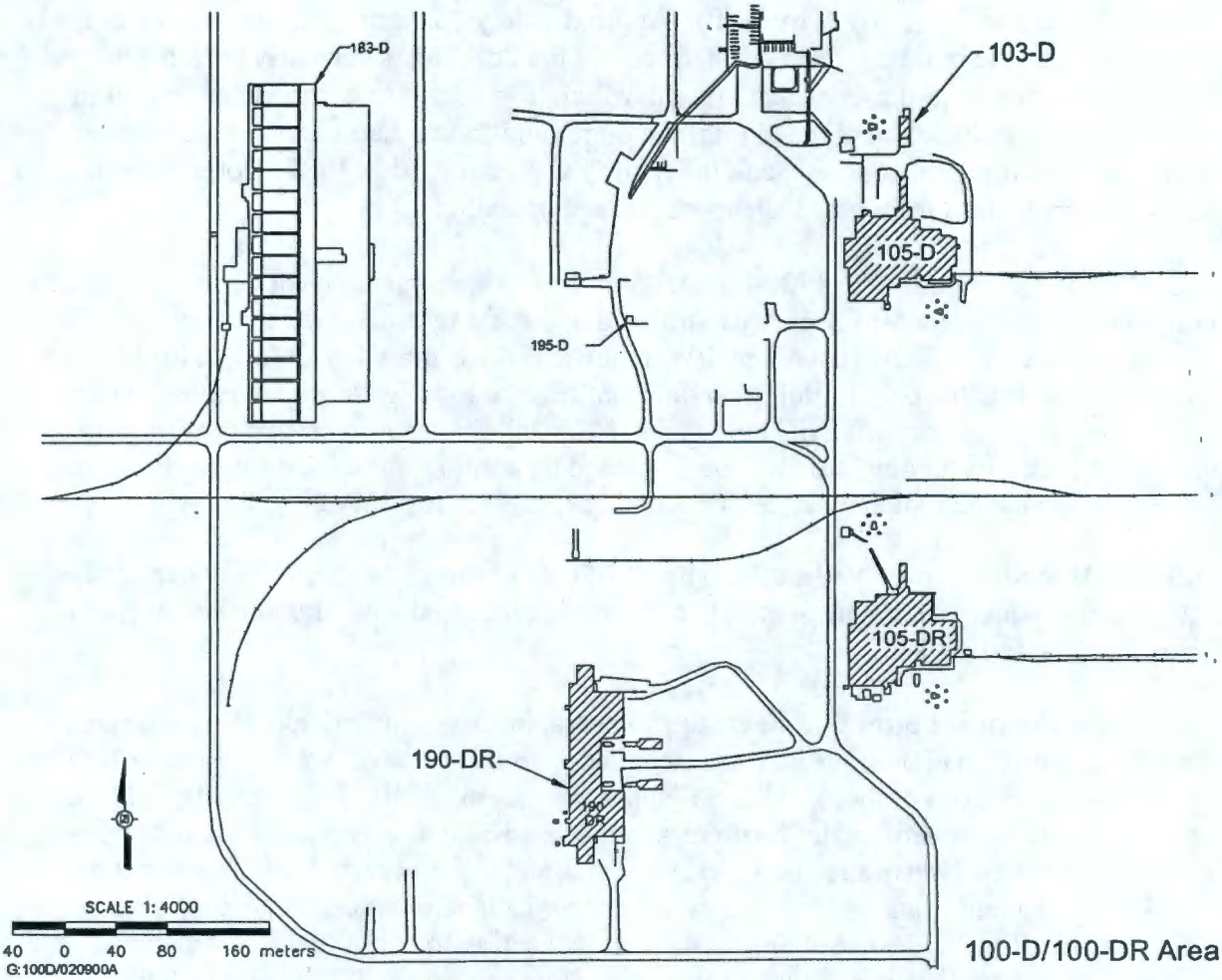


Figure 1-12. 100-H Area.

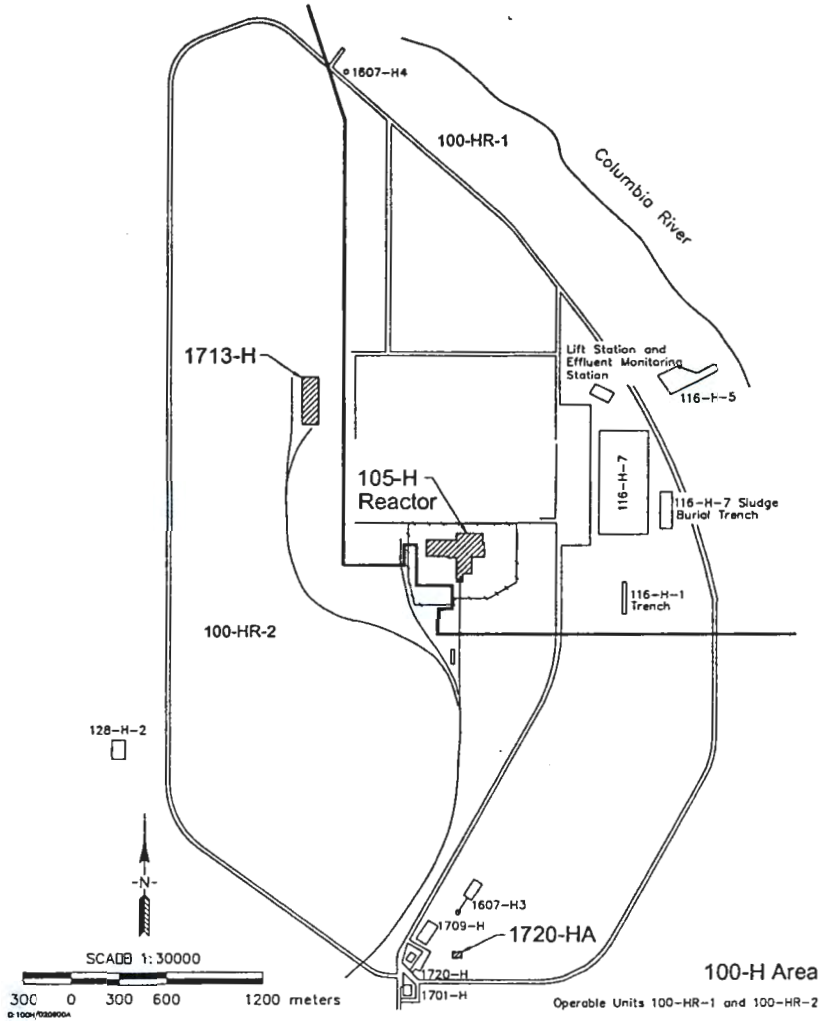


Table 1-1. Facilities and Potentially Impacted Waste Sites.

Facility	Waste Site	Waste Site Description	Reference
105-D	100-D-52	French drain	Proximity site to 100-D-48, 1995 ROD (EPA 1995)
	116-D-6	French drain (remediated)	
	100-D-24	French drain	Remaining Sites ROD (EPA et al. 1999)
	100-D-3	Burial ground	
	132-D-4	105-D Reactor exhaust stack debris	Under evaluation (DOE-RL 1999)
190-DR	126-DR-1	Clearwell tank pit (active)	100 Area Burial Grounds ROD (EPA et al. 2000)
	100-D-27	Transformer leak	Remaining Sites ROD (EPA et al. 1999)
	100-D-28	Septic tank system	Remaining Sites ROD (EPA et al. 1999)
103-D	None	--	--
105-H	100-H-31	Unplanned release	Remaining Sites ROD (EPA et al. 1999)
	100-H-7	French drains	Remaining Sites ROD (EPA et al. 1999)
	100-H-8		
	100-H-9		
	100-H-10		
	100-H-11		
	100-H-12		
	100-H-13		
	100-H-14	Surface contaminants	Remaining Sites ROD (EPA et al. 1999)
	100-H-21	Process sewer (effluent pipelines)	1995 ROD (EPA 1995)
	132-H-1	Burial ground	Remaining Sites ROD (EPA et al. 1999)
	132-H-2	Filter building site	1997 ROD amendment (EPA et al. 1997)
	132-H-3	Pump station	1997 ROD amendment (EPA et al. 1997)
	116-H-4	Crib located within boundary of 132-H-2	1995 ROD (EPA 1995)
1720-HA	None	--	--
1713-H	None	--	--

2.0 REMOVAL ACTION

The objective of the 105-D and 105-H ISS projects is to place the 105-D and 105-H Reactor buildings into ISS for a period of up to 75 years and to demolish the ancillary buildings. These actions will reduce the potential for release/exposure of hazardous and radioactive materials to workers, the public, and the environment. The ISS projects will also reduce periodic S&M costs incurred from maintenance of the degrading buildings.

2.1 REMOVAL ACTION WORK ACTIVITIES

The following sections provide a general description of how work activities will be performed for the 105-D and 105-H ISS projects. The general scope of work involved to implement this removal action includes the following activities:

- Removing hazardous substances (chemical and radiological)
- Removing facility equipment and miscellaneous piping
- Dismantling various facility structures
- Disposing waste
- Constructing the SSE
- Performing verification sampling
- Preparing the project closeout report
- Preparing the cleanup verification package.

The work scope will be accomplished by completing the activities described in the following subsections.

2.1.1 Site Mobilization and Preparation Work

Upon initiation of the 105-D and 105-H ISS projects, personnel will be mobilized and consumables and required equipment will be procured. The first activities to be performed will include mobilizing manual personnel and trailers to support the project activities. Field Support personnel will also terminate and/or verify termination of all 105-D and 105-H Reactor building services and utilities. Utilities currently servicing the facilities are electrical power and sanitary sewer system. Electrical systems that will be used throughout the 105-D and 105-H ISS projects are discussed in further detail in Section 2.3.1.

Concurrent with these activities, waste segregation and staging areas will be set up (within the area of contamination [AOC] or at an onsite location) to facilitate transportation of the material for recycling or disposal in accordance with Section 4.2. Supervisor trailers, lunch trailers, change trailers, office trailers, mobile shower trailers, and restroom facilities will also be mobilized as required at the sites to prepare for D&D activities. Electricity will be connected from an outside line or generator, and temporary power and lighting will be installed. Occupational Safety and Health Administration concerns (e.g., fall protection, guarding, and electrical) will be managed as the concerns are identified.

2.1.2 Characterization

Characterization will be conducted by the sampling and analysis of materials and radiological surveys throughout the 105-D and 105-H ISS projects and D&D of the ancillary buildings in accordance with the results and findings of the data quality objective (DQO) process. Sampling and analysis will be used to identify radiological and hazardous conditions that will be encountered during facility operations, to specify health and safety requirements, and to determine the waste streams that will be generated. These technical services will also be used to characterize waste for treatment and/or disposal and to verify facility and area conditions at various phases of project completion. Section 4.3 describes characterization in further detail.

One of the initial work activities inside the building will include conducting radiological surveys. Radiological surveys will be performed using hand-held and/or large-area detection equipment that may be augmented with the Laser-Assisted Ranging and Data System (LARADS) for recordkeeping during surveys. Additionally, an advanced characterization system, consisting of an AIL GammaCam™ M31 gamma-ray/video imaging system for the location of hot spots, a Canberra In Situ Object Counting System (ISOCS) gamma-ray spectrometric system, and data-logging contamination monitoring equipment, is planned to be deployed for the rapid, economical, and accurate characterization of materials for radiological contamination.

2.1.3 Decontamination and Demolition

Work activities, in general, will begin in the radiological controlled areas and will move progressively inward toward the contamination areas surrounding the reactor blocks. After an area has been surveyed and the radiological conditions have been established, biological cleanup and general housekeeping will commence as necessary, which involve removing loose biological feces and rubble and sweeping and vacuuming floors. Section 4.2 discusses how waste will be managed.

All friable and most nonfriable asbestos-containing materials (ACMs) and presumed ACMs will be removed prior to demolition of the area. The ACM typically consists of insulation for piping, floor tiles, cement asbestos board, etc. Insulation on piping will be removed as Class I asbestos work, and nearly all other ACM in the facilities will be removed as Class II (e.g., floor tiles and cement asbestos board). Asbestos work, air monitoring, and worker safety requirements will conform to BHI procedures for ACM removal and will be described in detail in the project-specific asbestos abatement work plan.

If alternate removal methods for friable asbestos are developed, or if nonfriable asbestos is to be left in place during demolition, a certified industrial hygienist or licensed professional engineer who is also qualified as a certified *Asbestos Hazard Emergency Response Act of 1986* (AHERA) (see 40 CFR 763) project designer shall evaluate the work area, the projected work practices and the engineering controls and shall certify in writing that the planned control method is adequate.

™GammaCam is a trademark of AIL Systems, Inc., Deer Park, New York.

Unattached not-in-use and accessible lead bricks and sheeting, polychlorinated biphenyls (PCBs) (primarily in motor oils and light ballasts), sodium dichromate (primarily from water system treatment), mercury (primarily in lighting components and switches), and other hazardous materials will be removed and disposed as hazardous or mixed waste or will be recycled consistent with guidelines found in Section 4.2.

Most of the loose, accessible radiological contamination will be either removed or fixed in place, depending upon the levels, accessibility, complex shapes (e.g., grating), and type of contamination found. Some equipment/piping will be removed, and loose contamination will be wiped or vacuumed. If loose contamination remains after the initial decontamination effort (unless the area will be inaccessible after completion of the ISS Project, or if the building configuration or conditions make removal of loose contamination impractical), then the contamination may be fixed in place, as required. Removal of fixed contamination (radiological or chemical) will be performed using nonaggressive means, such as wiping or using decontamination solutions. Aggressive means of decontamination such as scabbling, grinding, or other abrasive/mechanical means are planned to be used only as necessary to reduce levels to as low as reasonably achievable (ALARA).

Activities that have a potential to emit radiological emissions are discussed in Appendix B. The above-grade structure outside the existing shield walls, including the siding and structural framing above the shield walls, will be demolished using standard demolition techniques (e.g., an excavator with a hoe-ram, a hydraulic shear with steel shear jaws, concrete pulverizer jaws or breaker jaws, a crane with wrecking ball, controlled explosives). Steel will be segregated for salvage if economically feasible, unless determined to be contaminated. Included in the removal operation are the building exhaust fan room, supply fan room, maintenance shops, offices, control room, outer rod room, fuel storage areas, inlet water tunnels, change rooms, corridors, machinery rooms, valve pit, and other miscellaneous spaces currently located outside the shield wall, as shown in Figures 1-2 and 1-3. Below-grade areas of the buildings that meet the cleanup criteria (defined in Sections 4.1, 4.4, and 5.7) will be left in place, and voids will be backfilled with clean debris or soil. Areas where walls, floors, and roofs have been separated from the SSE walls will be trimmed as necessary to reduce jagged edges. Exposed rebar will be cut flush with the remaining concrete.

Decontamination necessary to allow removal of demolition equipment from contamination areas will be accomplished using standard industry practices and best management practices. Gross equipment decontamination methods will be employed to remove loose contamination within the contamination area. Best management practices for gross cleaning and/or decontamination of heavy equipment and vehicles consist of using wipes and nonhazardous materials to remove loose contamination.

One or more decontamination areas will be established within the AOC or in the onsite area. Additional or final decontamination will be performed in these established areas. The amount of water used to clean equipment in the decontamination area will be minimized. Water used will be raw or potable water only. Soaps, detergents, or other cleaning agents will not be added to the washwater. Pressure washing (if required) will normally be performed using cold water

(however, hot water may be used to avoid icing). Steam cleaning will be used only after other decontamination methods prove to be ineffective.

Spent decontamination water and associated contamination will be discharged to the ground within the decontamination area. Verification sampling of the area will be performed in accordance with an approved characterization plan prior to closeout of the project.

Decontamination practices will be documented in the field superintendent's daily log. Personnel responsible for equipment decontamination will be knowledgeable of the requirements of this section of the removal action work plan.

If cleanup of soils surrounding the buildings is too extensive to be managed in a cost-effective manner, the sites will then be stabilized in a manner that will not hinder future remediation. Future cleanup, if necessary, or transfer of the removal action scope will be coordinated with and approved by the lead regulatory agency. Future cleanup will occur at the same time that waste sites are addressed in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units.

2.1.4 105-H Fuel Storage Basin

A disposition plan for the 105-F FSB (BHI 2000a) was developed after various alternatives and removal methods were reviewed. Similar methods will be used at the 105-H FSB. The method chosen for basin cleanout combines safety and cost effectiveness using standard methods, available equipment, and proven techniques. The disposition plan discusses the cleanout of the FSB (as part of the facility ISS) and the two stages of completion. Initially, a water-removal system will be fabricated, installed, and operated within the FSB. Water will be removed, tested, and disposed of at the 200 Area Effluent Treatment Facility. Stage I will address the FSB from the surface to approximately 5.2 m (17 ft) below grade. Stage II will address the remaining 0.9 m (3 ft) of basin material. Both phases will apply engineering controls to ensure worker safety, maintain radiological doses ALARA, and minimize potential releases of radiological emissions to the environment. A readiness assessment will be conducted to assess work activity project readiness prior to initiating FSB cleanout work. A major portion of material/structure removal will use equipment (e.g., backhoes and excavators) that is typically used for D&D below-grade material removal, structure demolition, and large-scale soil remediation work. Experience gained in prior basin cleanout projects (i.e., 105-B, 105-C, 105-D, 105-DR, 105-F, and 105-N) will be used to optimize working conditions.

2.1.4.1 Upper Fill Removal (Stage I). Demolition of the above-grade structure will occur to allow access to the upper fill overburden and characterization of the fill material. Excavation of backfill will begin at grade and continue to approximately -5.2 m (-17 ft) below grade using primarily an excavator. The frequency of radiological surveys will increase as necessary as the removing backfill approaches the bottom of the basin. After being sampled, the upper fill material will be disposed of in the ERDF. The remaining soil layer will act as a biological shield and continue to confine the sediment and other radiological material located on or near the basin floor.

Originally, a retractable cover over the FSB was planned to be installed to provide weather protection. The need for such an enclosure was later reevaluated. Phase II excavation and demolition activities (Section 2.1.4.2) would be significantly easier and more efficient to perform without a cover and supporting structures. Unobstructed access to the basin allows for easier deployment of equipment. Supplemental lighting is minimized or eliminated. Subsequently, DOE and the lead regulatory agency agreed that a cover would not be necessary (Smith 2000).

2.1.4.2 Debris and Contaminated Fill Removal with the Integrated Equipment System (Stage II). Removal of fuel elements or hot spot materials will be typically accomplished by using a small excavator (e.g., Brokk™-type remote control crawler) with attachments to expose the fuel elements or hot spot materials and then load the materials into an appropriate container. A large excavator, or personnel with long-handled tools may be used to remove hot spot material and other lower fill debris and soil if dose rates do not pose a threat to personnel. Loaded fuel containers will be placed into appropriate shipment containers prior to removal from the controlled area. Other hot spot materials will be excavated and packaged for disposal. Backfill material removed during Stage II will be radiologically screened, and any fuel elements will be remotely placed into a fuel holding container. Other hot spot material will be removed and packaged for disposal. Heavy equipment will provide shielding and distance for operators, allowing for prudent excavation of high-dose-rate items. (Identifying, locating, and removing fuel elements and other hot spot materials are a first priority and are closely controlled by limitations outlined in the project authorization [safety] basis documents.)

The debris material (except for retrievable spent nuclear fuel) will be packaged for disposal at the ERDF or storage at the Central Waste Complex (CWC), as appropriate. Some waste materials may require segregation for macro-encapsulation, such as lead and/or high-dose materials (e.g., sediment). Typically, a loader trackhoe, backhoe bucket, and attachments will hook, grip, shear, lift, or remove buckets, monorail beams, wood planking material, etc., and place the materials into ERDF approved containers.

