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Rev. 3

Surplus Reactor Auditable Safety Analysis

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Surplus Reactor Auditable Safety Analysis

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EXECUTIVE SUMMARY

This auditable safety analysis (ASA) documents the authorization basis for the surveillance and maintenance (S&M), until final disposition, of the following inactive reactor buildings and ancillary facilities:

<u>105-B Reactor Building</u>

- 116-B Reactor Exhaust Stack
- 119-B Building
- 1608-B Gas Line Pressure/Vacuum Seal House

<u>105-C Reactor Building</u>

- No ancillary facilities

<u>105-DR Reactor Building</u>

- 190-DR Pumphouse

<u>105-F Reactor Building</u>

- No ancillary facility

<u>105-KE/KW Reactor Buildings</u>

- 182-K Emergency Water Reservoir Pumphouse
- 183-K Pipe Tunnels
- 1720-K Administrative Office Building
- 110-KE and 110-KW Gas Storage Facilities
- 115-KE and 115-KW Gas Recirculation Buildings
- 116-KE and 116-KW Reactor Exhaust Stacks
- 117-KE and 117-KW Exhaust Air Filter Buildings
- 118-KE-2 and 118-KW-2 Horizontal Control Rod Storage Caves
- 150-KE and 150-KW Heat Recovery Stations

- 166-KE and 166-KW Oil Storage Facilities
- 119-KW Exhaust Air Sample Building
- 165-KW Power Control Building
- 181-KW River Pumphouse
- 183-KW (Process Water) Filter Plant
- 190-KW Process Water Pumphouse.

The 105-D, 105-H, and 105-F Reactor Buildings, which are scheduled to be modified for interim safe storage under the Facilities Decommissioning Project, are outside the scope of this ASA and have their own authorization basis documents.

Except for the 105-B Reactor, the final disposition of the inactive reactor buildings, as recorded in DOE/EIS-0119D, *Draft Environmental Impact Statement*; *Decommissioning of Eight Surplus Production Reactors at the Hanford Site* (DOE 1989), and the Record of Decision (58 *Federal Register* 48509), is safe storage followed by deferred one-piece removal of the reactor blocks.

The approach used is in accordance with CCN 038398, *Nuclear Safety* (DOE-RL 1996), as implemented in BHI-DE-01, *Design Engineering Procedures Manual*, EDPI-4.28-01, and 0000X-EG-N0004, Rev. 1, *Engineering Guide for Performing Hazard Analysis and Final Hazard Classification* (BHI 1998d).

Deterioration of the reactor buildings and ancillary facilities, which have exceeded their design life, presents potential industrial safety and radiological/chemical/biological hazards to workers during S&M activities. In addition, the reactor blocks and fuel storage basins within the reactor buildings contain significant quantities of radionuclides that present potential radiological hazards onsite and to adjacent areas of the Columbia River. Corrective maintenance performed on these facilities under the risk management program has significantly reduced the risk associated with these hazards.

A detailed analysis of the potential hazards associated with the S&M activities at the inactive reactor buildings and ancillary facilities indicated that no activity/process authorized by this ASA could credibly result in undue risk to a worker, a member of the public, or the environment. Environmental Restoration Contractor programs and procedures, including the work control program, and passive barriers (e.g., asphalt emulsion covering fuel storage basin walls and floor, the thermal and biological shields encasing the reactor block graphite stack) adequately control the hazards associated with these facilities. The appropriate programmatic, project-specific, and special controls that protect the worker, the public, and the environment have been identified and are detailed in Section 5.0.

The final hazard classification for the inactive reactor buildings and ancillary facilities was determined to be radiological, based on an analysis of the hazards associated with the S&M of the facilities. The special controls necessary to ensure that the bounding analysis assumptions remain valid are detailed in Section 5.0.

Revision 3 of this ASA incorporates the following management of change (MOC) evaluations: MOC-2003-0003, MOC-2003-0004, MOC-2003-0006, and MOC-2003-0008 (BHI 2003b, 2003c, 2003d, and 2003e, respectively).