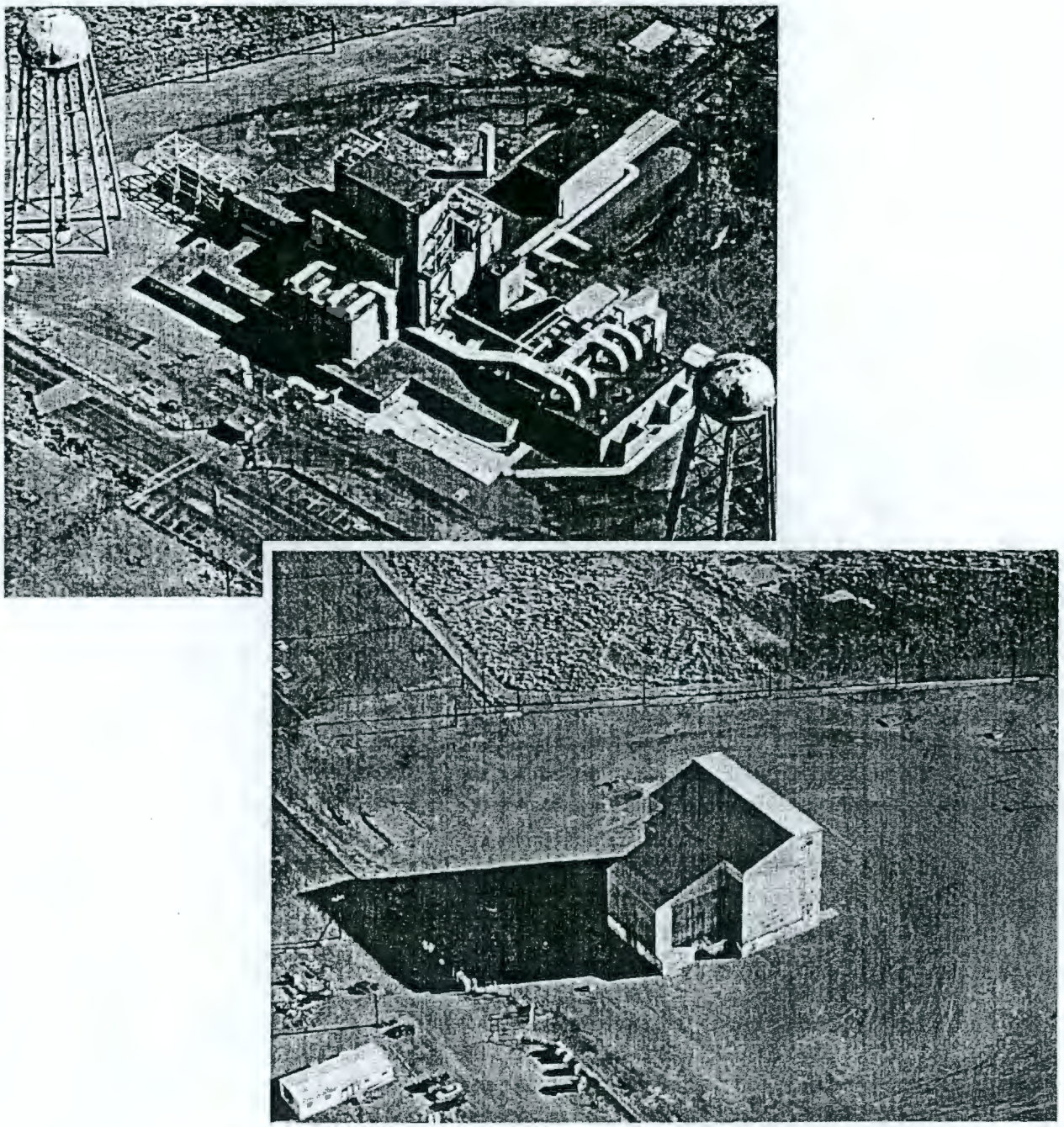
RESidual RADioactivity dose model (RESRAD) methodology may be used to determine radiological release levels for the basin wall, concrete floor, and the remaining structures, which is similar to the methodology used for the below-grade structures at the other reactors (i.e., 105-C, 105-DR, and 105-F).

2.1.5 Safe Storage Enclosure Construction

Following decontamination and partial demolition of the reactor buildings, the existing shield walls will be used to create a SSE, including a new or enhanced metal roof. The shield walls will support the roof, any openings/penetrations in the enclosure will be completely sealed, and remaining entrances will be welded shut. Other exposed SSE concrete surfaces will be left "as-is" upon completion of ISS work. A utility room located outside of the SSE will be used for ventilation controls, monitoring equipment, and electrical power. Figure 2-1 shows a graphical representation of what the SSE will look like when completed.

™ Brokk is a registered trademark of Brokk A.B. Skellfteä, Sweden.

Figure 2-1. Safe Storage Enclosure.



E0005016

Key elements of the SSE design are as follows:

- Use existing shield walls as the basis for establishing the SSE footprint and as prime components of the structure
- Remove exterior floors and decking to within the minimal acceptable distance of the wall for integrity of the remaining structure
- Seal all wall penetrations securely so penetration closures will not be dislodged in a seismic event or from wind loads
- Provide access door(s) for S&M activities
- Provide for ventilation of the facility, if required, during surveillance inspections and maintenance activities
- Address closure of all subsurface tunnels and pipes that will be left in place to prevent water or pest intrusion
- Allow for decontamination of equipment and structural components to the extent reasonable for radioactive and hazardous material volume reduction, ALARA practices, and, if practical, the release of material for unrestricted use
- Provide a lighting system and convenience receptacles designed to provide adequate illumination for access/egress and adequate power for S&M activities
- Provide a remote monitoring system for flooding and temperature monitoring with a read-out at a central monitoring station.

2.1.6 Waste Disposal

All waste management activities will be performed in accordance with waste management ARARs identified in the action memorandum for the 105-H and 105-D Reactor buildings and ancillary facilities (Ecology and DOE 2000). Waste from this action will either be disposed at the ERDF or at lead regulatory agency and EPA-approved offsite disposal facility. Treatment of waste may be necessary prior to disposal at the ERDF, and containerized waste may be stored at the ERDF with EPA concurrence while the waste is awaiting treatment.

If transuranic or mixed waste is encountered, storage is allowed at the Hanford Site's CWC on a case-by-case basis and requires lead regulatory agency and EPA approval. Certain material is eligible for salvage and recycling, which is encouraged if the appropriate regulatory requirements are met and it is economically feasible for the project to do so. Liquid waste will either be sent to the Hanford Site's Effluent Treatment Facility (ETF) or will be treated to meet the acceptance criteria of the receiving facility. Section 4.2 discusses waste management in further detail.

2.1.7 Site Restoration

Following the completion of demolition activities, if verification sampling of the site indicates that cleanup levels have been met, below-grade void spaces will be backfilled with nonhazardous/nonrecyclable material (e.g., clean concrete rubble and/or soil). Approximately the top 0.6 to 1 m (2 to 3.3 ft) will be backfilled with soil containing no greater than 20% cobble to facilitate future revegetation of the site. The final grade of the site will match the surrounding terrain. Existing borrow pits in the 100 Areas will be used. New borrow pits are not anticipated to be used for backfill.

If contamination is found in the soil during verification sampling, cleanup will proceed until it is determined to no longer be cost effective to continue. If this is the case, the site will be stabilized in a manner that will not hinder future remediation. The ISS project final report (see Section 5.7) will provide information to identify the location (i.e., longitude, latitude, and depth) and the composition/concentration of remaining contamination. Determination of whether to proceed with soil cleanup and/or transfer of scope of work to the RA/WD Program will be approved by the lead regulatory agency.

2.1.8 Demobilization

After verification sampling has been completed and the site has been graded to match the surrounding terrain, trailers, equipment, and personnel will be demobilized from the facility. Project closeout requirements are discussed in Sections 4.1 and 5.7.

2.2 FACILITY HAZARDS

The following subsections summarize information on facility hazards provided in the *Final Hazard Classification and Auditable Safety Analysis for the 105-D Reactor Interim Safe Storage Project* (BHI 2000b) and the *Final Hazard Classification and Auditable Safety Analysis for the 105-H Building Interim Safe Storage Project* (BHI 2000c), and applicable Management of Change (MOC) documents[1]. The MOC process is a DOE document change control process for a less than "Nuclear" facility used to determine if proposed changes or newly identified conditions require DOE notification and/or concurrence." As stated in Section 4.3, characterization of the ancillary facilities will be conducted to identify the potential existence of hazardous and radiological contamination.

---

[1] During the same time frame of the revision of the RAW document from Revision 1 to Revision 2, a special control was being deleted from the ASA document. The MOC document (MOC-2001-0003) addresses this matter and is anticipated to be approved at approximately the same time as the revision of the RAW. The special control reads, "The concrete spacers on the FSB floor will not be removed until all potential high-dose-rate items have been excavated and secured within approved containers."

The following MOCs are currently being drafted during the revision of this document:

- MOC-2001-0001
- MOC-2002-0010.

2.2.1 Hazardous Material Inventory

The 105-D and 105-H Reactor buildings have been deactivated and all bulk chemical inventories have been removed from the facilities for recycling or disposal. However, several types of hazardous materials remain in the facilities, including asbestos (in the form of cement asbestos board and insulation), mercury, lead, PCBs contained in light fixtures and paint, sodium dichromate, and equipment oil. Of these hazardous chemical constituents, asbestos and lead are found in the greatest quantities and are located throughout the facilities.

The potential for release of asbestos and lead is minimal because all asbestos and lead will be removed in accordance with approved procedures that ensure control over hazardous substances. Environmental Restoration Contractor (ERC) standards and procedures for asbestos and lead ensure that personnel removal and handling and disposal of waste are performed in a manner that achieves the following objectives:

- Protects the safety of employees and the general public
- Minimizes spills and releases to the environment
- Meets applicable DOE, Federal, state, and local regulatory requirements.

Solvents, grease, oils (i.e., hydraulic oil and fuel), and aerosol containers have also been found throughout the facilities. Although the majority of these items were disposed during deactivation, the potential exists for personnel to find containers with residual chemical constituents. If such containers are found, the containers will be managed in accordance with Section 4.2.

2.2.2 Radiological Material Inventory

2.2.2.1 105-D Facility. The two areas in the 105-D Facility with the greatest inventory of radionuclide contamination are the reactor block and the FSB. The other areas (i.e., Module 1, Module 2 [excluding the reactor block], and the 103-D ancillary building) of the facility are radioactively contaminated, though to a significantly lesser extent. It is estimated that the radionuclide inventory for these other areas is less than 1% of the total inventory of the 105-D Building (BHI 2000b).

Previous post-closure radiation surveys of 105-D Building areas (other than the reactor block and the FSB) have indicated general radiation levels of less than 1 mrem/hr to 5 mrem/hr, with isolated areas reading up to 10 mrem/hr (BHI 2000b).

2.2.2.2 105-H Facility. The two areas in the 105-H Facility with the greatest inventory of radionuclide contamination are the reactor block and the FSB. The other areas (i.e., Module 1 and Module 2 [excluding the reactor block]) of the facility are radioactively contaminated, though to a significantly lesser extent. It is estimated that the radionuclide inventory for these other areas is less than 1% of the total inventory of the 105-H Facility (BHI 2000c).

Previous post-closure radiation surveys of 105-H Facility areas (other than the reactor block and the FSB) have indicated general radiation levels of less than 1 mrem/hr to 5 mrem/hr, with isolated areas reading up to 10 mrem/hr (BHI 2000c).

2.2.3 Facility Hazard Classification

A facility hazard classification, which is required for DOE facilities in accordance with DOE Order 5480.23, is based on an assessment of the potential release of hazardous and radiological inventories and their impacts to workers and the public. The results of the assessment of potential impacts are based on a bounding unmitigated release of hazardous and radiological substances and a comparison to defined threshold values. The assessment of potential impacts considers the material quantity, form, location, dispersability, and interaction with available energy sources to determine unmitigated release potential. BHI-DE-01, *Design Engineering Procedures Manual*, Engineering Department Project Instruction (EDPI) 48-01, "Hazard Classification," establishes the basis for classifying a facility and the appropriate actions to be taken if a change in inventory is significant enough to change the facility classification or authorization basis.

The most consequential probable operational hazard event scenario for the 105-D Facility is an unmitigated release from a fire in the FSB. The consequences from this scenario bound the consequences of all ISS project activities in the FSB. The most consequential probable natural phenomena event is a postulated seismic event involving the reactor block. This event bounds all other natural phenomena events. The 105-D Facility ISS project is classified as radiological (Bauer 1996, and BHI-DE-01, EDPI 4.28-01). See BHI (2000b) for complete details regarding the 105-D Facility hazard classification.

The most consequential probable operational hazard event scenario for the 105-H Facility is an unmitigated release from a deflagration in the FSB. The consequences from this scenario bound the consequences of all ISS project activities in the FSB. The most consequential probable natural phenomena event is a postulated high wind impacting the FSB. This hazard provides the greatest amount of energy to the largest amount of radionuclide inventory in the FSB over the greatest duration of time and bounds all other natural phenomena events. The 105-H Facility ISS project is classified as radiological (Bauer 1996; BHI-DE-01, EDPI 4.28-01). See BHI (2000c) for complete details regarding the 105-H Facility hazard classification.

The auditable safety analyses for the 105-D and 105-H Reactor buildings will be revised when the ISS projects are completed, consistent with the hazard and mission requirements for long-term S&M (up to 75 years).

2.3 STRUCTURES, SYSTEMS, AND COMPONENTS THAT PROTECT FACILITY WORKERS

Controls that will be employed during the 105-D and 105-H ISS projects include temporary confinement enclosures, glovebag containments, and personal protective equipment (PPE), as directed by the 105-D or 105-H Reactor building health and safety plan (HASP). To control

emissions, vacuums will be equipped with high-efficiency particulate air (HEPA) and/or charcoal filters, and exhausters will be equipped with HEPA filters. Radiological work permits (RWPs), and the asbestos abatement work plan for asbestos removal will also be in place. Personnel monitoring and area monitoring will be used as required to determine and document worker exposures and work conditions.

Temporary confinement enclosures will be constructed, as required, to provide proper air-flow conditions and will be fabricated of noncombustible and fire-retardant materials. A standard type of temporary confinement is glovebag enclosures. Glovebag enclosures will be essentially one-time-use protective measures used to prevent contamination release during specific operations (e.g., pipe cutting and sample collection). Glovebags are available in a variety of sizes and designs and will be ordered to tailored specifications in accordance with their intended uses. Radiological containments will be evaluated and constructed in accordance with the ERC radiological control interpretive guidance document, *Control of Airborne Radioactivity* (BHI 1998); WHC-EP-07949, *Radiological Containment Guide* (WHC 1996); and BHI-01027, *ERC Radiological Glovebag Program* (as revised) (BHI 2000d).

2.4 ELECTRICAL SYSTEMS

The 105-D and 105-H Reactor buildings' electrical systems were upgraded several years ago to provide a new power supply to meet current code requirements. The upgraded electrical systems eliminated the use of the original systems, which were unsafe. All existing plant power supply circuits in each reactor were de-energized and deactivated prior to upgrading the power system to provide safety for future activities. The upgraded power supply was provided by a pole-mounted transformer (120/240 volts). This 120/240-volt power is fed through a new electrical system within each reactor building and provides power to lighting panels and outlets. The electrical power to the 105-D and 105-H Reactor facilities will be deployed in three separate stages.

2.4.1 Surveillance (Pre-Interim Safe Storage and Preliminary Interim Safe Storage Activities)

The surveillance power supply is provided via a pole-mounted transformer to provide 120 volts (approximately 50 kVA) of power. This power is fed through a new electrical system (e.g., new conduit, power supply distribution panels, limited lighting, and main disconnect switch) within the 105-D and 105-H Reactor buildings and provides power to a limited number of lighting panels and outlets. All electrical wiring is run in conduit. This system will also provide power for early ISS project activities, however, it is insufficient for the full ISS project work scope. The conduit exists throughout the building but is not adequate for the safe storage (up to 75 years) power supply system (Section 2.4.3). The reconfiguration of this system to supply the safe storage power system would not be cost effective. Because the electrical system is internal to the buildings, deactivation will be required later in the ISS project schedule to facilitate demolition.

2.4.2 Interim Safe Storage Project Decontamination and Decommissioning Activities

The second electrical stage will provide full power for all ISS activities by installing a mobile temporary power system that will meet current National Electrical Code (NEC). This temporary power system will consist of a generator or pole-mounted transformer and power distribution switchgear, load centers, and flexible temporary power cords connecting the substation and load centers. The temporary wiring is heavy-duty rubber cord and is not connected to the existing building power (this system will provide 480/277-volt, three-phase [approximately 200 kVA] power). The load centers are portable and can be located in proximity to ISS project activities. The temporary power system will be powered independently of any internal building power to allow de-energization of the surveillance power supply. The temporary power system will enhance safety during the ISS project because all permanent wired power systems within the building would be de-energized. The placement of the distribution centers constantly change during demolition as work areas change and rooms are demolished. This temporary system is designed and constructed to enable safe and efficient changes to the system. These changes include requirements for distribution centers to be added or removed throughout the facility during ISS activities and also for final demobilization. Main temporary power lines will be run underground or overhead to the greatest extent possible. At the completion of ISS, the mobile temporary power system will be de-energized and made available for reassignment.

2.4.3 Safe Storage (Up to 75 Years)

The last electrical stage will be installed during the SSE construction phase of the 105-D/105-H ISS project. The mobile temporary power system will then be replaced by a reduced-capacity (NEC-compliant) permanent power system that will provide power for the safe storage period up to 75 years. The S&M activities have lower power demands than ISS project D&D activities and require a reduced power supply system. The S&M power system will consist of a transformer providing 120/240 volts (approximately 5 kVA) to lighting panels and outlets to power remote monitoring instruments, lighting, and S&M activities. All instrument wiring is accomplished using flexible conduit. These devices are in place to facilitate surveillance walk-downs and are specific to accomplishing this goal. Any components existing from the initial two stages that can be used for the final stage of power will be considered for use. Power to the temporary exhauster (which will be used during S&M inspections to provide ventilation to the building) will be provided from a portable generator.

3.0 SAFETY AND HEALTH MANAGEMENT AND CONTROLS

3.1 EMERGENCY MANAGEMENT

The ERC Emergency Management Program (including preparedness, planning, and response) is described in detail in BHI-SH-03, Volume 1, *Emergency Management Program*, and contains the administrative responsibilities for compliance with the *Hanford Emergency Management Plan* (DOE-RL 1998a) and all applicable DOE orders. The Emergency Management Program establishes a coordinated emergency response organization capable of planning for, responding to, and recovering from industrial, security, or hazardous material incidents. BHI-SH-03, Volumes 2, 3, and 4, contain emergency action plans for BHI-managed facilities. The 100-D and 100-H Areas have an emergency action plan in BHI-SH-03, Volume 2, which identifies the capabilities necessary to respond to emergency conditions, provide guidance and instruction for initiating emergency response actions, and serve as a basis for training personnel in emergency actions for each facility. The emergency response actions within the emergency action plan are provided for recognizing incidents and/or abnormal conditions, initiating initial protective actions, and making proper notifications. The emergency action plan is consistent with Hanford Site emergency procedures and meets the requirements of the *Hanford Emergency Management Plan* (DOE-RL 1998a), applicable DOE orders, and state and Federal regulations (i.e., 29 *Code of Federal Regulations* [CFR] 1910.38 and *Washington Administrative Code* [WAC] 173-303-340, -350, and -360).

All emergency planning and preparedness activities for these projects will be consistent with planning and preparedness actions taken by other Hanford Site contractors and similar projects. Activities will be in a manner that ensures the health and safety of workers and the public and the protection of the environment in the event of an abnormal incident at either the 105-D or 105-H Reactor buildings or ancillary facilities.

Project response to any emergencies will be to evacuate personnel to a safe location. The emergency action plans contain the required responsibilities of project personnel who support the Incident Command System.

3.2 HEALTH AND SAFETY PROGRAM

3.2.1 Worker Safety Program

The ERC Hazardous Waste Operations Safety and Health Program was developed for employees involved in hazardous waste site activities. The program was developed to comply with the requirements of 29 CFR 1910.120 and 10 CFR 835 and to ensure the safety and health of workers during hazardous waste operations. The Integrated Environment, Safety, and Health Management System (ISMS) will be incorporated into all work activities.

The program includes the following elements:

- An organizational structure that specifies the official chain of command and the overall responsibilities of supervisors and employees
- A comprehensive work plan developed before work begins at a site to identify operations and objectives and to address the logistics and resources required to accomplish project goals
- A site-specific health and safety plan (SS HASP) for activities where workers may be exposed to hazardous substances
- Worker training commensurate with individual job duties and work assignments
- A medical surveillance program administered to comply with Occupational Safety and Health Administration (29 CFR 1910.120) requirements
- BHI-SH-02, *Safety and Health Procedures*, Volumes 1 through 4, and project/task-specific implementing plans and procedures
- Voluntary Protection Program.

3.2.2 Site-Specific Health and Safety Plan and Activity Hazards Analysis

A SS HASP will be prepared that defines chemical, radiological, and physical hazards and specifies the controls and requirements for work activities. Building access and work activities are controlled by approved work packages, as required by established BHI/ERC procedures. The SS HASP addresses the health and safety hazards of each phase of site operation and includes the requirements of a SS HASP for hazardous waste operations and/or construction activities, as specified in 29 CFR 1910.120 and DOE Order 5480.9A. A SS HASP will be written for each ISS project and may include the ancillary buildings; however, a separate SS HASP may be developed for the ancillary buildings. As part of work package development, a job hazards analysis (JHA) will be written to identify the hazards associated with specific tasks not already covered under a SS HASP. The SS HASP elements include the following:

- Results of a risk and hazard analysis of each task and operation in the work plan
- List of employee training requirements
- List of PPE to be used by employees at the work site
- Medical surveillance requirements
- Work site control measures
- Emergency response
- Confined space entry procedures
- Spill containment program
- Accountability procedure.

In addition to the SS HASP, a RWP will be prepared for work in areas with potential radiological hazards. The RWP extends the Radiological Protection Program (discussed in Section 3.2.3) to the specific work site or operation. All personnel assigned to the project and all work site visitors must strictly adhere to provisions identified in the SS HASP and RWP.

Before work and each activity begin, a pre-job briefing is held with the involved workers. This briefing includes reviews of the hazards that may be encountered and the associated requirements. Throughout an activity, daily briefings may also be held, as well as special briefings prior to major undertakings.

3.2.3 Radiological Controls and Protection

The Radiological Controls and Protection Program is defined in DOE-approved programs and BHI-approved procedures (BHI-RC-02 through BHI-RC-05, RadCon procedure manuals). This program implements the ERC's policy to reduce safety or health risks to levels that are ALARA and to ensure adequate protection of workers. The ERC Radiological Protection Program meets the requirements of 10 CFR 835. Radiological material handling will be managed in accordance with BHI-RC-01, *Radiation Protection Program Manual,* and appropriate procedures. Appropriate dosimetry, RWPs, PPE, ALARA planning, periodic surveys, and radiological control technical support will be provided.

Standard ERC controls for work in radiological areas are assessed as adequate to control project activities. These controls provide for radiological controls planning that identifies the specific conditions and governs the specific requirements for an activity, periodic radiation and contamination surveys of the work area, and periodic or continuous observation of the work by the Radiological Controls organization. The ALARA planning process will identify shielding requirements, contamination control requirements (including local ventilation controls), radiation monitoring requirements, and other radiation control requirements for the individual tasks conducted during the projects.

Measures are also taken to minimize the possibility of releases to the environment. Appendix B quantitatively addresses the radionuclide inventory and activities that could cause potential release of this inventory, but not to the exclusion of the DOE Standard Radiological Control (DOE 1999) or 10 CFR 835 requirements. Potential radiological air emissions are discussed in Appendix B.

3.3 MAINTENANCE MANAGEMENT

The BHI organizations responsible for the S&M and D&D programs have standing agreements regarding the transition and responsibility of the facilities covered by this removal action scope. The agreements are normally formalized and documented on a facility basis in a memorandum of understanding (MOU). The MOU transfers responsibility to D&D during the ISS phase and provides endpoint criteria to transfer the facility back to S&M upon completion of ISS work.

This MOU will be initiated upon approval of the removal action work scope. In general, the agreement will state that no systems will be maintained during decommissioning. Inspections, checks, and maintenance, which are activities normally conducted under S&M, will not be conducted during the D&D process. Access control to the respective facility during D&D activities will be under the control of the responsible field superintendent for the 105-D or 105-H ISS project.

4.0 ENVIRONMENTAL MANAGEMENT AND CONTROLS

4.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section describes how each of the ARARs identified in the action memorandum (Ecology and DOE 2000) will be met, to the extent practicable, during the removal action.

- The *Safe Drinking Water Act of 1974* and "National Primary Drinking Water Regulations" (40 CFR 141, Subpart B) for public drinking water supplies establish cleanup goals that are protective of groundwater. Although the removal action does not directly address groundwater cleanup in the 100-D/DR and 100-H Areas, below-grade structures, soil, and demolition debris to be left in place will be remediated to meet standards that are protective of groundwater. Protectiveness will be verified by ensuring that soil cleanup levels for materials left in place allow compliance with maximum contaminant levels (MCL) for hazardous and radioactive constituents in groundwater. The RESRAD dose models will be used to verify protectiveness with regard to radiological constituents, as described in Section 4.4. Soil not addressed by this removal action in the vicinity of the facilities that may be contaminated will be addressed in the final remedial action for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units.

- The *Model Toxics Control Act* (MTCA) (Method B), WAC 173-340, is applicable and specifies that cleanup actions must be protective of human health and the environment, comply with applicable state and Federal regulations to the extent practicable, and provide for compliance monitoring. The cleanup standards apply to soil, structures, and debris encountered during the removal action.

  Groundwater protection standards also apply if contaminated soil or structures remain in place. MTCA specifies that concentrations of residual contaminants are protective of groundwater at levels equal to or less than 100 times the MTCA groundwater cleanup levels, unless it can be demonstrated that a higher soil concentration is protective of groundwater at the site. If residual concentrations exceed cleanup levels calculated using the 100 times rule, site specific modeling will be performed to provide refinement on contaminants found to simulate actual site conditions.

  The MTCA cleanup standards for hazardous constituents in soil will be met for structures and/or demolition debris remaining after completion of the removal action. Remediation may be required for soil waste sites that fall within the layback area of the SSE. The MTCA cleanup levels will be met for soil waste sites remediated during the removal action.

  Achievement of cleanup standards will be verified through application of the MTCA cleanup levels and risk calculations Method B formula values for soil (Ecology 1996).

- The *Clean Water Act of 1977*, as implemented by WAC 173-201A, establishes cleanup goals that address protection of the Columbia River. Erosion and stormwater controls will be used as necessary during and following the removal action to prevent wastewater/stormwater discharges directly to the Columbia River. Building material, soil, and demolition debris to be left in place will meet standards that are protective of the Columbia River.

- The "National Primary and Secondary Ambient Air Quality Standards (NAAQS) (40 CFR 50). These standards do not apply directly to source-specific emissions limitation; rather, they are national limitations on ambient concentrations intended to protect health and welfare. Each state has the primary responsibility for ensuring that NAAQS are attained and maintained. Ecology has established standards and control requirements for air contaminants, including particulates and dust. WAC 173-400-040 requires that as long as emissions do not impact any nonattainment areas, control consists only of reasonable precautions to prevent the release of air contaminants. The standard demolition and dust control techniques employed during ISS and discussed in this document are reasonable precautions.

- The *Clean Air Act of 1955* (40 CFR 61) is applicable to releases of airborne contaminants that may occur during the removal action, as well as the air monitoring requirements for these contaminants. Specifically, Subpart H provides the standards to ensure that emissions from radionuclides are minimized during collection, processing, packaging, and transportation. These standards are applicable to radionuclides that may be encountered during the removal action to prevent exceeding 10 mrem/yr effective dose equivalent to any member of the public. Subpart M and the Occupational Safety and Health Administration (29 CFR 1910.1101 and WAC 296-62) define the regulations pertaining to removal and disposal of asbestos and ACM and provide special precautions to prevent exposure of workers to airborne emissions of asbestos fibers. Compliance with these regulations during the removal action will satisfy the requirements of these ARARs.

- The *Resource Conservation and Recovery Act of 1976* (RCRA), Subtitle C, is applicable regarding the generation, transportation, storage, treatment, and disposal of hazardous waste. Hazardous waste management regulations promulgated pursuant to RCRA are codified in 40 CFR 260 through 268. Regulations established under RCRA are applicable to any hazardous waste generated during the removal action. In addition, the State of Washington's dangerous waste regulations (WAC 173-303), which address the state program authorized under RCRA, are applicable for dangerous wastes encountered during the removal action. Additionally, this regulation applies for land disposal restricted waste, generator requirements, and transportation of hazardous wastes during the removal action.

  Disposition of hazardous substances from the facilities will be conducted in accordance with the waste generator requirements of RCRA, Subtitle C (40 CFR 262) and WAC 173-303, including waste designation, waste storage prior to disposal, and disposal restrictions. Waste disposal will also be governed by the requirements of the RCRA land disposal restriction (40 CFR 268); radiological waste land disposal requirements of 10 CFR 61, Subpart C; and the ERDF waste acceptance criteria (BHI 2002) for onsite disposal.

- "U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials" (49 CFR 100-179) are applicable for any wastes transported from the Hanford Site.

- The *Hazardous Materials Transportation Act of 1974* is applicable for transportation of potentially hazardous materials, including samples and waste. All offsite shipments for disposal will comply with applicable packaging, marking, labeling, and shipping requirements. Any shipment of potentially hazardous materials, either onsite or offsite, will also comply with *the Hazardous Materials Transportation Act*.

- The "Minimum Standards for Construction and Maintenance of Wells (WAC173-160 and -162) are applicable regulations for the location, design, construction, and abandonment of water supply and resource protection wells. When these wells are encountered during D&D activities, the abandonment requirements of this standard will apply.

- The *Toxic Substances Control Act of 1976* (TSCA) (40 CFR 761) regulates the management and disposal of PCBs and PCB waste. All waste suspected to contain PCBs will be evaluated to determine if the waste meets ERDF waste acceptance criteria (BHI 2002). Any PCB waste that does not meet ERDF waste acceptance criteria will be disposed offsite at a lead regulatory agency and EPA-approved facility capable of accepting TSCA waste.

- "Radiation Protection -- Air Emissions" (WAC 246-247) and "Emission Limits for Radionuclides (WAC 173-480) are applicable to the release of airborne radionuclides that may occur during the removal action, as well as the air monitoring requirements and best available radionuclide control technology.

  Quantifying radioactive emissions, implementing best available radionuclide control technology, and performing air monitoring for emission verification have been identified as substantive requirements. Appendix B provides detailed information demonstrating how these requirements will be met. The calculated unabated offsite dose (2.24E-4 mrem/yr for the 105-D Reactor building and 1.30E-2 mrem/yr for the 105-H Reactor building [including FSB activities]) are not greater than 0.1 mrem/yr; therefore, this activity is not subject to continuous monitoring requirements of 40 CFR 61, Subpart H (i.e., National Emission Standards for Hazardous Air Pollutants compliant monitoring). However, periodic confirmatory measurements, as described in Appendix B, will be conducted.

- The *National Archeological and Historical Preservation Act* (36 CFR 65) is applicable in order to recover and preserve artifacts in areas where an action may cause irreparable harm, loss, or destruction of significant artifacts. Because of the extensive disturbance resulting from construction of the facilities, it is unlikely that archaeological remains will be found in the footprint of the facilities (Neitzel 1997). However, if archeological remains are discovered, a mitigation plan will be developed in consultation with the appropriate authorities. Section 4.5 discusses this subject in more detail.

- The *Native American Graves Protection and Repatriation Act* (implemented via 40 CFR 10) requires agencies to consult with and notify culturally affiliated tribes when Native American remains are inadvertently discovered during project activities. It is unlikely that the removal action would inadvertently uncover human remains. If human remains are encountered, however, pre-established procedures, documented in the *Hanford Cultural Resource Management Plan* (PNL 1989), will be followed.

- The *National Historic Preservation Act of 1966* (implemented through 36 CFR 800) requires Federal agencies to evaluate and mitigate adverse effects of Federal activities on any site eligible for inclusion on the National Register of Historic Places. The programmatic agreement for the maintenance, deactivation, alteration, and demolition of the built environment allows DOE to prepare a treatment plan that provides for the mitigation of historic structures. The programmatic agreement requires that all mitigation activities identified in the treatment plan be completed before demolition, alteration, or removal of artifacts. Although the 105-D and 105-H Reactor buildings were determined eligible for listing on the National Register of Historic Places, the facilities were not recommended for mitigation (Neitzel 1997), and no further action is required to meet this ARAR.

- The *Endangered Species Act of 1973* (implementing regulations of 50 CFR 402) and WAC 232-012-297 prohibit activities that threaten the continued existence of listed species or that destroy critical habitat. Threatened and endangered species are known to be present in the 100 Areas, but no adverse impacts on protected species or critical habitat are anticipated from activities associated with the removal action. An ecological review will be conducted prior to demolition to identify any potential impacts. If potential impacts are discovered, an appropriate mitigation plan will be developed and implemented.

4.1.1 Other Criteria, Advisories, or Guidance to be Considered for this Removal Action

In addition to the ARARs identified in the action memorandum and discussed in Section 4.1, the following criteria, advisories, and guidance will be followed in accordance with the action memorandum (Ecology and DOE 2000) during implementation of the removal action. These additional criteria, while not promulgated as regulations, are important to protect human health and the environment and to protect workers during the implementation phase.

- *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination* (EPA 1997a) is an EPA policy statement that provides clarifying guidance for establishing cleanup levels for radioactive contamination at CERCLA sites. The statement provides guidance regarding protection of human health and does not address cleanup levels necessary to protect ecological receptors. It should be noted, however, that for most radionuclides, remediation goals that are protective of human health are also considered protective of ecological receptors. The guidance indicates that cleanup levels should consider exposure from all pathways and through all media (e.g., soil, groundwater, surface water, sediment, air, structures, and biota). The policy statement establishes a human health risk range of 10^{-4} to 10^{-6}, which is roughly equivalent to 15 mrem/yr effective dose equivalent as the maximum dose limit for humans. It further states that background should be determined on a

site-specific basis. Although not an ARAR, the cleanup standard in the EPA policy statement must be addressed to satisfy the threshold criterion for protectiveness.

Consistent with the risk range, EPA has considered cancer risk from radiation in a number of different contexts and has concluded that levels of 15 mrem/yr above background are protective of human health and the environment. Additionally, the impact to groundwater may not exceed the MCLs. In general, below-grade structures will be removed to a minimum of 0.9 m (3 ft) below surrounding grade. However, if any of the cleanup factors cannot be met, the portions of the below-grade structures and soils above cleanup levels will be removed. These waste sites will meet the rural-residential cleanup scenario, as previously agreed to in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 1998b). In the event that large volumes of contaminated soil are encountered or removal of contaminated soil inhibits reactor safe storage activities, with concurrence by the lead regulatory agency, the removal of contaminated soils may be deferred to the RA/WD Program (Ecology and DOE 2000).

- The ERDF waste acceptance criteria (BHI 2002) and *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility* (BHI 1997a) delineate primary requirements including regulatory requirements, specific isotopic constituents and contamination levels, dangerous/hazardous constituents and concentrations, and physical/chemical waste characteristics that are acceptable for disposal of wastes at the ERDF. Prior to disposal, waste will be evaluated to ensure that the waste meets ERDF waste acceptance criteria.

- "Radiation Protection Guidance for Exposure to the General Public" (59 FR 66414) provides EPA protection guidance recommending that nonmedical radiation doses to the public from all sources and pathways not exceed 100 mrem/yr above background. The guidance also recommends that lower dose limits be applied to individual sources and pathways. One such individual source is residual environmental radiation contamination after the cleanup of a site. The removal action will meet a 15 mrem/yr effective dose equivalent goal, excluding nearby waste sites to be addressed by the remedial action program.

- Several RODs exist for 100 Area remediation activities that contain cleanup standards and ERDF acceptance criteria that should be considered while conducting this removal action. These are the *Record of Decision, U.S. Department of Energy Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington* (EPA et al. 1995), the *Amended Record of Decision, Hanford Site-100 Area, Benton County, Washington* (EPA et al. 1997), and the *Interim Action Record of Decision: 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, Hanford Site, Benton County, Washington* (EPA et al. 1999).

- *Revised Procedures for Planning and Implementing Off-Site Response Actions* (EPA 1987) provides procedures for offsite disposal of CERCLA wastes. Although it is anticipated that waste generated by the removal action will be disposed onsite, these procedures will be implemented for any offsite disposal that would be required. The EPA Remedial Project

Manager will be responsible for decisions regarding the offsite disposal of regulated waste generated during the removal action.

- *Hanford Site Solid Waste Acceptance Criteria* (FDH 2002) identifies the criteria for acceptance of waste at the CWC.

- *Liquid Waste Processing Facilities Waste Acceptance Criteria* (FDH 2001) identifies the criteria for acceptance of waste at the ETF.

- "Occupational Radiation Protection" (10 CFR 835) establishes radiation protection standards, limits, and program requirements for protecting workers from ionizing radiation resulting from the conduct of DOE activities. This regulation also requires that measures are taken to maintain radiation exposures ALARA. A combination of PPE, personnel training, physical design features (e.g., confinement, remote handling, and shielded containers), and administrative controls (e.g., limiting time in radiation zones) would be used to ensure that the requirements for worker and visitor protection are met. In addition, the requirements to maintain exposure ALARA will be achieved by decontaminating surfaces to the extent practicable prior to demolition and by providing PPE, training, and administrative controls. For surfaces that could not be adequately decontaminated, fixatives would be applied to contaminants to ensure exposure ALARA. Individual monitoring would be performed as necessary to verify compliance with the requirements.

- Exposure limits, personnel protection requirements, and decontamination methods for hazardous chemicals are established by 29 CFR 1910. The regulation also requires identification and mitigation of physical hazards to workers posed by a facility including, but not limited to, confined spaces, falling hazards, fire, and electrical shock. The regulation provides requirements for worker safety during construction activities.

- *Radioactive Waste Management* (DOE Order 5820.2A) provides the requirements for managing low-level radioactive waste and transuranic waste.

- It is DOE's interpretation that *National Environmental Policy Act of 1969* (NEPA) requires CERCLA documents to address values of NEPA (DOE 1994). The EE/CAs (DOE-RL 2000a, RL 2000b), which are CERCLA documents, incorporated NEPA values to the extent practicable.

- The Tri-Party Agreement (Ecology et al. 1998) contains provisions governing RCRA and CERCLA cleanup activities at the Hanford Site and provides guidance for integrating RCRA and CERCLA requirements to the greatest extent practicable. These provisions are applicable during this removal action, and the requirements have been identified and addressed through the ARARs, as well as documented in the project schedule.

4.2 WASTE MANAGEMENT

CERCLA Section 104(d)(4) states that where two or more noncontiguous facilities are reasonably related on the basis of geography or on the basis of the threat or potential threat to the public health or welfare or the environment, these facilities may be treated as one for the

purposes of this section. The preamble to the National Contingency Plan (40 CFR 300) clarifies the stated EPA interpretation that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without obtaining a permit. Therefore, the facilities in the 100 Areas addressed by this removal action work plan and the various disposal/storage facilities such as the ERDF, CWC, and ETF, which are in the 200 Areas, are considered as a single site for response purposes under this removal action work plan.

Waste management activities will be performed in accordance with waste management ARARs identified in the action memorandum for the 105-D and 105-H Reactor buildings and ancillary facilities (Ecology and DOE 2000) and as discussed in Section 4.1. The requirements specified by the ARARs and other applicable guidance will be addressed in a site-specific waste management instruction prepared in accordance with BHI-EE-10, *Waste Management Plan*, Section 19.0, "Site-Specific Waste Management Instructions." The site-specific waste management instruction will address waste storage, transportation, packaging, handling, and labeling as they specifically apply to waste streams.

In conducting the removal action, various waste steams will be generated. Each waste stream will require specific processing and disposal. These waste streams may include the following:

- Solid waste
- Low-level radioactive waste
- Mixed waste (waste that is both low-level radioactive waste and hazardous waste)
- Used oil
- Hazardous, dangerous, and PCB wastes
- Asbestos
- Transuranic waste.

4.2.1 Waste Characterization and Designation

Waste generated will be characterized and designated in accordance with BHI-EE-10, *Waste Management Plan*; the requirements of the receiving facility; and the approved SAP. Waste will be segregated by radioactive content, physical form, and chemical form. The generation of waste will be minimized to the maximum extent practical. Wastes destined for the ERDF will be:

- Characterized in accordance with the appropriate project SAP
- Designated in accordance with the following:
  - BHI-EE-10, Procedure 14.0, "Waste Identification", Procedure 15.0, "Waste Characterization and Designation (Certification)"
  - ERDF waste acceptance criteria (BHI 2002)
  - State of Washington Dangerous Waste Regulations (WAC 173-303).

Waste destined for one of the Project Hanford Management Contractor (PHMC)-controlled facilities will be designated and characterized in accordance with BHI-EE-10, *Hanford Site Solid Waste Acceptance Criteria* (FDH 2002), and the approved SAP.

4.2.2 Waste Handling, Storage, and Packaging

In general, disposal of waste generated from the removal actions discussed in this work plan will either be disposed at the ERDF or at a lead regulatory agency and EPA-approved offsite disposal facility. Treatment of waste may be necessary prior to disposal at the ERDF. If transuranic or mixed waste is encountered, storage will be allowed at the Hanford Site's CWC on a case-by-case basis and requires lead regulatory agency and EPA approval. Liquid waste shall either be sent to the Hanford Site's ETF, shipped offsite to a lead regulatory agency and EPA-approved facility, or re-used for dust suppression with lead regulatory agency approval. Water from the 105-H FSB will be reused for dust suppression inside the 105-H FSB. This water has been designated as nondangerous, low-level radioactive waste (Atwood 2001). Ecology approval will be obtained prior to disposal of any waste streams sent to the ETF. Specific details on waste handling, storage, and packaging for the variety of wastes that may be encountered during the removal actions are discussed below.

Waste minimization practices will be followed to the extent technically and economically feasible during all phases of waste management. Waste materials will be recycled, reused, or reclaimed when feasible. Introduction of clean materials into a contamination area and contamination of clean materials will be minimized to the extent practicable. During all phases of waste management, emphasis will be placed on source reduction to eliminate or minimize the volume of wastes that will be generated.