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ACRONYMS

ALARA	as low as reasonably achievable
ARF	airborne release fraction
ASA	auditable safety analysis
BHI	Bechtel Hanford, Inc.
CFR	*Code of Federal Regulations*
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DR	deficiency report
DWR	demand work request
EMP	Emergency Management Plan
ERO	emergency response organization
ERC	Environmental Restoration Contractor
FDH	Fluor Daniel Hanford, Inc.
FHC	final hazard classification
FSB	fuel storage basin
HCR	horizontal control rod
HMS	Hanford Meteorological Station
ISS	interim safe storage
MOC	management of change
MOU	Memorandum of Understanding
NFPA	National Fire Protection Association
NHF	National Historic Foundation
NPS	National Park Service
PHA	preliminary hazard analysis
PHC	preliminary hazard classification
PMF	probable maximum flood
POD	plan of the day
RARA	Radiation Area Remedial Action
RF	respirable fraction
RL	U.S. Department of Energy, Richland Operations Office
RMA	radioactive materials area
RWP	radiological work permit
S&M	surveillance and maintenance
SFP	Spent Fuels Program
SMWR	scheduled maintenance work request
SPF	standard project flood
SS HASP	site-specific health and safety plan
TI	task instruction
TIDS	task instruction data sheet
UBC	Uniform Building Code
USDI	U.S. Department of the Interior
VSR	vertical safety rod
WHC	Westinghouse Hanford Company

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

1.0 INTRODUCTION

1.1 PURPOSE

This auditable safety analysis (ASA) provides the safety basis for maintaining the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings and ancillary facilities until interim or final disposition. The ASA provides a hazard baseline, identifies and evaluates the associated hazards, identifies the appropriate controls, documents the final hazard classification (FHC), and documents the resultant commitments for the surveillance and maintenance (S&M) of these inactive reactor buildings and associated ancillary facilities at the Hanford Site. In addition, this document provides a basis for evaluating proposed activities to determine if the activities are acceptable.

This document includes the following:

- A description of the S&M activities to be performed
- An assessment of the inventory of radioactive and other hazardous materials within the inactive reactors and ancillary facilities
- Identification of the hazards associated with the S&M activities for the inactive reactors and ancillary facilities
- Identification of internally and externally initiated accidents having the potential to result in significant consequences for workers, the environment, or the public
- An assessment of the bounding radiological and hazardous chemical consequences of the potentially significant accidents
- Determination of the FHC based on the bounding radiological and hazardous chemical consequences
- Identification of the controls (including commitments) necessary to control the identified hazards and to ensure that the FHC remains valid.

This ASA supercedes the preliminary hazard classifications (PHCs) performed for the 105-B, 105-KE, and 105-KW Reactors (BHI 1997e, 1997h, 1997i) and the safety analysis for interim stabilization to the 105-C, 105-DR, and 105-F Reactors (BHI 1996a, 1998f, 1998e).

The 105-D and 105-H Reactor Buildings, which are scheduled to be modified for interim safe storage (ISS) under the Facilities Decommissioning Project, are outside the scope of this ASA and have their own authorization basis. Upon completion of the modifications, these reactor buildings will reenter the S&M program.

1.2 DOCUMENT ORGANIZATION

The remainder of this introductory section (1) describes the activities that will be authorized by approval of this document; (2) describes how configuration and change control will be managed to maintain the requirements stipulated by this document; (3) summarizes the conclusions of the safety analysis and the programmatic and project-specific controls determined to protect the worker, the environment, and the public; and (4) states the basis for the FHC and summarizes the controls necessary to ensure that the FHC remains valid.

The document is composed of four additional sections. Section 2.0 provides the background information necessary to understand the hazards with a potential for dose or exposure to workers, the public, or the environment during S&M. Section 3.0 provides the basis of operations that are analyzed and authorized under the ASA. Section 4.0 summarizes the hazard analysis and FHC process. Section 5.0 identifies the special controls required to ensure that the FHC remains valid and summarizes the project-specific and programmatic controls necessary to control the identified hazards.

1.3 AUTHORIZED ACTIVITIES

The activities being authorized for the inactive reactor facilities are S&M. Facility surveillance activities typically include inspection for structural deterioration, inspection for hazardous materials and unidentified/unlabeled containers, performance of light housekeeping (e.g., picking up trash and debris, sweeping), and general surveys. Examples of maintenance activities include inspection of emergency lighting and fire extinguishers at the 105-B Reactor Building, construction, and electrical repair. These activities are discussed in greater detail in Sections 2.3 and 3.1.