Asbestos will be adequately wetted and double-bagged or double-wrapped in plastic in accordance with the site-specific asbestos abatement work plan, which is maintained at the site. Asbestos waste packages will be limited to 18.2 kg (40 lb) (with the exception of cement asbestos board panels, if removed intact, wrapped in bundles, and palletized, have no weight restriction per package.) Cut and wrapped pipe will be packaged to meet the requirements of the waste shipping and receiving plan for asbestos on pipe.

Biological wastes will be packaged in strong-tight containers that will not leak during storage. Generally, liquids will be collected in 208-L (55-gal) UN 1A2 drums. However, the size of the container (e.g., 57-L, 114-L, and 208-L [15-gal, 30-gal, and 55-gal]) may vary depending on the volume of material to be packaged. Aqueous solutions with a pH >2 and <12.5 may be stored in a large storage tank or in drums.

Aqueous solutions with a pH ≤ 2 and ≥ 12.5 will be stored in 208-L (55-gal) UN 1A2 drums. Signs stating, "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT," will be posted at each entrance of the storage area and along the boundary as necessary to be seen from any approach to the area. Portable fire extinguishers and spill-control equipment will be available. Containers will not be opened, handled, or stored in a manner that may rupture the container or cause the container to leak. Containers in poor condition will have the contents transferred to a container in good condition. A minimum 76.2-cm (30-in.) separation will be maintained between container rows. A row of containers will be no more than two containers wide.

Aqueous solutions that are stored in the large holding tanks will be shipped by tanker truck to the ETF upon Ecology approval. Nonbulk containers of aqueous solutions that cannot be combined in the large holding tank due to incompatibility or the presence of hazardous characteristics that cause the solutions to be designated as hazardous, nonradioactive waste may be treated in accordance with the approved waste treatment plan and sent to the ERDF. If waste is encountered for which there is no available treatment, DOE will meet with the regulatory agencies to determine the appropriate action for the waste stream. The preference for treatment of large-volume waste streams is the ETF. The ERDF will only be used when small volumes of waste needing treatment are encountered. Mixed (hazardous and radioactive) liquids may be treated and shipped to the ERDF. Nonradioactive, nonhazardous liquids will be shipped, reused, or recycled. Hazardous liquids (nonradioactive) will be treated and shipped to the ERDF or, with lead regulatory agency and EPA approval, shipped offsite for disposal.

Smaller items contaminated with mixed (radioactive and dangerous/hazardous) solids will be packaged in 208-L (55-gal) drums (UN 1A2). The weight will not exceed 385.9 kg (850 lb). Larger pieces (e.g., bricks and sheets) shall be double-wrapped in plastic and palletized.

High-dose radioactive items will be placed in U.S. Department of Transportation (DOT)-approved containers and shipped to a facility that is approved by the lead regulatory agency and EPA. For on-site shipments, high-dose radioactive items will be placed in containers specified by the receiving facility.

Demolished concrete will be reduced to approximately 0.03-m^3 (1-ft^3)-sized pieces. Loose rebar will be reduced to lengths of approximately 1.2 m (4 ft). Size reduction of concrete and rebar prevents materials from becoming lodged in and/or damaging the ERDF containers. Structural steel pieces will be sized-to-fit to ensure that ERDF acceptance criteria (BHI 2002) are met.

Demolition debris coated with paints that contain PCBs $\geq$ 50 ppm meet the TSCA definition of "PCB bulk product waste." The debris will be managed within the AOC until such time it is loaded into an ERDF container in the onsite area. The ERDF container will be marked with a M_L marking (CAUTION-CONTAINS PCBs) and will be closed and securely fitted with a tarp except when adding or removing waste.

All containers, packages, or items requiring storage in a radioactive material storage area will be marked/labeled with radioactive material markings and unique consecutive identification numbers. Containers or packages of waste requiring tracking (e.g., hazardous, mixed) will be assigned a package identification number by a Waste Transportation Specialist.

Nonradioactive solid items will be packaged in 208-L (55-gal) drums (UN 1A2). Larger items will be double-wrapped in plastic and palletized. Radioactive solids will be placed in bulk roll-off containers with side-swinging gates (400 and 700 series) for ERDF disposal. The containers will be lined with plastic sheeting and covered by a tarp. Light-weight material (e.g., paper and plastic) will be bagged prior to placement in the container to eliminate the potential of materials blowing out of the container.

Some demolition material may be surveyed and released from radiological restrictions using the ISOCS and GammaCam, yet may still be regulated for hazardous materials. Demolition debris that is contaminated with nonradiological hazardous materials (e.g., concrete rubble containing regulated quantities of PCBs, sodium dichromate, or lead) will be characterized, reduced in size to prevent damaging the ERDF containers, and disposed at the ERDF.

Nonradioactive solids designated as dangerous and that do not meet ERDF waste acceptance criteria may, with lead regulatory agency and EPA approval, be shipped as dangerous waste offsite or to the 1100 Area Excess Yard or the 400 Area Consolidation Center (if the material is recyclable). Lead regulatory agency and EPA approval will be obtained to ship PCB (TSCA) waste to offsite TSCA disposal facilities.

Areas containing PCB oils will be marked with signs posting, "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT," at each entrance and along the boundary as necessary to be seen from any approach to the area. The M_L marking will also be posted. Portable fire extinguishers and spill-control equipment will be available. Containers will not be opened, handled, or stored in a manner that may rupture the container or cause the container to leak. Containers in poor condition will have the contents transferred to a container in good condition. A minimum 76.2-cm (30-in.) separation will be maintained between container rows. A row of containers will be no more than two containers wide.

Storage of all containers (except for containers used to collect fluorescent light tubes) will be closed and secured when not being filled or emptied. Containers will be appropriately labeled in accordance with all applicable requirements. Radioactively contaminated waste will be stored in a radioactive materials storage area that is established, managed, and maintained in accordance with established BHI procedures. Containers will be stored to prevent the accumulation of water.

The *onsite area* includes the areal extent of contamination as well as all suitable areas in very close proximity to the contamination necessary for implementation of the removal action (40 CFR 300.400(e)). The AOC consists of the area of continuous contamination of various amounts and types (Shapiro 1996). This includes the footprint of the building itself and the adjacent areas where generally dispersed contamination may reside due to past practice activities. Figures 4-1 and 4-2 show the locations of the AOC and the onsite area. They also show waste storage areas and bulk ERDF container transportation queue areas located within the onsite areas that will be used at the 105-H and 105-D Areas.

4.2.3 Waste Treatment

Treatment of waste streams may be necessary to provide for safe transport or effective disposal. The type of treatment and the location of treatment will be determined by DOE and the lead regulatory agency on a case-by-case basis in accordance with the substantive requirements of RCRA and WAC 173-303. Upon lead regulatory agency approval, solidification, encapsulation, neutralization, and size reduction/compaction may be employed to treat various wastes. Other treatment methods may be considered if necessary. For wastes requiring treatment, the techniques will be documented in site-specific waste management instructions or an equivalent treatment document, which will be approved by the lead regulatory agency.

Figure 4-1. 105-D Waste Storage Areas.

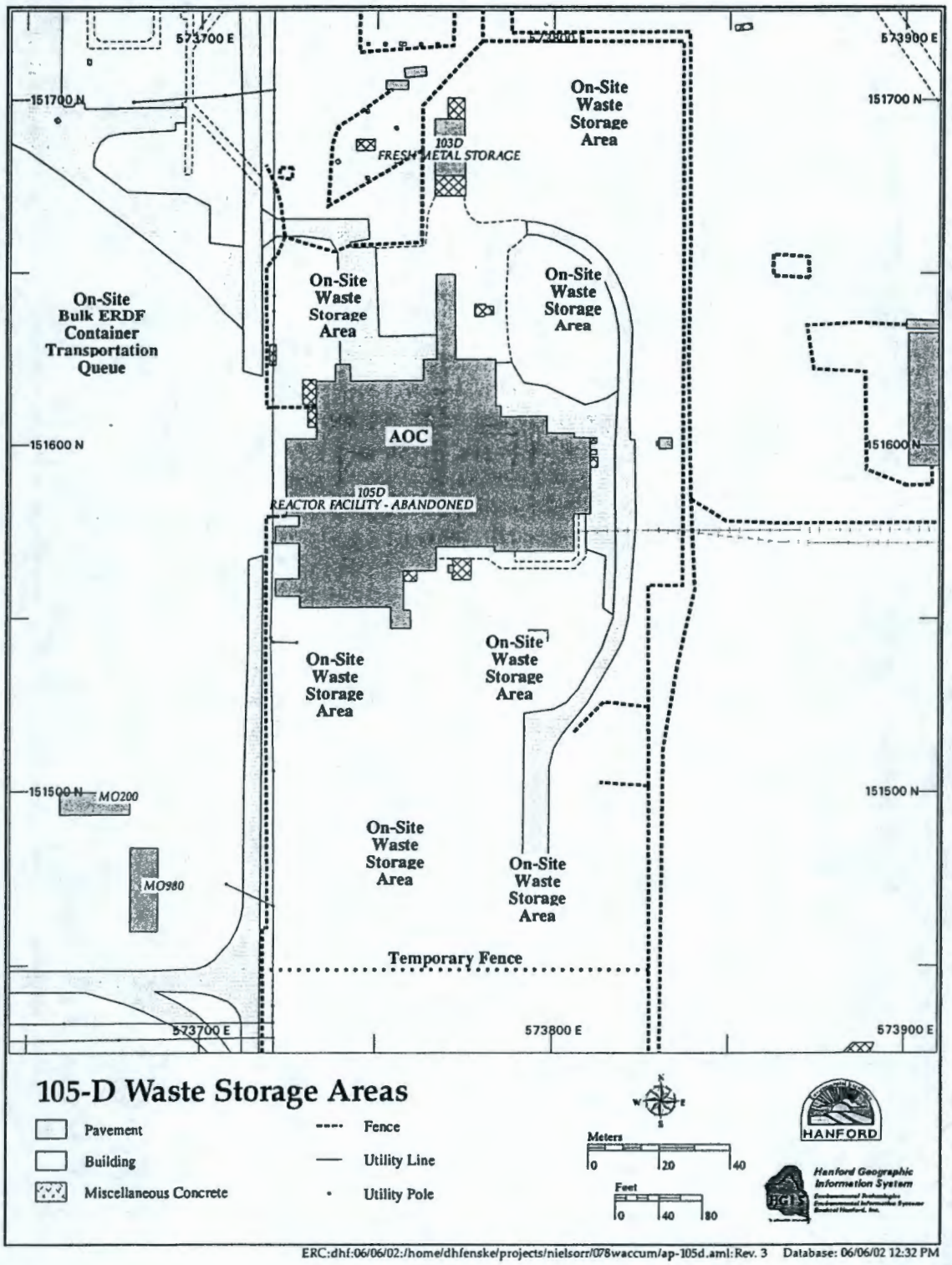
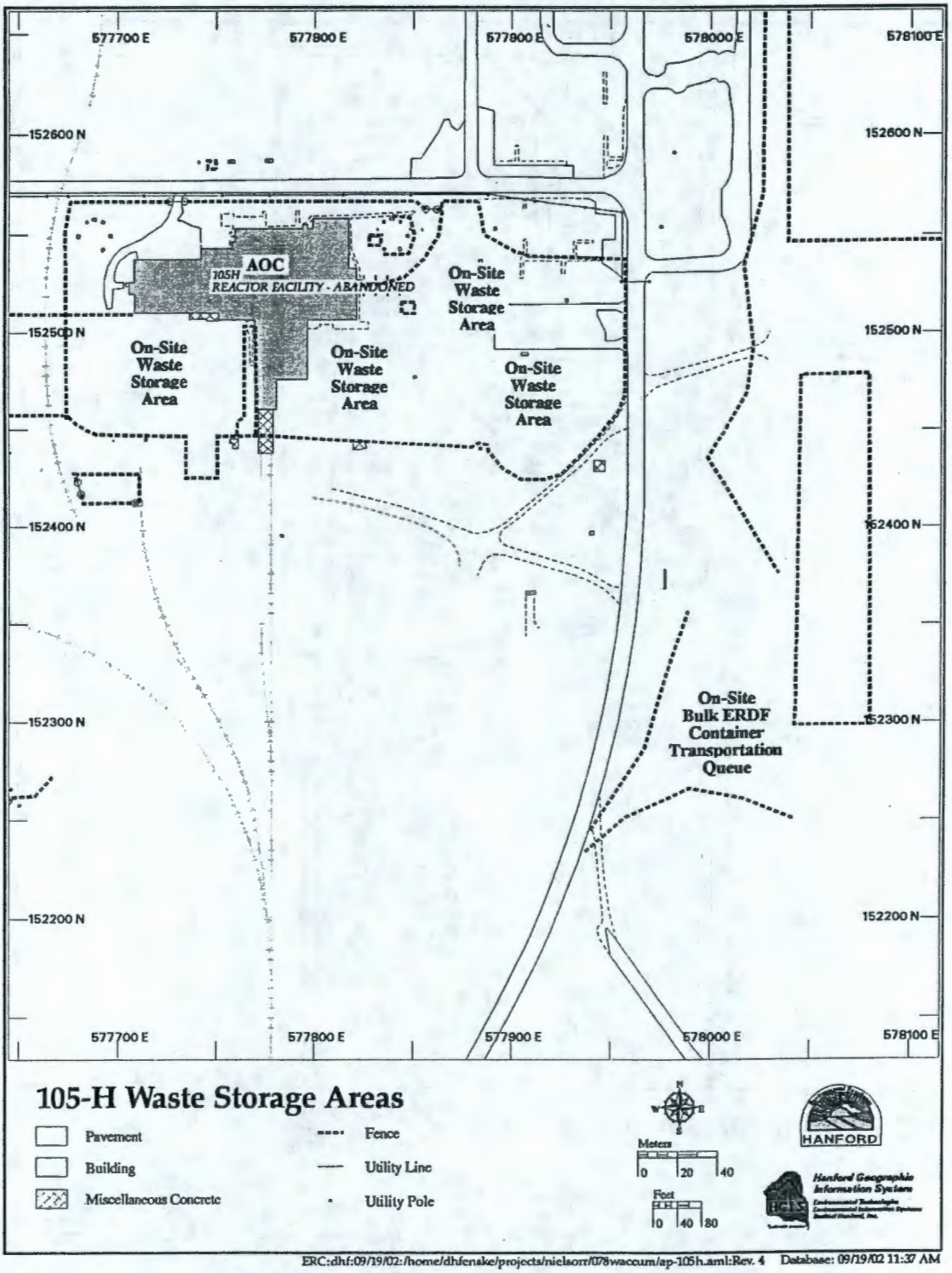


Figure 4-2. 105-H Waste Storage Areas.



4.2.4 Waste Transportation and Shipping

All shipments will be made in accordance with DOT regulations, 49 CFR 171-179, applicable sections of WAC 173-303, and BHI-EE-12. When transportation subcontractor services are used for waste generated during the 105-D and 105-H Reactor buildings removal action, the subcontractor will be responsible for using and maintaining appropriate transport motor vehicles and providing qualified commercial drivers.

4.2.5 Disposal

Contaminated soil encountered during demolition of the facilities and soil in the FSBs will be disposed in an appropriate disposal facility. The upper soil (potentially up to the top 5.2 m [17 ft] of the FSB) will be characterized and used for backfill at the 105-H Reactor if the soil passes the release criteria. The remaining contaminated soil waste sites will be addressed by DOE's RA/WD Program, as specified in other CERCLA decision documents.

Waste resulting from this action will either be disposed at the ERDF or a lead regulatory agency and EPA-approved offsite disposal facility. Treatment of waste may be necessary prior to disposal at the ERDF. If transuranic or mixed waste is encountered, storage will be allowed at the Hanford Site's CWC and requires lead regulatory agency and EPA approval. Certain material is eligible for salvage and recycling, which is encouraged, provided that the appropriate regulatory requirements are met and that it is economically feasible for the project to do so. In addition, materials shipped offsite for salvage or recycle must be certified as free of radioactive contamination in accordance with the ERC's material release program (as discussed in Section 4.4). Liquid waste will either be sent to the Hanford Site's ETF, treated to meet the acceptance criteria of the receiving facility, or used for dust suppression (with lead regulatory approval). Ecology approval is required prior to shipping contaminated water to the ETF for treatment or prior to use for dust suppression. Water from the 105-H FSB will be reused for dust suppression inside the 105-H FSB. This water has been designated as nondangerous, low-level radioactive waste (Atwood 2001). *Hanford Site Solid Waste Acceptance Criteria* (FDH 2002) identifies criteria for acceptance of waste at the CWC. *Liquid Waste Processing Facilities Waste Acceptance Criteria* (FDH 2001) identifies criteria for acceptance of waste at the ETF. *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI 2002) and the ERDF supplemental waste acceptance criteria (BHI 1997a) provide the waste acceptance criteria for the ERDF.

Small volumes of uncontaminated concrete rinse water and dilute concrete slurry may be generated from rinsing concrete trucks and pumping units. These small volumes will be discharged to soils immediately adjacent to the reactors in areas that have met interim closure requirements of the applicable sampling and analysis plan. Discharges will occur in a variety of locations rather than in a single location. Water used for rinsing purposes will either be raw or potable water. Reasonable efforts will be taken to minimize volumes and prevent ponding and runoff.

4.2.6 Waste Management Strategy

To summarize the information presented in the previous sections, basic waste management strategies for various waste streams are discussed below. However, if more cost-effective methods become available, other methods may be used. Throughout the project, material will be recycled whenever possible, assuming that it is economically feasible for the project to do so.

- **Solid waste:** Solid waste will be managed in accordance with WAC 173-304, with an emphasis on recycling or reuse to the maximum extent possible. Solid waste will primarily be sent to inert demolition waste landfills and for offsite disposal at a municipal/industrial landfill (e.g., the City of Richland landfill). All materials released offsite for disposal, recycle, or salvage must be certified as free of radioactive contamination in accordance with the ERC's material release program (as discussed in Section 4.4).

- **Low-level radioactive waste:** Low-level radioactive waste that meets ERDF waste acceptance criteria (BHI 2002) will be disposed at the ERDF.

- **Mixed waste:** RCRA mixed waste will be managed in compliance with the requirements for both hazardous/dangerous wastes (WAC 173-303) and radioactive waste (10 CFR 61). Where treatment is deemed not feasible, approval will be obtained from the lead regulatory agency and EPA to ship waste to an approved treatment, storage, and disposal facility. If mixed waste streams are found in quantities large enough to make treatment a viable option, mixed wastes may be treated to meet applicable land disposal restrictions and then disposed at the ERDF. Small volumes of waste may be treated or accumulated for later treatment.

- **Used oil:** Most used oil identified at this time is nonradioactively contaminated. The preferred strategy is to manage the oil (except for PCB oils) as a recyclable material in accordance with the Hanford Site-wide used oil program. Used oil will be evaluated with the material release program (as discussed in Section 4.4).

- **Hazardous/dangerous waste:** Hazardous/dangerous wastes in the facilities consist primarily of mercury, lead, sodium dichromate, and PCBs. Some forms of mercury can be treated as a recyclable material (if not radioactive). If any of these wastes are found to be radioactive, the wastes will be treated as mixed waste. Waste that cannot be treated to meet the ERDF waste acceptance criteria may be shipped to an offsite treatment, storage, and disposal facility, contingent upon the waste meeting the offsite disposal facility's waste acceptance criteria and obtaining an offsite determination of acceptability by the lead regulatory agency and EPA. In addition, waste shipped offsite for disposal will be certified as free of radioactive contamination in accordance with the ERC's material release program (as discussed in Section 4.4).

- **Asbestos:** Nonradioactively contaminated asbestos will be packaged and shipped offsite to a landfill permitted to accept asbestos waste. Radioactively contaminated asbestos will be packaged and shipped to the ERDF.

- **Transuranic waste:** Without regard to source or form, waste that is contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay is classified as transuranic waste (DOE Order 5820.2A). Transuranic waste will be managed in accordance with BHI-EE-10. The CWC, operated by the PHMC, will be used for interim storage of any transuranic waste encountered. Storage at transuranic waste at the CWC requires lead regulatory agency and EPA approval.

- **Accountable nuclear materials:** If accountable nuclear materials (e.g., fuel elements or pieces) are discovered in the FSB sediment or elsewhere in the facility, the materials will be packaged and stored in accordance with Hanford Site security requirements. (Potential storage locations for onsite storage are identified in Figures 4-1 and 4-2.) With concurrence of the lead regulatory agency, this material will be transferred to the PHMC for disposal in accordance with a MOU.

4.3 CHARACTERIZATION

Characterization (through sampling and analysis and radiological surveys) will be conducted throughout the 105-D and 105-H ISS projects to identify radiological and hazardous conditions that will be encountered during facility operations. These technical services will also be used to identify and characterize waste streams for treatment and/or disposal and to verify facility and area conditions at various phases of project completion. They will also determine if the appropriate cleanup standards have been met. Analytical data generated in these efforts will be used to develop the following information:

- Contaminant identification
- Contaminant concentrations
- Compliance with cleanup standards
- Waste type categories
- Worker health and safety conditions
- Decontamination requirements
- Operational precautions
- Waste treatment requirements
- Waste packaging and disposal requirements.

The characterization efforts will address the 105-D and 105-H Reactor buildings, the 103-D ancillary facility, and the 105-D water tower pedestals. Sampling and analytical activities have been separated into an initial scoping survey and two phases of sampling and analysis and radiological surveys. The project will generate two SAPs (one for waste and soil characterization and one for verification of soils and release of below-grade structures) following the initial scoping survey. The SAPs will include the specific human health risk based-values, based on Ecology (1996) formula values for soil, as appropriate for the constituents of concern. The human health and ecological risk-based values will serve as cleanup goals or verification

criteria, depending on the phase. Each SAP will be sent to Ecology for review and approval prior to use in the field.

- **Initial scoping survey:** Initial characterization begins with a review of historical information, including the review of procedures, technical manuals, drawings, photographs, past radiological surveys, and interviews with experienced reactor operation personnel associated with the historical operation of the reactor. Environmental radiological scoping surveys and technical smears will be collected to identify radiological conditions and isotopic distribution throughout the facility. A selected team of personnel will conduct facility inspections to examine the physical conditions of the facilities and determine suspect chemical/hazardous and radiological material locations. This information will be used to summarize the waste streams during project planning. The initial scoping survey does not require a SAP.

- **Waste designation:** This characterization activity specifically includes sample collection and laboratory analysis to support removal and disposal of the facility components and structures and disposal at the appropriate waste facility. Waste designation will occur to support the proper management of waste. Waste designation for the wastes generated by ISS activities at the 105-D and 105-H Reactors will rely heavily on the process knowledge gained in performing this project scope at the 105-C, 105-DR, and 105-F Reactors. This is intended to minimize sampling efforts while accounting for noted differences between the facilities and to confirm the process knowledge that is applied. *105-D and 105-H ISS Project Sampling and Analysis Plan for Waste and Soil Characterization* has been prepared for this purpose (DOE-RL 2000c)

- **Verification and release:** Specific objectives of verification and release include sampling and analysis of grade-level concrete foundations, below-grade concrete structures, and underlying soils to determine which materials are suitable for closure without decontamination. All areas outside the SSE, including the FSB, will be addressed by this activity. This characterization activity will also identify those areas that require removal and/or remediation prior to closure. This phase will include the development of a SAP, as well as a final verification report, which will document the status of the facility upon completion of the ISS projects.

In addition to the two phases of characterization for the ISS projects, the 190-DR, 1713-H, and 1720-HA ancillary buildings/structures and associated ducting and piping will also be characterized. The characterization activities will follow the same general approach, to include the sample documents, as defined below. The characterization and verification sampling plan of these facilities will also require approval from Ecology but will be funded under separate cost accounts.

4.3.1 Sampling Documents

4.3.1.1 Data Quality Objectives. The DQO procedure (BHI-EE-01, *Environmental Investigations Procedures,* Procedure 1.2, "Data Quality Objectives") will be used to define the quantity and quality of data to be collected to meet the project objectives. The results of the

DQO process, including agreements, will be documented in a standardized DQO summary report, which will be developed prior to the SAP.

4.3.1.2 Sampling and Analysis Plan. Two separate SAPs will be prepared in accordance with BHI-EE-01, Procedure 1.15, "Sampling Documents." The SAPs will be written for each phase identified in Section 4.3. The SAPs will be prepared in support of the Tri-Party Agreement (Ecology et al. 1998) and site characterization, waste characterization, and/or environmental restoration and remediation activities. Each SAP will be composed of a summary of the DQO, project-specific quality assurance project plan (QAPjP), and field sampling plan.

4.3.1.3 Quality Assurance Project Plan. When the DQO summary report has been completed and approved by the appropriate decision makers and technical team, the QAPjP will be written consistent with guidance provided in *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1997b). The QAPjP will address the following major elements:

- Project management
- Measurements and data acquisition
- Assessment and oversight
- Data validation and data usability.

4.3.1.4 Field Sampling Plan. The field sampling plan (which is included in the SAP) will be written following the completion of the QAPjP. This section of the SAP will describe the field sampling approach to be implemented in the field.

4.4 RESIDUAL RADIATION RELEASE CRITERIA

Underlying structures and soils will be disposed in accordance with Section 4.2 or will be released in accordance with criteria described in the action memorandum (Ecology and DOE 2000). The process to be used will be compliant with applicable Federal, state, and DOE-mandated requirements, such as those imposed by CERCLA, the Tri-Party Agreement (Ecology et al. 1998), and DOE Order 5400.5. The guidance document, *Guidance for Radiological Release of DOE Real Property at Hanford* (DOE-RL 1997), will be used, where appropriate, to develop the appropriate scenarios for the derivation of radiological release limits based on D&D alternatives. In order to meet the EPA CERCLA risk range of 10^{-4} to 10^{-6} increased cancer risk, the action memorandum (Ecology and DOE 2000) established a dose limit of 15 mrem/yr from all pathways above Hanford Site background for 1,000 years following remediation, and residual contamination levels to be at or below MCLs for protection of groundwater or Ambient Waste Quality Concentrations (AWQC).

The determination of whether to release the below-grade portions of the buildings will be based on the unrestricted residential use of the below-grade portions of the buildings. Dose to receptors will be based on three risk scenarios: post-drilling residential, sleeping resident, and building renovation (as outlined in DOE-RL 1997). Radiological dose to the receptor is modeled via RESRAD-BUILD and RESRAD-SOIL computer codes supplied by Argonne National

Laboratory. RESRAD-SOIL is primarily used for estimating doses to a receptor from contaminated soil or other sources of contamination that may move into the soil and ultimately to groundwater. The contamination is modeled as a horizontal layer moving through soil. RESRAD-BUILD is used to derive the dose that an individual may receive while living, working, or visiting the released facility. RESRAD-BUILD may be used to create a three-dimensional model of a source term and facility (e.g., contaminated walls in a building). Both models consider multiple exposure pathways to the receptor (i.e., inhalation, ingestion, and external exposure).

RESRAD-SOIL has been widely used throughout the United States in modeling both radiological and chemical risk. RESRAD-BUILD has been used by several DOE sites in modeling radiological dose to workers and risk scenarios supporting release of real property. Both of the scenarios and software have been generally accepted by regulatory agencies (i.e., Ecology, DOE, and EPA). Parameters used in the model are outlined in DOE-RL (1997) and have been reviewed by these regulatory agencies on previous occasions. The scenarios were deemed acceptable for evaluation of release criteria for the 105-C, 105-F, and 105-DR ISS projects.

To proceed with closeout, concentration-based limits must be developed that are based on the previously discussed scenarios and dose limits. The target derived concentration guideline levels are based on land use, risk scenarios, and modeling. Verification measurements will be made after remediation, and the results will be used in the models to estimate the receptor dose from final radionuclide levels. Radiological measurement procedures are based on an approved SAP, and technical guidance provides regulatory requirements for the release of real and nonreal property. If the final runs of the dose model with the final measured radionuclide levels indicate that the dose limits are met, the data will be fully assessed and validated to ensure that the final verification data meet requirements.

All property that is released for offsite disposal and/or reuse and recycle is nonreal property. The release of nonreal property will follow the guidance in DOE Order 5400.5 and recent guidance (e.g., DOE 1995, DOE O 451.1A, DOE 1997, and BHI 1997b). For nonreal property that is surface-contaminated only (i.e., not contaminated in volume), the project may use the processes described in the above referenced documents and authorized limits that are provided in Table 1 of DOE (1995). If the property meets the surface contamination limits and the person or entity receiving the property is aware of the measured radioactivity on the property, the property may be dispositioned without regard to residual radioactivity.

If the property is to some extent volumetrically contaminated (e.g., soil, concrete exposed to water, activated concrete, and activated metal), the property must be evaluated through a pathway dose assessment to determine the potential dose to a receptor and the allowable residual contamination. Depending on the estimated dose to a member of the public, DOE guidance (DOE 1995) requires U.S. Department of Energy, Richland Operations Office (RL) and/or DOE-Headquarters approval, as well as the concurrence of the property recipient (e.g., the state or disposal site operator) for any nonreal property disposed as waste. An ALARA evaluation must be performed prior to final use of any surface or volumetric authorized limits. The DOE has provided guidance for ALARA evaluations applied to environmental releases in DOE (1997).

4.5 NATURAL AND CULTURAL RESOURCES PROTECTION

Most of the areas surrounding the 105-H and 105-D Reactor buildings are covered with graveled and asphalt surfaces. Native vegetation does not exist within the reactor exclusion areas; therefore, no avoidance mitigation will be required to protect native plants. An ecological and cultural review of the 105-D and 105-H Reactor buildings and surrounding areas was conducted in April-June, 2000 to identify cultural and ecological resources (Teel 2000).

During the 105-H Reactor ecological review, birds observed outside of the building included rock doves, starlings, and ravens. Cliff swallows were also observed flying over the building. Only the rock doves and starlings appeared to be nesting. Because these birds are not considered to be species of concern, no significant impacts to nesting birds are anticipated.

On the inside of the 105-H Building, five different individual bats were observed roosting. No maternity colonies were found, and workers within the building have not reported seeing any aggregation of bats that would indicate the presence of a maternity colony. However, the ecological review recommends that artificial roost sites (e.g., bat houses) should be installed either on the reactor building or on utility poles in the vicinity of the reactor as mitigation for the potential loss of habitat when the reactor is sealed.

During the 105-D Reactor ecological review, birds observed outside of the building included rock doves, starlings, raven, cliff swallows, and white crown sparrow. Only the rock doves and the starlings appeared to be nesting. Because these birds are not considered to be species of concern, no significant impacts to nesting birds are anticipated.

On the inside of the 105-D Building, only one dead bat was found and no live bats were observed. Any bats that do use the 105-D Reactor building currently have a suitable alternative roost site in the process water tunnels that lead from the 105-DR Building to the 190-DR and former 190-D Buildings. These tunnels will provide excellent habitat for the bats after the ISS projects are complete at 105-D and 105-DR; therefore, no further mitigation is required.

No other species of concern were identified either inside or in areas surrounding the 105-D and 105-H Reactor buildings that would be impacted by the project. However, because of the possibility of migratory birds using the buildings and surrounding areas for nesting, annual surveys (and seasonal surveys, as needed) would be required throughout the duration of this project. If nesting migratory birds are found within the project area, mitigation actions will be developed to avoid nest destruction or abandonment.

The areas surrounding the 105-H and 105-D Reactor buildings will be maintained clear of vegetation until all associated waste sites have been remediated and final disposition of the reactors occurs. Therefore, revegetation of these sites is not planned to immediately follow the ISS projects. However, provisions will be made during final site grading to ensure that suitable soils are in place to facilitate revegetation at a later time.

A cultural resource reviews concluded that the 105-D and 105-H Reactors are situated in areas of low cultural resource potential and that no archeological resources have been recorded within or adjacent to the areas of potential effect. Due to the extensive disturbance to the areas, no intact subsurface materials are anticipated. However, due to potential interest from Native American Tribal representatives to monitor ground-disturbing activities associated with demolition, notification will be provided one week prior to conducting ground-disturbing activities.

The reviews of historic significance found that both the 105-D and 105-H Reactors were determined by RL and the Washington State Historic Preservation Office to be contributing properties within the Hanford Site Manhattan Project and Cold War Era Historic District. However, neither of the reactors were selected for individual documentation, and additional mitigation measures were not required prior to demolition. Pursuant to Stipulation V (C) of the Historic Buildings Programmatic Agreement (DOE-RL 1996), a walk-through of the 105-D and 105-H Reactor buildings was conducted as part of the cultural resource review to determine which, if any, artifacts and objects remaining within these buildings had educational or interpretive potential. Several items were identified and tagged in the areas inspected. These and any additional items identified during D&D activities have been relocated to a secure area for storage prior to demolition of the area.

These initial ecological and cultural reviews have been periodically updated (Teel 2001a; Teel 2001b; Teel 2001c; Teel 2002), and specific information can be found in these referenced reports. Ecological and cultural resource reviews for the ancillary facilities are completed prior to initiating D&D activities at these locations. Ecological and cultural reviews for ongoing activities will be conducted at least annually.

4.6 ADDITIONAL RELEVANT CONTROLS OR ACTIONS

4.6.1 Occupational Safety Controls

Operations during the 105-D Facility ISS project that involve potentially significant nonradiological hazards include the following:

- Lifting of heavy loads
- Asbestos removal
- Use of cutting equipment
- Lead paint removal
- Removal of PCBs from existing equipment

- Removal of lead and mercury containing items (e.g., lead-lined casks in the FSB)

- Removal of miscellaneous legacy items (e.g., reagents, refrigerants, organics, and unknown liquid content in tanks).

Asbestos removal is performed under the ERC asbestos abatement program. Use of torches requires a hot work permit and will be conducted under a fire watch by trained personnel. Lead paint removal will be conducted under the ERC lead abatement program. These actions and practices are considered to provide adequate controls of this activity to protect the worker.

4.6.2 Special Controls

The following specific controls are identified in the 105-D Auditable Safety Analysis (ASA) (BHI 2000b) and applicable MOC documents, and will apply to activities conducted at 105-D:

- To ensure that the FHC of "radiological" remains valid, activities will not be conducted that require penetrating the steel outer shell/gas seal of the reactor block.

- Withdrawal cables on the VSRs will be removed, but the rods will remain latched and in the full-in position. The VSR channel openings/gaskets around the VSRs on the top of the reactor will be stabilized to prevent pathways to the reactor block. The HCRs will remain fully inserted in the reactor block, and openings around the HCRs will be sealed and/or plugged. Any process tube capping, sealing or plugging will be performed so the steel outer shell/gas seal of the reactor block is not affected. Water and reactor process gas piping may be cut and capped, sealed, or plugged, but the task shall be performed at the furthest practical distance from the steel outer shell/gas seal of the reactor block.

- The areas identified for reactor block stabilization were chosen for purposes of long-term contamination control of the inventory within the block. Controls in place shall include the following:

  - AHA/health and safety plan
  - Hot work permit
  - Radiological control requirements
  - Work package.

- The potential flammability of the Masonite in the biological shield will be considered while preparing the required permitting, and pathways for heat and burning will also be taken into consideration.

The following special controls are defined in the 105-H ASA (BHI 2000c), and applicable MOC documents (BHI 2001a; BHI 2001b), and will apply to activities conducted at 105-H[1]:

- To ensure that the FHC of "radiological" remains valid, activities will not be conducted that require penetrating the steel outer shell/gas seal of the reactor block.

- Withdrawal cables on the VSRs will be removed but the rods will remain latched and in the full-in position. The VSR channel openings/gaskets around the VSRs on the top of the reactor will be stabilized to prevent pathways to the reactor block. The HCRs will remain fully inserted in the reactor block and openings around the HCRs will be sealed and/or plugged. Any process tube capping, sealing, or plugging will be performed such that the steel outer shell/gas seal of the reactor block is not affected. Water and reactor process gas piping may be cut and capped, sealed or plugged, but the task shall be performed at the furthest practical distance from the steel/gas seal of the reactor block.

- The areas identified for reactor block stabilization were chosen for purposes of long-term contamination control of the inventories within the block. Controls in place shall include the following:

  - AHA/HASP
  - Hot work permit
  - Radiological control requirements
  - Work package.

- The potential combustibility of the Masonite in the biological shield will be considered while preparing the required permitting, and pathways for heat and burning will also be taken into consideration.

The following FSB special controls are defined to ensure the validity of assumptions in the hazard analysis:

- Excavation of the fill material from the FSB will be performed until approximately the last 1 m (3 ft) of the fill remains in the FSB (which is how high the top of the concrete spacers on the floor of the FSB reach) to provide basin workers with the shielding properties of the fill material. The last 1 m (3 ft) is where items would have been collected. Surveys of the surface of the fill material will be made throughout and during the excavation process to

[1] During the same time frame of the revision of the RAW document from Revision 1 to Revision 2, a special control was being deleted from the ASA document. The MOC document (MOC-2001-0003) addresses this matter and is anticipated to be approved at approximately the same time as the revision of the RAW. The special control reads, "The concrete spacers on the FSB floor will not be removed until all potential high-dose-rate items have been excavated and secured within approved containers."

The following MOCs are currently being drafted during the revision of this document:

- MOC-2001-0001
- MOC-2002-0010.

identify areas with elevated dose readings. These locations will be identified as possible areas where high-dose-rate items (including pieces or whole fuel elements) may be located. Radiation monitoring will be performed throughout the excavation process for the remaining 1 m (3 ft) of fill to address the possibility of uncovering high-dose-rate items that had not been detected during surveys of the remaining 1 m (3 ft) of basin fill material.

- A safety evaluation for packaging will be required for spent nuclear fuel that may be found during the project. High-dose and radiological waste will be packaged in appropriate containers based on the radiological content and disposal facility of the waste. Remote-operated devices and/or long-handled tools will be used to remove the covering fill material and debris over the high-dose-rate items, extract the items from the excavation site, and deposit these items into appropriate containers (cutting where appropriate and/or required). This operation will be performed for each location containing potential high-dose-rate items.

- Excavation and removal of high-dose-rate items from one location in the basin will be completed before another site is to be excavated. This is to control direct doses from multiple sources. Appropriate measures to control doses to workers will be used, typically by controlling the duration of worker exposure to external doses, using various types of shielding, and controlling the distance of the operator to the high-dose-rate items.

- The concrete spacers on the FSB floor will not be removed until all potential high-dose-rate items have been excavated and secured within approved containers.

- No flammable gases (e.g., propane or oxygen-acetylene) will be used within the confines of the FSB when fuel pieces/elements are exposed.

- Work control documents specific to the fuel removal shall be prepared in accordance with BHI-FS-01, *Field Support Administration*, Procedure 2.1, "Work Control," and Procedure 2.3, "Task Instruction Development," and will implement the appropriate project-specific controls described in Section 5.2 and the programmatic controls described in Section 5.3. Field-level work control documents will contain the following:

  - Walk-down checklist, detailing issues noted and discussed during the pre-job walk-down
  - Detailed task instructions describing how the work will be performed
  - ALARA review
  - Task-specific job hazard analysis
  - Rigging plan for moving fuel packages and retrieval equipment
  - Training requirements of the operating staff
  - Fuel handling and transfer procedures
  - Canister and cask loading procedures from the safety evaluation for packaging
  - Response procedures for unplanned conditions and events
  - RWPs and requirements.

- Work control documents are reviewed and approved by project and functional representatives prior to implementation in the field.

5.0 PROJECT MANAGEMENT AND ORGANIZATION

5.1 PROJECT SCHEDULE AND COST ESTIMATE

The 105-D and 105-H ISS projects have been scheduled and estimated using the ERC hierarchy of schedules, which include activity logic and restraints. Activities will be resource-loaded for both nonmanual and manual personnel. Equipment needs are identified and other materials are estimated and included in the budgeted cost of work scheduled.

Estimates of project costs have been prepared at the activity level by the project team and have subsequently been reviewed and approved by the ERC, RL, EPA, and Ecology.

The removal action was initiated in October 2000. The current schedule, which encompasses the work scope of the 105-H and 105-D ISS project and ancillary buildings is included in Appendix A. Appendix A also includes the project scope for all of the projects covered under this removal action by fiscal year. A more detailed schedule, including assumptions, resources, and activity breakdown, will be developed and submitted with the detailed work plan for each fiscal year. The major activities for which a roll-up of cost and schedule performance have been prepared include the following:

- Auditable safety analysis/final hazard classification document preparation
- DQO/SAP
- EE/CA and action memorandum
- Air monitoring plan and best available radionuclide control technology (BARCT) documentation
- Pre-construction, mobilization, and support
- Radiation scope identification surveys
- Decontamination
- Asbestos abatement
- Hazardous material removal
- Pipe and equipment removal
- Structure demolition
- Radiation monitoring/sampling/analysis
- Equipment/material/consumables
- SSE subcontract/construction
- Demobilization/project closeout.

Schedule status is reviewed weekly in project review meetings. Cost and schedule performance is reviewed by the ERC on a monthly basis. Members of DOE, EPA, and Ecology are invited to participate in these review meetings.