1.4 CONFIGURATION CONTROL

Established configuration/change control processes ensure that proposed changes are reviewed relative to the specified commitments. If discovery indicates a breach of these commitments, work will cease to allow stabilization and/or recovery actions to be identified and implemented as appropriate. Bechtel Hanford, Inc. (BHI) off-normal event procedures describe the reporting process and protocol applicable to such a discovery. BHI-DE-01, *Design Engineering Procedures Manual*, EDPI-4.40-01 defines the management of change (MOC) process for facilities that have an FHC of less than Nuclear.

1.5 SAFETY SUMMARY

A detailed analysis of the potential hazards associated with the S&M activities at the inactive reactors and ancillary facilities indicated that deterioration of the reactor buildings and ancillary facilities, which have exceeded their design life, presents potential industrial safety and radiological/chemical/biological hazards to workers. In addition, the reactor blocks and fuel storage basins (FSBs) within the reactor buildings contain significant quantities of radionuclides that present potential radiological hazards onsite and to adjacent areas of the Columbia River. However, it was determined that no activity/process authorized by this ASA could credibly result in undue risk to a worker, a member of the public, or the environment.

Corrective maintenance performed on these facilities under the risk management program has significantly reduced the risk associated with these hazards. Additional scheduled maintenance activities will serve to reduce the risk further. The Environmental Restoration Contractor's (ERC's) programs and procedures, including the work control program, and passive barriers (e.g., asphalt emulsion on FSB walls and floor, thermal and biological shields encasing the reactor block graphite stack) adequately control the hazards associated with these facilities. The appropriate programmatic, project-specific, and special controls that protect the worker, the public, and the environment have been identified and are detailed in Section 5.0.

1.6 HAZARD CLASSIFICATION

The FHC for the inactive reactors and ancillary facilities was determined to be Radiological. The basis for this FHC is found in CCN 038398, *Nuclear Safety* (DOE-RL 1996). To ensure that the FHC remains valid, activities requiring penetration of the steel outer shell/gas seal of the reactor blocks are prohibited. Section 5.0 provides additional detail of this control.

2.0 BACKGROUND

2.1 FACILITY HISTORY

The reactor buildings, designated as 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW, were six of the nine water-cooled, graphite-moderated reactors constructed along the Columbia River by the U.S. Government within the Hanford Site's 100 Areas (Figure 2-1) to support the plutonium production effort initiated in 1942. The reactor buildings contain the nuclear reactor and equipment directly associated with reactor operations. Cooling water for the reactors was withdrawn from the Columbia River, filtered and treated, pumped through the reactor block, and then returned to the river in a single-pass process. Each reactor has been placed in final shutdown and, except for 105-B, has been declared surplus by the U.S. Department of Energy (DOE). The 105-B Reactor Building was the first full-scale production nuclear reactor ever constructed. The 105-B Reactor Building was placed on the National Register of Historical Places on April 3, 1992, by the National Park Service (NPS) of the U.S. Department of the Interior (USDI). The 105-B Reactor Building was also listed as a National Historic Mechanical Engineering Landmark in 1976 by the American Society of Mechanical Engineers' History and Heritage Committee. In October 1993, the American Society of Civil Engineers named the 105-B Reactor Building a National Civil Engineering Landmark. The American Nuclear Society presented the Nuclear Landmark Award to the 105-B Reactor Building in 1992. The *105-B Reactor Facility Museum Phase 1 Feasibility Study Report* (BHI 1995) was issued in October 1995. An estimated 5,000 visitors tour the existing reactor facility annually.

In general, the reactors can be assigned to two groups: (1) the older 105-B, 105-C, 105-DR, and 105-F Reactors, and (2) the newer 105-KE and 105-KW Reactors. The thermal and biological shields and graphite stacks of the older reactors are similar in size and are constructed of the same materials. The older reactors also had similar neutron flux distributions.

The 105-KE and 105-KW Reactors are generally comparable to the older reactors in design. However, the 105-KE and 105-KW Reactors differ as follows: (1) the biological shields are constructed of concrete rather than the steel/Masonite laminate used for the older reactors, (2) their graphite stacks are one and one half times larger than those of the older reactors, and (3) they have approximately 61% more process tubes. Additional noteworthy differences include the following: (1) the concrete foundations contain tunnels for the retrieval of the boron-steel balls used for the ball 3x system (a shutdown safety system); (2) the outer rod rooms have reinforced-concrete walls 1 to 3 ft thick; (3) the supply and exhaust fan areas are located on opposite ends of the building instead of both being located on the same end; (4) the valve pits are below grade, directly under the front-face work area; and (5) the mechanical rooms and miscellaneous above-grade support rooms were built with transite wall panels and roofs. The operating history of each reactor is summarized in Table 2-1.

Also included within the scope of this ASA are associated ancillary facilities within the 100-B/C, 100-D/DR, 100-F, and 100-K Areas. The facilities addressed by this ASA are as follows:

105-B Reactor Building

- 116-B Reactor Exhaust Stack
- 119-B Building
- 1608-B Gas Line Pressure/Vacuum Seal House

105-C Reactor Building

- No ancillary facilities

105-DR Reactor Building

- 190-DR Pumphouse

105-F Reactor Building

- No ancillary facilities

105-KE/KW Reactor Buildings

- 105-KH Process Water Tunnel
- 182-K Emergency Water Reservoir Pumphouse
- 183-K Pipe Tunnels
- 1720-K Administrative Office Building
- 110-KE and 110-KW Gas Storage Facilities
- 115-KE and 115-KW Gas Recirculation Buildings
- 116-KE and 116-KW Reactor Exhaust Stacks
- 117-KE and 117-KW Exhaust Air Filter Buildings
- 118-KE-2 and 118-KW-2 Horizontal Control Rod Storage Caves
- 150-KE and 150-KW Heat Recovery Stations
- 166-KE and 166-KW Oil Storage Facilities
- 119-KW Exhaust Air Sample Building
- 165-KW Power Control Building
- 181-KW River Pumphouse
- 183-KW (Process Water) Filter Plant
- 190-KW Process Water Pumphouse.

Several areas within the 105-KE and 105-KW Reactor Buildings and several of their associated ancillary facilities are not addressed by this ASA because responsibility for them has not been assigned to BHI. An agreement attached to the Memorandum of Understanding (MOU) (BHI 1996b) between BHI and Westinghouse Hanford Company (WHC) established the agreement of BHI and WHC regarding coordination of their respective responsibilities at the 100-K Area, the 100-B/C Area, the 100-D/DR Area, 100-F Area, and the 100-N Area. The MOU was assigned to Fluor Daniel Hanford, Inc. (FDH) by WHC in the September 30, 1996, transfer agreement between the contractors and DOE. The MOU established the following: (1) a lead contractor for each of the structures/facilities and the general area within the exclusion fence for each of the 100 Areas noted, (2) facility access and control requirements, (3) waste handling and disposal protocol, and (4) WHC's (now FDH's) responsibilities for providing the 100-N potable water from the 100-B/C Area. An addendum to the MOU further specified, via area designation on facility maps, the division of responsibilities for the 105-KE and 105-KW Reactor Buildings. The sections of the reactors and ancillary facilities that are outside the scope of this ASA include the following:

- 105-KE Fuel Storage Basin and Transfer Bay Area and some office areas
- 105-KW Fuel Storage Basin and Transfer Bay Area and some office areas
- 165-KW Switchgear Room in Power Control Building
- 183.1-KW Chlorine Vault
- 190-KW South and East Highbays in Process Water Pumphouse.

The FSBs at 105-KE and 105-KW Reactors were cleaned of debris and deactivated after final reactor shutdown. However, the basins were modified and reactivated to provide storage space for irradiated fuel removed from the 105-N Reactor. Both basins currently continue to be used by the Spent Fuels Program (SFP) K Basin operations to store N Reactor fuel. The sections of the ancillary facilities noted above provide support to the storage operation.

Because of the length of time that has elapsed since the reactor buildings and ancillary facilities were operational, no information was obtained regarding significant, historical off-normal events that could potentially be relevant to understanding current conditions within the structures. The information relied upon to understand the current conditions has been gathered subsequent to final shutdown of the reactors (primarily within the last 20 years).

2.2 FACILITY DESCRIPTION

This section describes each facility within the 100-B/C, 100-D/DR, 100-F, and 100-K Areas that is included in the scope of this ASA. The facilities are grouped in subsections according to the 100 Area in which they are located.