5.1.1 Project Cost and Schedule Tracking

Performance measurement and analysis are performed by the D&D Project Planning and Controls organization. Project cost and schedule are controlled and updated using the ERC Management Control System, as described in BHI-PC-01, *Baseline and Funds Management System.*

An earned-value system tracks the cost, schedule, and performance for all D&D projects as they progress towards completion. Cost/schedule performance reports provide budgeted cost of work scheduled comparisons and budgeted costs of work performed against the actual cost of work performed. These reports provide variances to the baseline schedule and cost as budgeted in the project's detailed work plan. Variances above threshold values are documented, as well as the rationale for the variances and any recovery plan required.

Trends and baseline change proposals are readily identified through the ERC formal trend and change control program (BHI-PC-01, PCP 1.11, "Trend Identification, Monitoring, and Analysis," and PCP 1.12, "Baseline Change Control"). All changes that affect the baseline are documented. The ERC trend register, which is reviewed monthly by ERC senior management, categorizes trends from conception to final resolution. Trends are identified as either performance trends or scope trends and are further defined as resolved or unresolved.

Fiscal year project staffing, as budgeted, is reconciled monthly during the project reviews to the actual number of full-time-equivalent personnel used during the month. Likewise, the corresponding number of hours actually worked are presented and compared to the budgeted current work plan. Actual overtime is monitored monthly (by department) and reconciled to the current budgeted overtime.

Cost and schedule variances to the current budget are tracked both on a monthly and to-date basis and are reconciled back to the cause of the variance. Project impacts due to the cost and/or schedule variance are described and corrective actions are identified and tracked to the point of final resolution.

5.2 CONDUCT OF OPERATIONS

Conduct of operations is imposed to ensure that work is performed in a controlled and organized manner, that all facets of work activities are considered, and that necessary documentation is maintained.

The performance of field activities and D&D projects is governed by *Decontamination and Decommissioning Project Manager's Implementing Instructions (PMIIs)* (BHI 1999), applicable field support instructions, and specific work instructions. The PMIIs are based on a graded approach to the conduct of operations authorized by DOE Order 5480.19 and the ERC D&D conduct of operations applicability matrix. The PMIIs are applicable to all ERC personnel, assigned or matrixed, who perform activities under the responsibility and direction of the D&D project manager. The applicability matrix is issued and maintained by the D&D project manager

and identifies elements of the DOE order that apply to project activities, implementing documents, and any deviations or exceptions to the DOE order guidelines.

Conduct of operations strongly emphasizes technical competency, workplace discipline, and personal accountability to ensure the achievement of a high level of performance during all activities. Project personnel must fully comply with the PMIIs and, if conflict arises with other instructions or directions, work shall be safely stopped until resolution is achieved. Safety is the first priority, and all planning shall include appropriate safety analyses to identify potential safety and health risks and the means to appropriately mitigate them. Workers will not start work until approved safety procedures, instructions, and directions are provided for nonroutine operations.

Conduct of operations requires workers to be alert and aware of conditions affecting the jobsite. Operators and workers conducting field activities should be notified of changes in the facility and/or work area status, abnormalities, and difficulties encountered in performing project operations. Similarly, operators and workers shall notify the chain of command of any unexpected situations. In accordance with the severity of a finding (e.g., an emergency condition), notification requirements will be in accordance with ERC procedures.

5.3 CHANGE MANAGEMENT/CONFIGURATION CONTROL

If a change arises that results in a fundamental change to the selected response action that is not within the scope of the action memorandum (Ecology and DOE 2000) and the implementing documents, an EE/CA or proposed plan and supporting documentation will be prepared to allow DOE, EPA, and Ecology to select a revised response action.

Established configuration/change control processes ensure that proposed changes are reviewed in relation to the specified commitments. If discovery indicates a breach of these commitments, work will cease so stabilization and/or recovery actions may be identified and implemented, as appropriate. BHI off-normal event procedures describe the reporting process and protocol applicable to such a discovery. BHI-DE-01, EDPI 4.40-01 defines the management of change process and requirements for facilities that have a final hazard classification of less than nuclear:

- Evaluate the impact of proposed changes that could affect authorization basis documents
- Determine whether proposed changes require prior DOE approval
- Evaluate the impact of discovered conditions
- Evaluate the effect of deviations from activities or commitments described in authorization basis documents.

5.4 PERSONNEL TRAINING AND QUALIFICATIONS

During the performance of project activities, the experience and capabilities of the operating staff are extremely important in maintaining worker and environmental safety. Day-to-day knowledge of ongoing operations, thorough understanding of conditions encountered, and continual incorporation of lessons learned will be vital to continued safe operations.

Training requirements will ensure that personnel have been instructed in the technologies to work safely in and around radiological areas, and to maintain their individual radiation exposure and the radiation exposures of others ALARA. Standardized core courses and training material will be presented, and site-specific information and technologies will be added to adequately train workers.

Health physics workers are required to have completed and be current in radiological control technician qualification training. These training courses require the successful completion of examinations to demonstrate understanding of theoretical and classroom material.

Specialized training will be provided as needed to instruct workers in the use of nonstandard equipment, in the performance of abnormal operations, and in the hazards of specific activities. Specialized training may be provided by on-the-job training activities, classroom instruction and testing, or pre-job briefings. The depth of training in any discipline will be commensurate with the degree of the hazards involved and the knowledge required for task performance.

Some activities will require the acquisition of expert services as opposed to project staff training. Assaying of waste packages and dismantling the facility by specialized methods (e.g., diamond-wire sawing) are examples of activities requiring expert assistance.

The ERC Training Program provides workers with the knowledge and skills necessary to safely execute assigned duties. A graded approach is used to ensure that workers receive a level of training commensurate with their responsibility that complies with applicable requirements. Specialized employee training includes pre-job safety briefings, plan-of-the-day meetings, and facility/work site orientations. The following training and qualifications may be applicable as required by job assignment for work activities:

- Training in accordance with 29 CFR 1910.120
  - 40-Hour Hazardous Waste Worker/8-Hour Refresher
  - 24-Hour Experience Component
  - 8-Hour Supervisor Training (for selected individuals)
  - SS HASP and RWP
  - Respirator Training
  - First Aid (two qualified persons per shift/crew)
  - Certified Asbestos Worker and/or Asbestos Awareness
  - Lead Worker
  - Radiation Worker II.

- Medical surveillance requirements
  - Hazardous waste worker physical
  - Mask fit
  - Lead worker baseline
  - Asbestos worker.
- Dosimetry and bioassay requirements
  - Thermoluminescent dosimeter (as directed in the RWP)
  - Plutonium bioassay (as determined by the Radiological Controls organization)
  - Whole body count.

The SS HASP, RWP, and JHA will include specific requirements for project activities being conducted, which include PPE and required training for project personnel. This is discussed in detail in Section 3.2.

5.5 PLAN FOR READINESS

A readiness assessment may be conducted in accordance with BHI-MA-02, *ERC Project Procedures*, Section 8.2, "Readiness Assessments," to detail the level of readiness that will be required to initiate certain project activities. The project manager is responsible for defining activities requiring a readiness assessment and the type of readiness assessment required in accordance with the readiness assessment procedure. The decision to conduct a readiness assessment for certain work scopes will be based on the risk involved and the complexity of the work or work outside the boundaries of the authorization basis. A readiness assessment will also be required if the project activities are shut down for reasons other than routine, as described in the readiness assessment procedure.

5.6 QUALITY ASSURANCE REQUIREMENTS

The overall quality assurance for the removal action work plan will be planned and implemented in accordance with DOE O 414.1A, 10 CFR 830.120, and other applicable standards. Full implementation will be required when the conceptual design for the SSE is approved and detailed design is initiated. The quality assurance activities will be graded based on the potential impact on the environment, safety, health, reliability, and continuity of operations. Specific activities include quality assurance implementation, responsibilities and authority, document control, quality assurance records, and audits. These activities are discussed in the following subsections.

5.6.1 Quality Assurance Implementation

All project-related activities will establish and implement appropriate quality assurance requirements. Conditions adverse to quality will be identified in nonconformance reports, audit reports, surveillance reports, and corrective action requests. Investigation and corrective actions in response to these adverse conditions will be completed in a timely manner.

5.6.2 Responsibilities and Authority

BHI must perform quality engineering, design reviews, surveillance, and audits (as necessary) to achieve quality assurance objectives. BHI must also ensure that the various contractors and design agencies establish design and D&D quality assurance programs to control design and D&D in accordance with applicable requirements. The D&D contractors must establish, implement, and document an inspection plan in accordance with approved specifications and drawings.

5.6.3 Document Control

The D&D documents, such as specifications and drawings, will be controlled in accordance with approved configuration management procedures. The responsible design agency will maintain control of the design D&D documents through acceptance of the documents. A project records checklist will be initiated to identify those records required for the final project file.

5.6.4 Quality Assurance Records

Each organization that maintains quality assurance records will be required to control the records in accordance with applicable BHI quality assurance requirements.

5.6.5 Audits/Assessments

Internal and external audits are to be performed by the Compliance and Quality Programs organization to ensure project compliance with the quality assurance program requirements.

5.6.6 Self-Assessments

Self-assessments will be conducted by project personnel to determine compliance in accordance with the requirements of BHI-MA-02, Procedure 2.7, "Self-Assessment."

5.7 PROJECT CLOSEOUT

Removal of the facilities (up to reactor shield walls) and their systems will be completed to a minimum depth of 0.9 m (3 ft) below grade. At this excavation level, additional characterization will be conducted to verify the status of the remaining below-grade structure. If the remaining below-grade structure is found to exceed cleanup standards, then excavation will continue to a maximum depth of 4.6 m (15 ft) below grade. If groundwater protection standards are not met at

the 4.6 m (15 ft) depth, then any additional remediation will be coordinated with and conducted under the remedial action for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units. Soil excavated as a result of the removal of below-grade structures will be designated and disposed, as appropriate.

Waste sites within the footprint of the removed portions of the facilities will be remediated during ISS. If large volumes of contaminated soil are encountered or if removal of the contaminated material inhibits reactor safe storage activities and/or are not cost effective, then remediation of these sites will be coordinated with and conducted under the final remedial action for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units. The lead regulatory agency will be involved in determining the cost effectiveness and deferrals to the RA/WD Program. The impacted waste sites will be covered with a cap of clean borrow soil or soil cement and routine S&M activities will be initiated. The S&M efforts and remediation planning will be consistent with that established for the 100 Areas until remedial action in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units. Waste sites that are remediated and achieve the established cleanup standards during the removal action will be documented and removed from the Waste Information Data System in accordance with Tri-Party Agreement Procedure TPA-MP-14 (Ecology et al. 1994).

Upon completion of D&D activities, a minimum of 0.9 m (3 ft) of clean fill/soil cover will be placed over any remaining below-grade structure and inert/demolition material, and the fill will be graded to match the surrounding terrain.

The ARARs for project activities identified in the action memorandum (Ecology and DOE 2000) establish the cleanup criteria for the 105-D and 105-H sites and ancillary facilities. Cleanup levels specified for soils, below-grade structures, and fill materials will meet the MTCA Method B standard for nonradiological contaminants in soils and protection of groundwater. For radionuclides, the action memorandum (Ecology and DOE 2000) established a dose limit of 15 mrem/yr above Hanford Site background from all pathways for 1,000 years following remediation. Residual contamination levels will be at or below MCLs for protection of groundwater or AWQC. Rubble created from demolition of the structure will be evaluated against dangerous waste criteria, ERDF waste acceptance criteria (BHI 2002), and radiological standards. Materials that exceed dangerous waste criteria and/or radiological standards will be appropriately segregated and disposed in accordance with Section 4.2. Subsurface structures and debris that meet the MTCA and radiological standards may be left in place.

After completion of all demolition activities, a project closeout report will be prepared. The report will include the location and quantities of waste dispositioned, project costs, lessons learned, summarization of characterization and monitoring data, and a reconciliation to the conceptual model for D&D baseline estimating. The report will be forwarded to the records retention center where it will be included in the Administrative Record for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 Operable Units. In accordance with the action memorandum (Ecology and DOE 2000), the closeout report will be submitted to the regulatory agencies for review and approval.

6.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations,* as amended.

10 CFR 830, "Nuclear Safety Management," *Code of Federal Regulations,* as amended.

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations,* as amended.

29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations,* as amended.

36 CFR 65, "National Historic Landmarks Program," *Code of Federal Regulations,* as amended.

36 CFR 800, "Protection of Historic and Cultural Properties," *Code of Federal Regulations,* as amended.

40 CFR 10, "Native American Graves Protection and Repatriation Act," *Code of Federal Regulations,* as amended.

40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards," *Code of Federal Regulations,* as amended.

40 CFR 61, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations,* as amended.

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations,* as amended.

40 CFR 260, "Hazardous Waste Management System: General," *Code of Federal Regulations,* as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations,* as amended.

40 CFR 262, "Standards Applicable to Generators of Hazardous Waste," *Code of Federal Regulations,* as amended.

40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste," *Code of Federal Regulations,* as amended.

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations,* as amended.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 266, "Standards for Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations,* as amended.

40 CFR 300, "National Oil and Hazardous Substance Pollution Contingency Plan," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs)," *Code of Federal Regulations*, as amended.

40 CFR 763, "Asbestos Hazard Emergency Response Act of 1986 (AHERA)," *Code of Federal Regulations*, as amended.

49 CFR 100-179, "U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials," *Code of Federal Regulations,* as amended.

50 CFR 402, "Interagency Cooperation – Endangered Species Act of 1973," *Code of Federal Regulations*, as amended.

50 FR 20489, 1985, "Notice of Intent to Prepare an Environmental Impact Statement on Decommissioning the Eight Shutdown Production Reactors Located at the Hanford Site Near Richland, Washington," *Federal Register*, Vol. 50, pp. 20489 (May 16).

58 FR 48509, 1993, "Department of Energy, Record of Decision, Decommissioning of Eight Surplus Reactors at the Hanford Site, Richland, Washington," *Federal Register,* Vol. 58, pp. 48509 (September 16).

59 FR 66414, 1994, "Radiation Protection Guidance for Exposure to the General Public," Final Rule, *Federal Register*, Vol. 59, pp. 66414 (December 23).

Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa, et seq.

Atwood, J. M., 2001, *Liquid Waste Profile Sheet for 105-H Fuel Storage Basin Water*, CCN 094989, letter to D. L. Flyckt, Fluor Hanford, Inc., dated December 17, 2001, Bechtel Hanford, Inc., Richland, Washington.

Bauer, L. K., 1996, *Nuclear Safety*, CCN 038398, letter to J. F. Nemec, Bechtel Hanford, Inc., dated October 22, 1996, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

BHI, 1997a, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility*, 0000XDC-W0001, Rev. 3, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997b, *The Reuse of 105-C Fuel Storage Basin Rubble as Fill*, BHI-01137, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1998, *Control of Airborne Radioactivity*, ERC-98-01, Rev. 1, ERC Radiological Control, Interpretive Guidance Document, February 19, 1998, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1999, *Decommissioning Project Manager's Implementing Instructions*, 0000X-PMII-G0002, Rev. 0, issued 3/12/99, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000a, *105-F Fuel Storage Basin Stage I Fill Removal Engineering Evaluation*, BHI-01348, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Final Hazard Classification and Auditable Safety Analysis for the 105-D Reactor Interim Safe Storage Project*, BHI-01349, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000c, *Final Hazard Classification and Auditable Safety Analysis for the 105-H Building Interim Safe Storage Project*, BHI-01350, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000d, *ERC Radiological Glovebag Program,* BHI-01027 (as revised), Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001a, *Proposed Changes for Water Removal in the 105-H Fuel Storage Basin*, MOC-2001-0005, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001b, *Proposed Change to the 105-H Fuel Storage Basin Remediation Approach*, MOC-2001-0006, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

BHI-DE-01, *Design Engineering Procedures Manual*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington."

BHI-EE-10, *Waste Management Plan*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-12, *ERC Transportation Manual*, Bechtel Hanford, Inc., Richland, Washington.

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

BHI-PC-01, *Baseline and Funds Management System*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-01, *Radiation Protection Program Manual*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-02, *Radiation Protection Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-03, *Radiation Control Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-04, *Radiological Control Work Instructions*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-05, *Radiological Instrumentation Instructions*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-02, *Safety and Health Procedures*, Volumes 1 through 4, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-03, *Emergency Management Program*, Volumes 1 through 4, Bechtel Hanford Inc., Richland, Washington.

Clean Air Act of 1955, 42 U.S.C. 7401, et seq.

Clean Water Act of 1977, 33 U.S.C. 1251, et seq.

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

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

DOE, 1994, *Secretarial Policy on the National Environmental Policy Act*, U.S. Department of Energy, Washington, D.C.

DOE, 1995, *Responses to Questions and Clarification of Requirements and Processes: DOE 5400.5, Section II.5 and Chapter IV Implementation (Requirements Relating to Residual Radioactive Material)*, from the Assistant Secretary of Environmental, Safety and Health, Office of Environmental Policy and Assistance (EH-41), dated November 17, 1995, U.S. Department of Energy, Washington, D.C.

DOE, 1997, *Establishment and Coordination of Authorized Limits for Release of Hazardous Waste Containing Residual Radioactive Material*, memorandum from Acting Deputy Assistant Secretary for Waste Management, Environmental Management, Office of Environmental Management (EM 37), dated January 1997, U.S. Department of Energy, Washington, D.C.

DOE, 1999, *DOE Standard Radiological Control*, DOE-STD-1098-99, U.S. Department of Energy, Washington, D.C.

DOE Order 414.1A, *Quality Assurance*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 451.1A, *National Environmental Policy Act*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5480.9A, *Construction Project Safety and Health Management*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5480.19, *Conduct of Operations for DOE Facilities*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5480.23, *Nuclear Safety Analysis Reports*, as amended, U.S. Department of Energy, Washington, D.C.

DOE Order 5820.2A, *Radioactive Waste Management*, as amended, 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, 1996, *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington*, DOE/RL-96-77, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1997, *Guidance for Radiological Release of DOE Real Property at Hanford*, DOE/RL-97-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998a, *Hanford Emergency Management Plan*, DOE/RL-94-02 (as amended), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1999, *100 Area Burial Grounds Focused Feasibility Study*, DOE/RL-98-18, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000a, *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facilities*, DOE/RL-2000-45, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000b, *Engineering Evaluation/Cost Analysis for the 105-H Reactor Facility and Ancillary Facilities*, DOE/RL-2000-46, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000c, *105-D and 105-H ISS Project Sampling and Analysis Plan for Waste and Soil Characterization*, DOE/RL-2000-67, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DUN, 1969, *Deactivation of Hanford Reactor Facilities*, DUN-SA-114, Douglas United Nuclear.

Ecology, 1996, *Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC) Update,* Publication #94-145 (updated January 1996), Washington State Department of Ecology, Olympia, Washington.

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

Ecology and DOE, 2000, *Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington*, CCN 087896, Washington State Department of Ecology, and U.S. Department of Energy, Richland, Washington.

Endangered Species Act of 1973, 16 U.S.C. 1531, et seq.

EPA, 1987, *Revised Procedures for Planning Implementing Off-Site Response Actions*, OSWER 9834.11, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1995, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* September 1995, U.S. Environmental Protection Agency, Richland, Washington.

EPA, 1997a, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, OSWER 9200.4-18, letter from S. D. Luftig to L. Weinstock, dated August 22, 1997, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1997b, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5, Draft Final, U.S. Environmental Protection Agency, Quality Assurance Management Staff, Washington, D.C.

EPA, Ecology, and DOE, 1995, *Record of Decision, U.S. Department of Energy Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Richland, Washington.

EPA, Ecology, and DOE, 1997, *Amended Record of Decision, Hanford Site-100 Area, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

EPA, Ecology, and DOE, 1999, *Interim Action Record of Decision: 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, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

EPA, Ecology, and DOE, 2000, *Declaration of the Record of Decision – 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington,* U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

FDH, 2001, *Liquid Waste Processing Facilities Waste Acceptance Criteria*, HNF-3172, Rev. 1, Fluor Daniel Hanford, Inc., Richland, Washington, March 2001.

FDH, 2002, *Hanford Site Solid Waste Acceptance Criteria*, HNF-EP-0063, Rev. 7, Fluor Daniel Hanford, Inc., Richland, Washington, March 2002.

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

Hazardous Materials Transportation Act of 1974, 49 U.S.C. 1801-1813, et seq.

National Historic Preservation Act of 1966, 16 U.S.C. 470, et seq.

National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321, et seq.

Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001, et seq.

Neitzel, D. A., 1997, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 9, Pacific Northwest National Laboratory, Richland, Washington.

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington.

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

Safe Drinking Water Act of 1974, 42 U.S.C. 300f, et seq.

Shapiro, M., 1996, *Use of the Area of Contamination (AOC) Concept During RCRA Cleanups*, Memorandum, Director, EPA Office of Solid Waste, to RCRA Branch Chiefs and CERCLA Regional Managers, dated March 13, 1996.