2.2.1 100-B/C Area Facilities

The facilities located within the 100-B/C Area that are included are numerically designated as 105-B, 105-C,116-B, 119-B, and 1608-B. The location of these facilities within the 100-B/C Area is shown in Figure 2-2. BHI-00981, Rev. 4, *ERC Hazard Classification Matrices for Above-Ground Structures and Groundwater and Soil Remediation Activities* (BHI 2002a) provides a summary description for these facilities and additional ancillary facilities associated with the 105-B and 105-C Reactor Buildings. BHI (2002a) was developed to provide a perspective on the relationship of the facilities within the original Reactor Production Plant, to ensure that the ownership and the responsibilities for the facilities are understood, and to ensure that the facilities identified as BHI's responsibility are adequately addressed. BHI (2002a) includes the number, name, purpose, and current status (e.g., active, deactivated, or demolished) of each structure. Also provided, if applicable, is the name of the managing contractor, agreements established by the MOU between BHI and FDH, and information regarding hazard identification/evaluation documentation. BHI (2002a) puts the building/structure function and interfaces in perspective to the hazards identification (see Appendix A), but is not inclusive of waste site designations of demolished structures that are addressed under the BHI Radiation Area Remedial Action (RARA) Program. The BHI-managed above-grade facilities within the scope of the ASA are described in the following subsections.

2.2.1.1 105-B Reactor Building. The 105-B Reactor Building was a plutonium production reactor. The 105-B Reactor Building provided housing for the nuclear reactor and equipment directly associated with reactor operations. Construction of the 105-B Reactor Building began in 1943, with the initial startup of the reactor occurring on September 26, 1944. The 105-B Reactor was shut down and held in standby from March 19, 1946, to June 2, 1948; the reactor was restarted and operated until February 13, 1968, when it was permanently shut down. Sections of the building are still energized.

The building is a light, nonairtight industrial structure (346 by 256 by 120 ft high; 53,750 ft^2 total area) of reinforced-concrete construction in the lower portions and of concrete block construction in the upper portion. Roof construction is of reinforced-concrete or precast concrete roof panels.

Damaged pre-cast concrete roof panels were repaired (circa 1994) in the "C" Elevator area, Corridor 1, Corridor 221, and valve pit room; and (circa 2002) in the fuel storage viewing room, Corridor 221, Electrical Equipment Room, Corridor 227, valve pit room, and fan room.

Safety nets in the 105-B Reactor front-face work area ceiling area and a restraint for the existing vertical curtain were installed in 2002. The safety nets and curtain restraint will provide protection from potential failed roof panels and a potential failed vertical curtain retraction system. Expanded metal was installed on the 105-B Reactor valve pit existing walkway guardrails in 2002. Three expanded metal lockable gates were installed on the walkway. The expanded metal partitions and lockable expanded metal gates provide protection from trips and falls and control access to the valve pit lower area.

A ventilation system was installed in 2003. This system normally does not provide supply air during occupancy but is used to sweep the area with fresh air during the night as a means to cool down the areas (which may have been heated up by the lights and from people) and reduce the radon levels, as necessary. The air is supplied into the clean areas of the building, which slightly pressurizes the building as the air is released to the outside through the various cracks in this nonairtight industrial structure. This system is composed of three zones as follows:

- Zone 1: Supply Fan Room 230a, Valve Pit Area #315, and Flow Lab #231a
- Zone 2: Corridors 5 and 227b, Corridor 227a, Electrical Equipment Room 223, Toilet 225a, Accumulator Room 222, Corridors 2, 3, and 211b, Corridors 4 and 211, Office/Storage 228a, and Viewing Room 414
- Zone 3: Control Room 220 and Office 219.

Nontempered air is supplied for Zones 1 and 2 through roof-mounted ventilation units, while the Zone 3 ventilation unit is located inside the building. The units are provided with medium efficiency inlet filters that can handle differential pressure up to 1.5 in. The combined airflow from the units is approximately 22,500 ft^3/min of air at 2.5 in. W.G.

The building contains a reactor block; FSB; inner and outer rod rooms (i.e., inner and outer horizontal control rod [HCR] rooms); vertical safety rod (VSR) winch level, front-face work area; fans and ducts for ventilation and recirculating inert gas systems; water cooling systems; and supporting offices, lunchroom, shops, and laboratories. Figure 2-3 shows the ground-level layout of the reactor building. Figure 2-4 shows a cut-away view of a typical older reactor building. These figures are general in nature and do not include all the areas that are included in this description. The ventilation system was designed such that air flowed from office and service areas to potentially contaminated areas. The air was exhausted to the atmosphere through the 116-B Reactor Exhaust Stack.

The reactor building can essentially be divided into three areas: (1) those areas within the massive, reinforced-concrete shield walls of the building surrounding the reactor process areas (e.g., inner rod room, ball 3x system, and front-face work area), including the reactor block, which is composed of the graphite moderator stack, thermal and biological shields, process tubes, and the safety and control systems; (2) the FSB; and (3) the general ancillary areas of the reactor building (excluding the FSB) located outside the shield walls (e.g., fan area, general office areas, and lunchroom). These three areas are designated as module 2, FSB area, and module 1, respectively. The building contains approximately 23,000 Ci of radionuclides (as of March 1, 1985, according to UNC 1987), 98.3 tons of lead (WHC 1993a), and an unknown quantity of asbestos (WHC 1993a).

2.2.1.1.1 Module 1. Module 1 provided ancillary support areas during former reactor operations. The prior support areas included office areas, the reactor control room, tool storage rooms, restrooms, cooling water influent areas, change rooms, ventilation equipment areas, electrical systems areas, and other infrastructure support. Figure 2-3 provides a plan view of module 1.

2.2.1.1.2 Module 2. Module 2 is the area inside the shield walls, including the reactor block. Areas and rooms within module 2 include the inner rod room, front-face work area, ball 3x system, laboratories, and other support areas. Figure 2-3 provides a plan view of module 2.

Reactor block. The reactor block is located near the center of the building. The reactor block consists of a graphite moderator stack (36 ft high by 36 ft wide by 28 ft deep) encased in a cast iron thermal shield (8 to 10 in. thick) and a biological shield consisting of alternating layers of steel and Masonite® (52 in. thick). The entire block rests on a massive concrete foundation. The block weighs approximately 8,930 tons. Figure 2-5 shows the typical reactor block construction.

- **Graphite moderator stack.** The graphite moderator stack is composed of 4-ft-long interlocking graphite blocks, which are stacked to provide a central region for fuel loading and an outer region for a neutron reflector. The 105-B Reactor contains 2,004 process tube openings. The reactor also has openings for HCRs, VSRs, test facilities, and instrumentation. The HCR penetrations are on the left side of the reactor block (when facing the reactor front face), and the VSR penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor block. Experimental test penetrations are located on the right side of the reactor block.

- **Thermal shield.** The cast iron thermal shield surrounding the graphite stack isolates the biological shield from the core. The 105-B Reactor thermal shield is constructed of overlapping sheets, and the shield varies in thickness from 8 to 10 in. on the sides, top, bottom, front, and rear. Stainless-steel 3/4-in. schedule-40 tubes were imbedded in the thermal shield and provided cooling water to the shields. Gunbarrels, steel tube connections to the process tubes for the cooling water and instrumentation, also ran through the thermal shield.

- **Biological shield.** The biological shield of 105-B Reactor consists of alternating laminated layers of steel and Masonite. A breakdown of the lamination pattern for the biological shield is provided in Figure 2-6. The figure shows two layers of steel at the surface, followed by a layer of Masonite. There are seven layers of steel plate; the first six layers consist of two 1.9-in.-thick steel plates, while the layer closest to the thermal shield is a single 2.5-in.-thick plate. The six layers of Masonite are each 4.5 in. thick. The massive concrete foundation that the reactor rests on is also considered part of the biological shield.

- **Process tubes.** Process tubes contained the uranium fuel elements and provided channels for cooling water flow. The 105-B Reactor used process tubes made of 1100 aluminum alloy.

- **Safety and control systems.** The reactor control system included the HCRs, VSRs, and ball 3x system. The HCRs moved into and out of passages in the graphite core. The HCRs were used for controlled startup transients and power level during equilibrium operation. The VSRs were located on top of the reactor. Electromagnets held the VSRs with just the tips in the top of the thermal shield. The ball 3x system served as a separate emergency shutdown system. The ball 3x system consisted of hoppers that were full of boron-steel balls that would automatically drain into channels if the VSRs did not terminate the chain reaction after receiving a shutdown signal.