Smith, D. C., 2000, *Cover Installation at the 105-F Fuel Storage Basin (FSB)*, CCN 083373, letter to D. A. Faulk, U.S. Environmental Protection Agency, dated October 25, 2000, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Teel, D. D., 2000, *Ecological and Cultural Review of 105-D and 105-H Reactors, #00-ER-017*, CCN 079742, letter report to S. M. Hamblin, dated July 3, 2000, Bechtel Hanford, Inc., Richland, Washington.

Teel, D. D., 2001a, *Cultural and Ecological Resources Review for Construction of a Queue Area for 105-D Interim Safe Storage (01-ER-001)*, CCN 085736, letter report to R. M. Ellenbest, dated January 17, 2001, Bechtel Hanford, Inc., Richland, Washington.

Teel, D. D., 2001b, *Ecological and Cultural Resources Review for the Construction of a Queue Area for the 105-H Interim Safe Storage (01-ER-006)*, CCN 087195, letter report to R. M. Ellenbest, dated March 1, 2001, Bechtel Hanford, Inc., Richland, Washington.

Teel, D. D., 2001c, *Ecological and Cultural Resources Review of 105-D, 105-DR, 105-H, and 105-F Reactors (01-ER-016)*, CCN 088548, letter report to M. R. Morton, dated April 30, 2001, Bechtel Hanford, Inc., Richland, Washington.

Teel, D. D., 2002, *Ecological and Cultural Resources Review of 105-D, 105-DR, 105-H, and 105-F Reactor Areas (02-ER-011)*, CCN 098523, letter report to H. G. Doolittle, dated April 17, 2002, Bechtel Hanford, Inc., Richland, Washington.

Toxic Substances Control Act of 1976, 15 U.S.C. 2601, et seq.

UNI, 1986, *Fuel Storage Basins Cleanup and Stabilization Project Report*, UNI-3958, Rev. 0, UNC Nuclear Industries, Inc., Richland, Washington.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

WAC 173-161, "Regulation and Licensing of Well Contractors and Operators," *Washington Administrative Code*, as amended.

WAC 173-200, "Water Quality Standards for Ground Waters of the State of Washington," *Washington Administrative Code*, as amended.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, as amended.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," *Washington Administrative Code,* as amended.

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

WAC 173-400, "General Regulation for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 173-480, "Emission Limits for Radionuclides," *Washington Administrative Code,* as amended.

WAC 232-012-297, "Endangered, Threatened, and Sensitive Wildlife Species Classification," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Protection -- Air Emissions," *Washington Administrative Code,* as amended.

WAC 296-62, "Department of Labor and Industries," *Washington Administrative Code,* as amended.

WHC, 1989, *105-F and –H Basins Moisture Study Report*, WHC-SD-TI-037, Westinghouse Hanford Company, Richland, Washington.

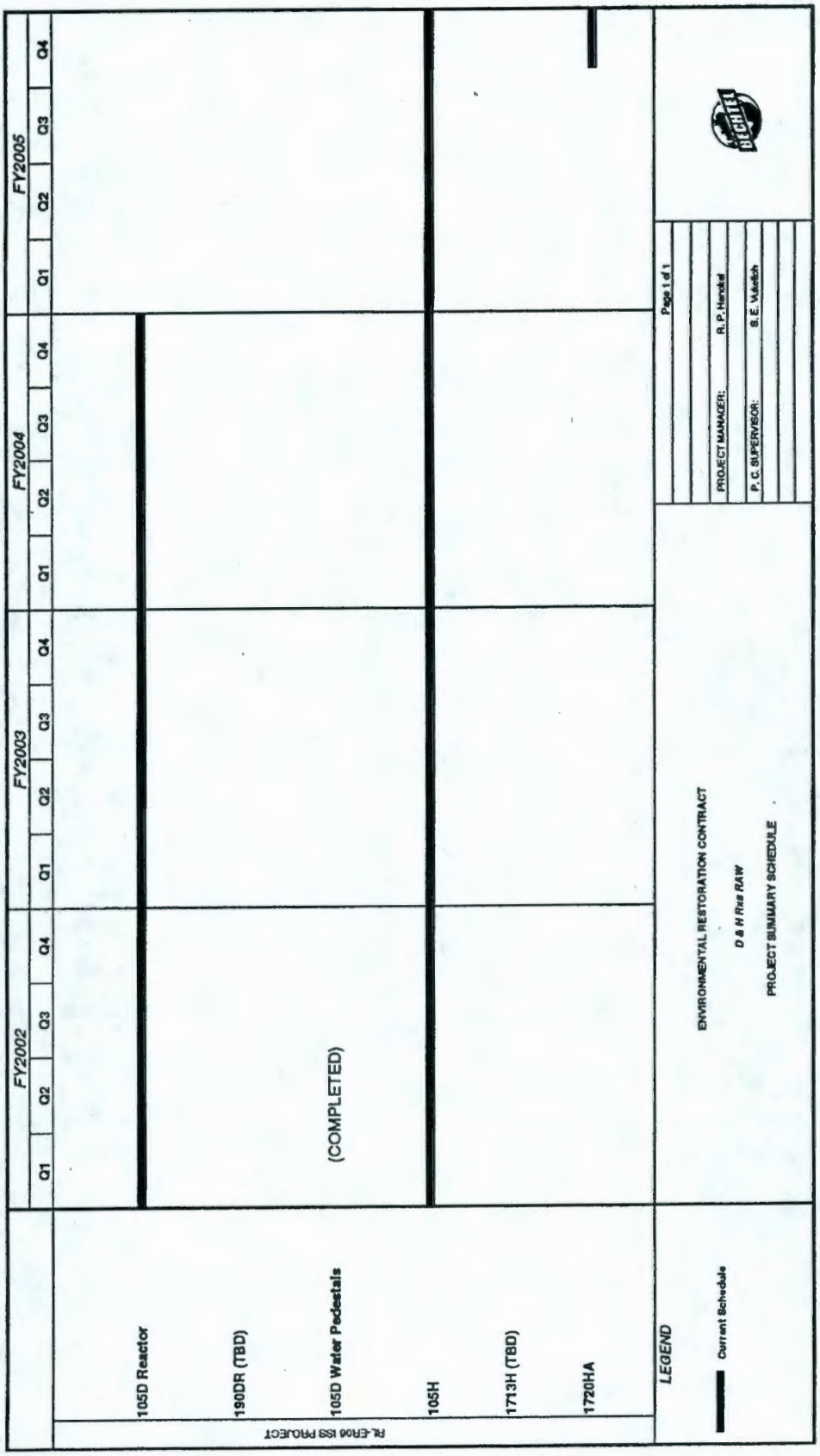
WHC, 1991, *Sampling and Analysis Plan for the 105-F and –H Fuel Storage Basins*, WHC-SD-DD-AP-012, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996, *Radiological Containment Guide,* WHC-EP-07949, Rev. 1, Westinghouse Hanford, Inc., Richland, Washington.

APPENDIX A

105-D AND 105-H INTERIM SAFE STORAGE PROJECT SCHEDULE

Appendix A – 105-D and 105-H ISS Project Schedule



APPENDIX B

AIR MONITORING PLAN

APPENDIX B

AIR MONITORING PLAN

B.1 INTRODUCTION

The decontamination and decommissioning (D&D) activities for the 105-D and 105-H Reactor Facilities are initial steps in placing the 100 Area reactor buildings into interim safe storage (ISS). All of these D&D activities have been identified as *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) program activities (DOE-RL 2000a, 2000b). Quantification of radioactive emissions, implementing best available radionuclide control technology (BARCT), and air monitoring have been identified as substantive requirements (i.e., relevant and appropriate requirements). A BARCT compliance demonstration is determined by the regulatory agency on a case-by-case basis. These substantive requirements are in accordance with *Washington Administrative Code* (WAC) 246-247-040. This appendix presents compliance with those requirements.

The ancillary facilities (103-D Unirradiated Fuel Element Storage Building, the 190-DR Process Water Pumphouse, 1713-H Warehouse, and the 1720-HA Arsenal) are not included in this air monitoring plan. Prior to D&D of these facilities, when the additional information becomes available, this plan will be updated as appropriate and submitted to the lead regulatory agency for approval.

B.1.1 Planned Activities

B.1.1.1 105-D and 105-H Reactor Facilities. The D&D activities on the 105-D and 105-H Reactor Facilities have the potential to generate particulate radioactive air emissions. The construction of the safe storage enclosures (SSEs) will not have potential-to-emit (PTE) radioactive air emissions because the contamination will be fixed or removed during D&D. Both reactor facilities D&D activities will be performed during the same time period (in parallel). For each facility, the three areas of concern for air emission releases are as follows:

- Operations support areas (Module 1) (e.g., office areas, reactor control room, tool storage rooms, restrooms, cooling water influent areas, change rooms, ventilation equipment areas, electrical systems areas, and other infrastructure areas)

- Inner rod room, work area, and laboratories (Module 2)

- Fuel storage basins (FSBs).

Specific D&D activities for both 105-D and 105-H Reactor Facilities include the following:

- Removal and disposal of equipment/piping from all areas outside of the eventual location of the SSEs
- Removal and disposal of accessible radiological and hazardous waste
- Demolition and removal of above-grade structures outside of the eventual location of the SSE
- Removing or fixing accessible, loose contamination in areas within the shield walls
- Demolition and removal of slabs at grade and structures to a depth of 0.9 m below grade outside of the eventual location of the SSE
- Demolition and removal of the structures below approximately 0.9 m from grade (e.g., FSB and transfer pits and below-grade tunnels) or leave in place, if site cleanup levels are met.

The removal of contamination ranges from nonaggressive to aggressive decontamination. Nonaggressive decontamination includes methods such as wiping or applying fixatives to stabilize contamination. Aggressive decontamination techniques are methods such as scabbling, abrasive blasting, vacuuming, and the use of portable ventilation filter units. If these techniques do not remove all the contamination or it is not cost effective to do so, the contamination will be fixed with a fixative or the contaminated material will be removed and disposed of as appropriate.

Demolition methods will be selected based on the structural elements to be demolished, remaining radionuclide contamination, and location of the SSE. Such methods could include use of an excavator with a hoe-ram, a hydraulic shear with steel shear jaws, concrete pulverizer jaws or breaker jaws, a crane with wrecking ball, or controlled explosives. These activities are considered nonaggressive (an RF of 1E-3) per WAC 246-247-030. Any fixed contamination will be segmented using techniques such as cutters or mechanical/power saws and will be handled separately.

B.1.1.2 105-H Fuel Storage Basin. A disposition plan for the 105-F FSB (BHI 2000a) was developed after various alternatives and removal methods were reviewed. Similar methods will be used at the 105-H FSB. The method chosen for basin cleanout combines safety and cost effectiveness using standard methods, available equipment, and proven techniques. The disposition plan discusses the cleanout of the FSB (as part of the facility ISS) and the two stages of completion. Initially, a water-removal system will be fabricated, installed, and operated within the FSB. Water will be removed, tested, and disposed of at the 200 Area Effluent Treatment Facility (ETF). Stage I will address the FSB from the surface to approximately 5.2 m below grade. Stage II will address the remaining 0.9 m of basin material.

Both phases will apply engineering controls to ensure worker safety, maintain radiological doses as low as reasonably achievable (ALARA), and minimize potential releases of radiological

emissions to the environment. A major portion of material/structure removal will use equipment (e.g., backhoes and excavators) that is typically used for D&D below-grade material removal, structure demolition, and large-scale soil remediation work. Experience gained in prior basin cleanout projects (i.e., 105-B, 105-C, 105-D, 105-DR, 105-F, and 105-N) will be used to optimize working conditions.

B.1.1.3 Upper Fill Removal (Stage I). Demolition of the above-grade structure will occur to allow access to the upper fill overburden and characterization of the fill material. Excavation of backfill will begin at grade and continue to approximately 5.2 m below grade using primarily an excavator. The frequency of radiological surveys will increase as necessary as the removing backfill approaches the bottom of the basin. After being sampled, the upper fill material will be disposed of in the Environmental Restoration Disposal Facility (ERDF). The remaining soil/media layer will act as a biological shield and continue to confine the sediment and other radiological material located on or near the basin floor.

Originally, a retractable cover over the FSB was planned to be installed to provide weather protection. The need for such an enclosure was later reevaluated. Phase II excavation and demolition activities (Section 2.1.4.2) would be significantly easier and more efficient to perform without a cover and supporting structures. Unobstructed access to the basin allows for easier deployment of equipment. Supplemental lighting is minimized or eliminated. Subsequently, the U.S. Department of Energy and the lead regulatory agency agreed that a cover would not be necessary (Smith 2000).

B.1.1.4 Debris and Contaminated Fill Removal with the Integrated Equipment System (Stage II). Removal of fuel elements or hot spot materials will typically be accomplished by using a small excavator (e.g., Brokk™-type remote control crawler) with attachments to expose the fuel elements or hot spot materials and then load the materials into an appropriate container. A large excavator, or personnel with long handled tools may be used to remove hot spot material and other lower fill debris and soil if dose rates do not pose a threat to personnel. Loaded fuel containers will be placed into appropriate shipment containers prior to removal from the controlled area. Other hot spot materials will be excavated and packaged for disposal. Backfill material removed during Stage II will be radiologically screened and any fuel elements will be remotely placed into a fuel holding container. Other hot spot material will be removed and packaged for disposal.

The soil/debris material (except for retrievable spent nuclear fuel) will be packaged for disposal at the ERDF or the Central Waste Complex, as appropriate. Some waste materials may require segregation for macro-encapsulation, such as lead and/or high-dose materials (e.g., irradiated hardware). Typically, a loader trackhoe, backhoe bucket, and attachments will hook, grip, shear, lift, or remove buckets, monorail beams, wood planking material, etc., and place the materials into ERDF approved containers.

Demolition of the walls, floor and underlying soils would occur during Stage II, depending on characterization results. RESidual RADioactivity (RESRAD) dose model methodology may be

™Brokk is a registered trademark of Brokk A. B. Skellfteä, Sweden.

used to determine radiological release levels for the basin wall, concrete floor, and the remaining structures, which is similar to the methodology used for the below-grade structures at the other reactors (i.e., 105-C, 105-DR, and 105-F).

B.2 AIRBORNE SOURCE INFORMATION

The potential exists for particulate radioactive airborne emissions resulting from the D&D activities previously described. The radionuclide inventory for 105-D was obtained from *Final Hazard Classification and Auditable Safety Analysis for the 105-D Facility Interim Safe Storage Project*, (BHI 2000b). The radionuclide inventory for 105-H was obtained from *Final Hazard Classification and Auditable Safety Analysis for the 105-H Facility Interim Safe Storage Project*, (BHI 2000c). The isotopes selected bound the possibility of what can be found, resulting in a conservative estimate.

The radionuclide annual possession quantities (APQ) and subsequent potential emission calculations are presented in Table B-1 for the D&D of the 105-D Reactor Facility, and Table B-2 for the D&D of the 105-H Reactor Facility. For both 105-D and 105-H Module 1 and 2 Areas, the same sets of release fractions (RFs) were used. Approximately 95% of the decontamination activities will be performed using nonaggressive methods (a RF of 1E-3 will be used per WAC-246-247-030), while 5% of the decontamination activities will be performed using aggressive methods (a RF of 1.0 will be used per Washington State Department of Health Letter AIR-94-802).

For the 105-D FSB, 95% of the inventory is assumed to be nondispersible solids with a RF of 1E-6 and 5% is assumed to be particulate solids with a RF of 1E-3. The RF for the 105-D FSB was chosen based on current conditions, historical documentation, and engineering judgment of the walls, floor, and columns within the FSBs. The 105-D FSB was cleaned of sediment/debris and the walls/floor/columns were sprayed down. Asphalt emulsion was then applied with rollers. The remaining inventory is primarily fixed within the concrete surfaces, concrete walls, floor and columns and therefore is treated as a solid. Details of the calculations are documented in Bechtel Hanford, Inc. (BHI) calculation 0100X-CA-V0035, *Air Emissions Calculation for Demolition Activities at the 105-D and 105-H Facilities* (BHI 2002).

As previously stated, the 105-H FSB contains sediment and potential irradiated fuel elements. The RF value of 1.8×10^{-5} is assumed for the 105-H FSB sediment (U.S. Environmental Protection Agency Clearinghouse for Inventories and Emission Factors [CHIEF], Compilation of Air Emission Factors, AP-42, Table 11.9-4 [EPA 1998]). The RF value of 1.8×10^{-5} represents a power shovel (large excavator) loading trucks with soil overburden. This value seems appropriate and bounding for the sediment which is composed of fine sand, clay sediment, and iron oxides. The same RF value was used for the irradiated fuel elements. Because the elements are primarily solid (which would normally use RF of 1E-06), the inventory will conservatively use the same RF as the sediment (1.8×10^{-5}) due to possible oxide layers on the outside of the fuel. Details of the calculations are documented in BHI calculation 0100X-CA-V0035, *Air Emissions Calculation for Demolition Activities at the 105-D and 105-H Facilities* (BHI 2002).

The radionuclide inventory in the water at the bottom of the 105-H FSB is negligible compared to the sediment; therefore, it was not included. This was confirmed by a review of sampling data generated for acceptance at the ETF. The radiological contribution of the water to the APQ is significantly lower than that of the sediment, which continues to bound the inventory.
A relatively insignificant amount of inventory is assumed to be present within the FSB concrete walls, columns, and floor and is included in the inventory of the sediment, as stated in UNI 3714, Rev. 1 (UNC 1987). Also, some of the FSB inventory may have contaminated the soil underlying and adjacent to the FSB, however minimal amounts are expected to be present and are included as the sediment inventory. The demolition of the FSB walls and floor and also the soils underlying and adjacent to the FSB are included as part of the FSB activities. If extensive soil contamination is found in adjacent and underlying soils, work will be deferred to the Remedial Action/Waste Disposal Project with approval from the appropriate lead regulatory agencies .

The CAP-88-PC Version 2.0 model was used to determine the annual unabated offsite dose to the maximally exposed individual (MEI). The PTE (Ci/yr) was the input for the computer model, and the model generated the annual unabated dose. The distance to the MEI used in the model for the 105-D Reactor Facility was 9,776 m west northwest, and 10,499 m east for the 105-H Reactor Facility. The CAP-88-PC model summaries are presented in BHI calculation 0100X-CA-V0035 (BHI 2002). The total unabated dose from the D&D activities for 105-D Reactor Facility is 2.24E-4 mrem/yr, and for 105-H Reactor Facility is 1.30E-2 mrem/yr.

After the initial characterization activities (described in Section 2.1.2 of this document) are complete, the results will be evaluated to determine that the D&D activities are still within the assumptions made for the PTE calculations. Characterization activities themselves, were assumed to be included in the total unabated dose (BHI 2002) for each of the facilities' three areas analyzed (Modules 1, 2, and FSB). If changes have occurred, this monitoring plan will be modified and resubmitted, as necessary.

B.3 BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY

The D&D activities have the potential to release radioactive emissions to the atmosphere. Implementing the BARCT for these radioactive emissions has been identified as an applicable or relevant and appropriate requirement.

For nonaggressive decontamination, the use of wiping or applying foam polymers is an ALARA control that has been accepted as BARCT for fugitive particulate radionuclide air emissions, particularly when the potential offsite dose is low. For aggressive techniques high-efficiency particulate air (HEPA) filters are used to collect the dust generated. The use of HEPA filters has been generally accepted as BARCT. Because structure demolition may be a source of radioactive fugitive emissions, dust suppressants (e.g., water and fixatives) will be used and are considered BARCT for demolition. When using water, quantities used will be minimized to prevent water accumulation, puddles, and run-off within the area where the water is being used. The BARCT discussed above (i.e., use of fixatives and water) is consistent with the BARCT to be performed for controlled explosive demolition.

For the 105-H FSB, activities will primarily consist of heavy equipment excavating soil and sediment, demolishing the walls and columns, and removing the floor. Fixatives (e.g., paint, soil sealants) may be applied to areas of contamination. Because excavation may be a source of radioactive fugitive emissions, dust suppressants (e.g., water and fixatives) will be used and are considered BARCT.

- Water will be applied during excavation, container loading, and backfilling processes to minimize airborne releases.

- Soil fixatives will be applied to any contaminated soils or soils that are being stockpiled (e.g., for reuse) that will be inactive for more than 24 hours.

- Fixatives will be applied to contaminated soils that will be inactive less than 24 hours at the end of work operations, if the sustained windspeed is predicted overnight to be 20 mph or greater, based on the Hanford Meteorological Station morning forecast. This will allow for enough time, if necessary, to prepare for the application of dust control measures. If a soil fixative has already been applied and the soil will remain undisturbed, further uses of fixatives will not be reapplied, unless needed. The fixatives or other controls will not be applied when the contaminated soils are frozen or it is raining, snowing, or other freezing precipitation is falling at the end of work operations.

- An entry will be made in the project logbook when the forecasts predict sustained wind speeds of 20 mph or greater, and dust control is to be applied at the end of the work shift.

No forced ventilation of the building is anticipated either during the ISS period or during periodic surveillance. A provision will be made to provide forced ventilation to the facility during the ISS surveillance and maintenance period, if required, for nonstandard maintenance activities. If forced ventilation is required, a portable skid mounted exhauster will be used. This portable exhauster will either meet the conditions of the portable temporary radionuclide air emission unit Notice of Construction, or a separate approval may be obtained prior to conducting the maintenance depending on current site conditions. The skid-mounted exhauster would be configured with HEPA filters.

B.4 MONITORING

Monitoring activities will consist of using near-facility air monitoring stations. These air monitors will run continuously during D&D activities involving radiologically contaminated materials. Each reactor area will have one upwind and one downwind air monitor. This is consistent with the D&D activities of previous reactors (105-DR and 105-F). The existing 105-DR upwind monitor (N-492) will be used as the upwind monitor for the 105-D Reactor Area, with a new monitor set up for the downwind monitor (N523). For the 105-H Reactor Area, new upwind (N524) and downwind (N525) monitors will be established. Figures B-1 and B-2 show the location of the monitors.

The near-facility air monitors are the means/methods to verify emissions. The operation of these monitors will follow the protocol established for near-facility monitors on the Hanford Site. Basically, the samplers will run continuously for 2 weeks (or for the duration of the radiological work if less than two weeks). The 2-week samples will be analyzed for total alpha and total beta. The samples will be composited quarterly and analyzed for Gamma Energy Analysis radionuclides, strontium-90, isotopic uranium, and isotopic plutonium. The data results will then be entered into the Automated Bar Coding of Air Samples at Hanford (ABCASH) database for record keeping and reporting. The data from these monitors will be included in the annual reports prepared for the Hanford Site.

B.5 REFERENCES

BHI, 2000a, *105-F Fuel Storage Basin Stage I Fill Removal Engineering Evaluation,* BHI-01348, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Final Hazard Classification and Auditable Safety Analysis for the 105-D Reactor Interim Safe Storage Project,* BHI-01349, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-2000c, *Final Hazard Classification and Auditable Safety Analysis for the 105-H Building Interim safe Storage Project,* BHI-01350, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002, *Air Emissions Calculation for Demolition Activities at the 105-D and 105-H Buildings*, 0100X-CA-V0035, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2000a, *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facilities,* DOE/RL-2000-45, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000b, *Engineering Evaluation/Cost Analysis for the 105-H Reactor Facility and Ancillary Facilities,* DOE/RL-2000-46, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1998, *Compilation of Air Emission Factors,* Fifth Edition, Volume I, Chapter 11, "Mineral Productions Industry," U.S. Environmental Protection Agency, Washington D.C.

Smith, D. C., 2000, *Cover Installation at the 105-F Fuel Storage Basin (FSB)*, CCN 083373, letter to D. A. Faulk, U.S. Environmental Protection Agency, dated October 25, 2000, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

WAC 246-247, "Radiation Protection – Air Emissions," *Washington Administrative Code,* as amended.

Figure B-1. 105-D Air Monitoring Locations.

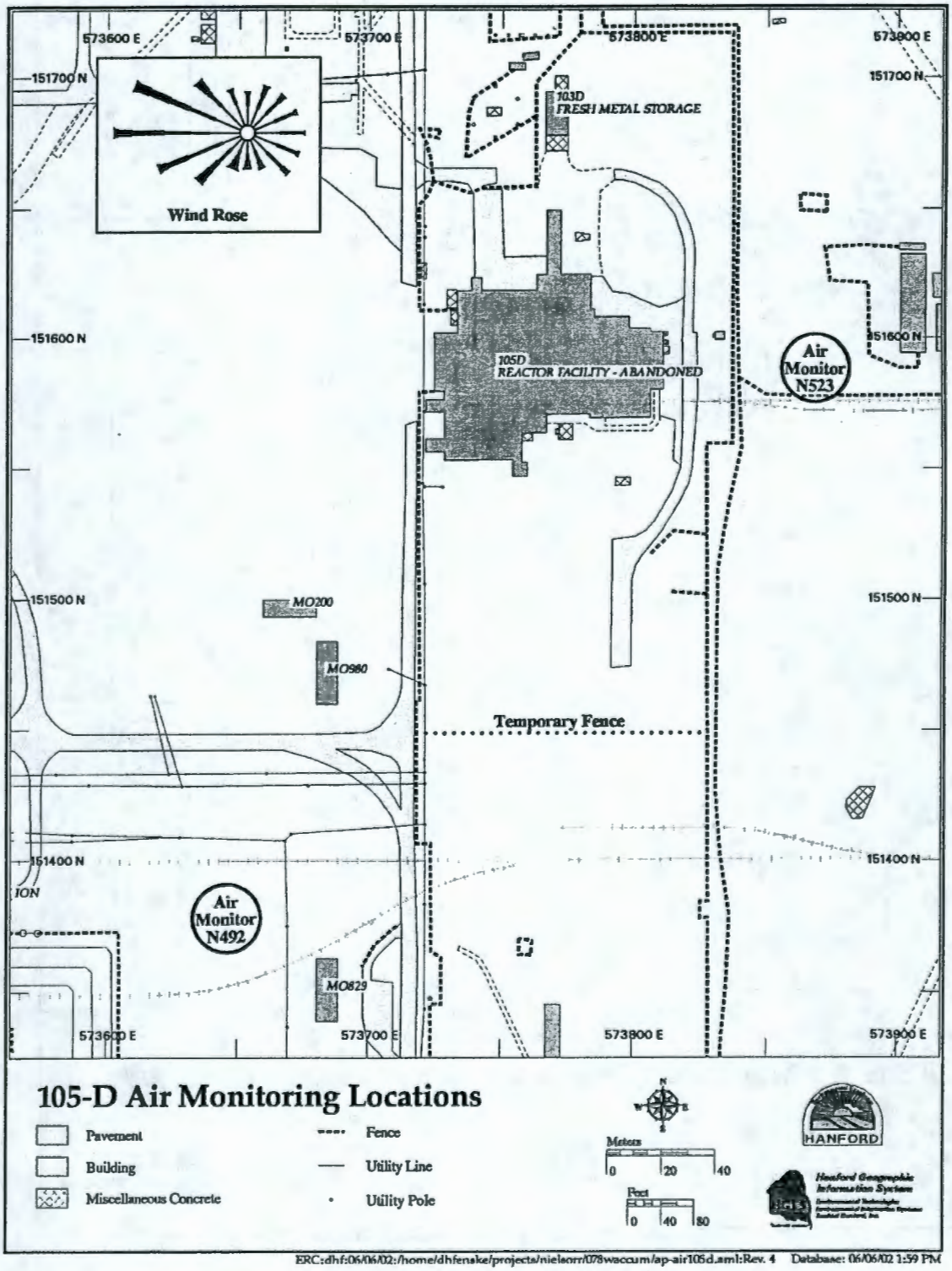


Figure B-2. 105-H Air Monitoring Locations.

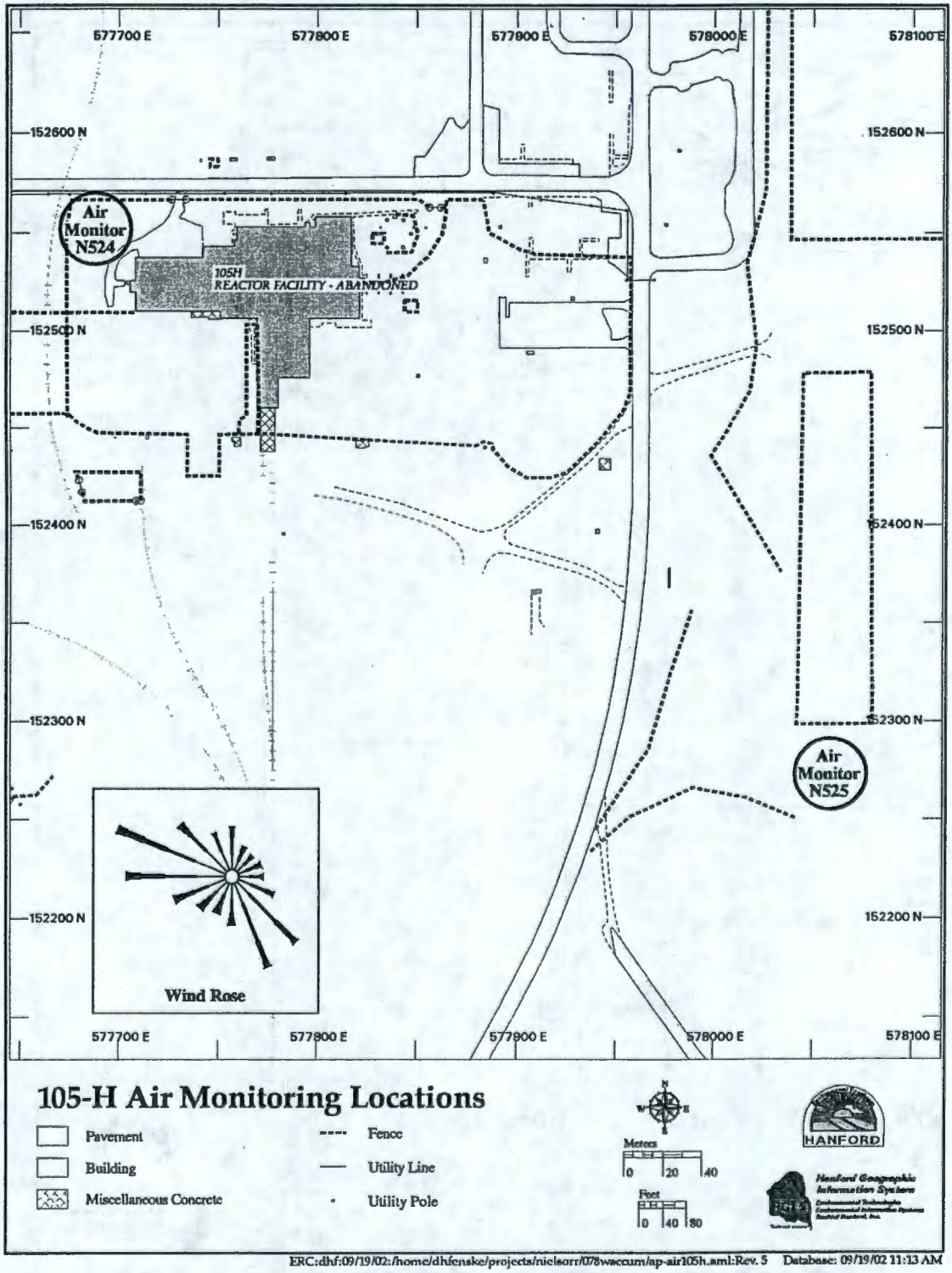


Table B-1. 105-D PTE and Unabated Offsite Dose Values.[a]

Isotope	Support Areas (Modules 1 and 2)				FSB				Modules + FSB = Total PTE	Unabated Offsite Dose (mrem/yr)[d]
	APQ (Ci/yr)	PTE (1E-3)[b] (Ci/yr)	PTE (1.0)[b] (Ci/yr)	PTE (Total) (Ci/yr)	APQ (Ci/yr)	PTE (1E-6)[c] (Ci/yr)	PTE (1E-3)[c] (Ci/yr)	PTE (Total) (Ci/yr)		
Ni-59	0E+00	0E+00	0E+00	0E+00	2.0E-03	1.9E-09	1.0E-07	1.02E-07	1.02E-07	2.65E-11
Co-60	2.98E-05	2.83E-08	1.49E-06	1.52E-06	9.06E-03	8.61E-09	4.53E-07	4.62E-07	1.98E-06	2.75E-07
Ni-63	0E+00	0E+00	0E+00	0E+00	2.47E-01	2.35E-07	1.24E-05	1.26E-05	1.26E-05	3.58E-09
Sr-90	4.28E-02	4.06E-05	2.14E-03	2.18E-03	4.39E-02	4.17E-08	2.20E-06	2.24E-06	2.18E-03	2.04E-04
Y-90[e]	4.28E-02	4.06E-05	2.14E-03	2.18E-03	4.39E-02	4.17E-08	2.20E-06	2.24E-06	2.18E-03	4.44E-07
Cs-137	1.83E-03	1.74E-06	9.16E-05	9.33E-05	8.9E-02	8.46E-08	4.45E-06	4.53E-06	9.78E-05	3.25E-06
Ba-137m[f]	1.73E-03	1.65E-06	8.66E-05	8.82E-05	8.42E-02	8.0E-08	4.21E-06	4.29E-06	9.25E-05	5.25E-14
Eu-152	1.94E-04	1.84E-07	9.71E-06	9.89E-06	1.01E-02	9.6E-09	5.05E-07	5.15E-07	1.04E-05	1.38E-06
Eu-154	4.71E-05	4.47E-08	2.35E-06	2.40E-06	2.42E-03	2.3E-09	1.21E-07	1.23E-07	2.52E-06	2.71E-07
Pu-239	0E+00	0E+00	0E+00	0E+00	2.4E-02	2.28E-08	1.20E-06	1.22E-06	1.22E-06	9.66E-06
Am-241	0E+00	0E+00	0E+00	0E+00	7.84E-03	7.45E-09	3.92E-07	3.99E-07	3.99E-07	4.86E-06
TOTAL										**2.24E-04**

[a]The information for this table was obtained from BHI calculation number 0100X-CA-V0035, Rev 2 (BHI 2002).
[b]Conservatively, 95% of the inventory is assumed to have a release fraction of 1E-3 and 5% is assumed to have a release fraction of 1.0.
[c]Conservatively, 95% of the inventory is assumed to have a release fraction of 1E-6 and 5% is assumed to have a release fraction of 1E-3.
[d]The annual unabated dose was determined using the CAP-88 model. The PTE (Ci/yr) was the input, and the model generated the annual unabated dose. The distance to the maximally exposed individual is 9,776 m to the west-northwest of the 105-D Reactor Facility. The CAP88 model summary and synopsis is presented in BHI calculation number 0100X-CA-V0035, Rev. 2 (BHI 2002).
[e]The total PTE for Sr-90 was used for Y-90.
[f]The total PTE for Ba-137m was 94.6% of Cs-137.
APQ = annual possession quantity
FSB = Fuel Storage Basin
PTE = potential-to-emit

Table B-2. 105-H PTE and Unabated Offsite Dose Values.[a]

Isotope	Support Areas (Modules 1 and 2)				FSB		Modules + FSB = Total PTE	Unabated Offsite Dose (mrem/yr)[d]
	APQ (Ci/yr)	PTE (1E-3)[b] (Ci/yr)	PTE (1.0)[b] (Ci/yr)	PTE (Total) (Ci/yr)	APQ[g] (Ci/yr)	PTE (Total)[c] (Ci/yr)		
Ni-59	0E+00	0E+00	0E+00	0E+00	1.00E+00	1.80E-05	1.80E-05	6.49E-09
Co-60	2.98E-05	2.83E-08	1.49E-06	1.52E-06	3.98E+00	7.16E-05	7.32E-05	1.41E-05
Ni-63	0E+00	0E+00	0E+00	0E+00	1.10E+02	1.98E-03	1.98E-03	7.83E-07
Se-79	0E+00	0E+00	0E+00	0E+00	4.00E-03	7.20E-08	7.20E-08	0E+00
Sr-90[e]	4.28E-02	4.06E-05	2.14E-03	2.18E-03	6.06E+02	1.09E-02	1.31E-02	1.70E-03
Y-90	4.28E-02	4.06E-05	2.14E-03	2.18E-03	6.06E+02	1.09E-02	1.31E-02	3.75E-06
Zr-93	0E+00	0E+00	0E+00	0E+00	4.00E-02	7.20E-07	7.20E-07	1.30E-09
Nb-94	0E+00	0E+00	0E+00	0E+00	1.60E-02	2.88E-07	2.88E-07	2.40E-07
Tc-99	0E+00	0E+00	0E+00	0E+00	2.00E+01	3.60E-04	3.60E-04	9.84E-06
Pd-107	0E+00	0E+00	0E+00	0E+00	4.00E-04	7.20E-09	7.20E-09	3.68E-12
Cd-113	0E+00	0E+00	0E+00	0E+00	4.00E-02	7.20E-07	7.20E-07	0E+00
Cs-137	1.83E-03	1.74E-06	9.16E-05	9.33E-05	6.18E+02	1.11E-02	1.12E-02	5.16E-04
Ba-137m[f]	1.73E-03	1.65E-06	8.66E-05	8.82E-05	5.83E+02	1.05E-02	1.06E-02	9.38E-12
Sm-151	0E+00	0E+00	0E+00	0E+00	7.22E+00	1.30E-04	1.30E-04	1.34E-07
Eu-152	1.94E-04	1.84E-07	9.71E-06	9.89E-06	1.42E+00	2.56E-05	3.55E-05	6.56E-06
Eu-154	4.71E-05	4.47E-08	2.35E-06	2.40E-06	2.90E+00	5.22E-05	5.46E-05	8.15E-06
Pu-238	0E+00	0E+00	0E+00	0E+00	4.95E-01	8.91E-06	8.91E-06	9.18E-05
U-238	0E+00	0E+00	0E+00	0E+00	1.38E-01	2.48E-06	2.48E-06	9.25E-06
Pu-239	0E+00	0E+00	0E+00	0E+00	2.72E+01	4.90E-04	4.90E-04	5.45E-03
Pu-240	0E+00	0E+00	0E+00	0E+00	6.00E+00	1.08E-04	1.08E-04	1.20E-03
Am-241	0E+00	0E+00	0E+00	0E+00	1.19E+01	2.14E-04	2.14E-04	3.66E-03
Pu-241	0E+00	0E+00	0E+00	0E+00	1.07E+02	1.93E-03	1.93E-03	3.36E-04
TOTAL								**1.30E-02**

[a]The information for this table was obtained from BHI calculation number 0100X-CA-V0035, Rev. 2 (BHI 2002).
[b]Conservatively, 95% of the inventory is assumed to have a release fraction of 1E-3 and 5% is assumed to have a release fraction of 1.0.
[c]The sediment in the FSB is assumed to have a release fraction of 1.8E-5, as stated in AP-42, Table 11.9-4 (EPA 1998).
[d]The annual unabated dose was determined using the CAP-88 model. The PTE (Ci/yr) was the input, and the model generated the annual unabated dose. The distance to the MEI is 10,499 m to the east of the 105-H Reactor Facility. The CAP88 model summary and synopsis is presented in BHI calculation number 0100X-CA-V0035, Rev. 2 (BHI 2002).
[e]The total PTE for Sr-90 was used for Y-90.
[f]The total PTE for Ba-137m was 94.6% of Cs-137.
[g]The APQ is based on the bounding sediment and 50 bounding fuel elements (0100X-CA-V0035).
APQ = annual possession quantity
FSB = Fuel Storage Basin
PTE = potential-to-emit

DISTRIBUTION

U.S. Department of Energy,
Richland Operations Office

E. B. Dagan	A5-15
S. M. McDuffie	L1-02
D. C. Smith	A3-04

ERC Team

W. J. Allenbaugh, BHI	X0-17
J. M. Atwood, BHI	H0-18
D. R. Byers, BHI	X9-08
M. W. Caldwell, BHI	X9-10
R. S. Day, BHI	H0-18
H. G. Doolittle, BHI	X9-09
J. J. Ehlis, BHI	X9-10
R. M. Ellenbest, BHI	X9-09
E. T. Feist, CHI	H9-03
P. W. Griffin, BHI	X9-08
S. M. Hamblin, BHI	X9-14
R. P. Henckel, BHI	X9-08
J. A. Howell, BHI	X9-10
E. G. Ison, BHI	X9-05
S. L. Keller, BHI	X9-09
R. J. Landon, BHI	H0-02
J. R. Laws, BHI	X9-10
R. J. Lewis, BHI	X9-10
C. J. Lucas, BHI	X9-14
M. A. Mihalic, BHI	X9-08
G. E. Minkler, BHI	X9-08
C. W. Moorman, BHI	X9-09
M. R. Morton, BHI	X9-05
P. A. Newman, BHI	X9-10
R. R. Nielson, BHI (5)	X9-05
J. P. Petty, BHI	X9-08
E. A. Prichard, BHI	X9-09
T. J. Rodovsky, BHI	X9-05
D. L. Schilperoort, BHI	X9-05
C. H. St.John	X9-05
R. A. Thoren, CHI	X9-05

ERC Team (cont.)

S. E. Vukelich, BHI	X9-08
P. K. Wells, BHI	X5-54
J. G. Woolard, BHI	H0-02
Project File	X9-08

Document Information Services (3)	H0-09
Human Resources Training	H0-08
Hanford Technical Library	P8-55