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All penetrations through the block outer shielding (e.g., the process tubes, HCR/VSR/ball 3x channels, and instrumentation/experimental channels) were provided with cover gas seal designed tubes/sleeves/thimbles to maintain cover gas containment.

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. The process used at the 105-B Reactor was assumed to be similar to the process at 105-KE/KW. The procedures used at the 105-KE and 105-KW Reactors can be found in the reactor deactivation manuals (BHI 1998a, 1998b). Examples of the activities performed include the following: process tube caps were installed, cover-gas lines were drained, drain valves were closed, and all water lines were drained.

2.2.1.1.3 Fuel Storage Basin. The FSB served as a collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. It consists of a fuel element pickup area, the storage area, and the transfer area. Irradiated fuel elements were stacked in buckets underwater in the pickup area, transported by an overhead monorail to the storage area, and temporarily stored under water to allow decay of short-lived radionuclides before transporting for reprocessing. Figure 2-3 shows the location of the FSB, and the typical layout can be seen in Figure 2-7.

The 105-B FSB has been drained and cleared of debris, and a fixative has been applied to radiologically contaminated surfaces. The removed sludge (a radiologically contaminated sediment composed of iron oxides and silt) was placed in the transfer pit where it remains covered by a layer of sand (reported by individuals involved in the project to be 1 to 3 ft thick) and a wood deck.

2.2.1.2 105-C Reactor Building. As a result of the ISS Project activities, the reactor building, designated as the 105-C Building, consists only of a reactor block and adjacent work areas. The original FSB was partially removed. The top 15 ft of wall was removed while the remaining wall sections were coated with a fixative and covered with soil. The fuel examination facility adjacent to the FSB; inner and outer HCR rooms; fans and ducts for ventilation and recirculating inert gas systems; water cooling systems; supporting offices, shops, and laboratories; and fuel transfer pits and their contents (BHI 1998c) were all demolished and removed during the decontamination and decommissioning (D&D) efforts associated with the ISS Project. Module 2, as highlighted in Figure 2-3, is all that remains (above ground) of the facility.

The 105-C Building is a reinforced concrete and concrete block structure with steel framing with corrugated asbestos cement (transite) covering major portions of the building exterior. The lower levels of the building and the central portion surrounding the reactor block are constructed of reinforced concrete walls 0.9 m to 1.5 m thick. The structure is topped by a steel roof.

The original footprint area of the 105-C Building was 5,528 m^2 (59,500 ft^2). The final footprint resulting from ISS activities is 1,059 m^2 (11,400 ft^2). Thus, the footprint area of the 105-C Reactor was reduced by 81% (BHI 1998c). The footprint area includes only the areas at-grade and excludes any square footage below ground level or above grade level.

2.2.1.2.1 Module 2. Module 2 is the area inside the shield walls, including the reactor block. Areas and rooms within module 2 include the inner rod room, front-face work area, ball 3x system, laboratories, and other support areas. Figure 2-3 provides a plan view of module 2.

Reactor block. The reactor block is located near the center of the building. The reactor block consists of a graphite moderator stack (36 ft high by 36 ft wide by 28 ft deep) encased in a cast iron thermal shield (8 to 10 in. thick) and a biological shield consisting of alternating layers of steel and Masonite (52 in. thick). The entire block rests on a massive concrete foundation. The block weighs approximately 8,930 tons. Figure 2-5 shows the typical reactor block construction.

- **Graphite moderator stack.** The graphite moderator stack is composed of 4-ft-long interlocking graphite blocks, which are stacked to provide a central region for fuel loading and an outer region for a neutron reflector. The 105-C Reactor contains 2,004 process tube openings. The reactor also has openings for HCRs, VSRs, test facilities, and instrumentation. The HCR penetrations are on the left side of the reactor block (when facing the reactor front face), and the VSR penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor block. Experimental test penetrations are located on the right side of the reactor block.

- **Thermal shield.** The cast iron thermal shield surrounding the graphite stack isolates the biological shield from the core. The 105-C Reactor thermal shield is constructed of overlapping sheets, and the shield varies in thickness from 8 to 10 in. on the sides, top, bottom, front, and rear. Stainless-steel 3/4-in. schedule-40 tubes were imbedded in the thermal shield and provided cooling water to the shields. Gunbarrels, steel tube connections to the process tubes for the cooling water and instrumentation, also ran through the thermal shield.

- **Biological shield.** The biological shield of 105-C Reactor consists of alternating laminated layers of steel and Masonite. A breakdown of the lamination pattern for the biological shield is provided in Figure 2-6. The figure shows two layers of steel at the surface, followed by a layer of Masonite. There are seven layers of steel plate; the first six layers consist of two 1.9-in.-thick steel plates, while the layer closest to the thermal shield is a single 2.5-in.-thick plate. The six layers of Masonite are each 4.5 in. thick. The massive concrete foundation that the reactor rests on is also considered part of the biological shield. The roof of the facility is shielded by a 2.1-m (84-in.)-thick heavy aggregate poured concrete shield.

- **Process tubes.** Process tubes contained the uranium fuel elements and provided channels for cooling water flow. The 105-C Reactor used process tubes made of 1100 aluminum alloy.

- **Safety and control systems.** The reactor control system included the HCRs, VSRs, and ball 3x system. The HCRs moved into and out of passages in the graphite core. The HCRs were used for controlled startup transients and power level during equilibrium operation. The VSRs were located on top of the reactor. Electromagnets held the VSRs with just the tips in the top of the thermal shield. The ball 3x system served as a separate emergency shutdown system. The ball 3x system consisted of hoppers that were full of boron-steel balls that would automatically drain into channels if the VSRs did not terminate the chain reaction after receiving a shutdown signal.

All penetrations through the block outer shielding (e.g., the process tubes, HCR/VSR/ball 3x channels, and instrumentation/experimental channels) were provided with cover gas seal designed tubes/sleeves/thimbles to maintain cover gas containment.

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. The process used at 105-C Reactor was assumed to be similar to the process at 105-KE/KW. The procedures used at the 105-KE and 105-KW Reactors can be found in the reactor deactivation manuals (BHI 1998a, 1998b). Examples of the activities performed include the following: process tube caps were installed, cover gas lines were drained, drain valves were closed, and all water lines were drained.

2.2.1.3 116-B Reactor Exhaust Stack. The 116-B Reactor Exhaust Stack was used to discharge ventilation air 200 ft above grade from the 105-B Building. Initially, exhaust air flowed through concrete ducts from the 105-B Building directly out the exhaust stack. After a confinement project was completed in the 1950s, the air was diverted through underground reinforced-concrete ducts to the 117-B Filter Building (which has been demolished). After flowing through the fiber (particulate) and activated charcoal filters, the air went through below-grade and above-grade concrete ducts into the exhaust stack. The exhaust stack has been isolated from sources of potential contamination within the reactor building.

The 116-B Reactor Exhaust Stack is 200 ft above grade and 10 ft below grade, with a 16-ft-outside-diameter base. The wall thickness varies from 1.5 ft to 0.5 ft. A steel door cover at the bottom of the stack provides access to the interior of the stack. The stack is supported on a solid concrete base, which is supported by a solid concrete, octagonal-shaped foundation. The inside of the stack has minor levels of fixed surface contamination, but no hazardous materials are believed to be present. The stack has no electrical service.

2.2.1.4 119-B Building. The unlabeled 119-B Building was used as a storage building, not to be confused with the 119-B Building's exhaust sampling enclosure, which has been demolished and removed. The unlabeled 119-B Building is an empty wooden shack with an asphalt shingle roof. The building is approximately 100 ft directly south of the 105-B Reactor fan room. The structure contains no radioactive or hazardous materials and has no electrical service.

2.2.1.5 1608-B Gas Line Pressure/Vacuum Seal House. The 1608-B Gas Line Pressure/Vacuum Seal House (the effluent waste water pumping station designation number was used because the 105-B Reactor facility did not have a lift station building) contained the apparatus to provide a gas line pressure/vacuum for the 105-B Reactor gas system.

The facility consists of three components: (1) a small wood frame structure, approximately 3 ft by 6 ft, housing the control panels connected to an exterior, above-grade diesel oil tank; (2) the diesel oil tank; and (3) a seal pit structure approximately 20 ft long, 17 ft wide, and 18 ft high (3 ft above grade and 15 ft below grade). The control house and diesel oil tank are intact. The oil tank was emptied during fiscal year 1998. The seal pit structure housed two large liquid seal chambers (which have been removed) that were connected to the gas recirculation lines running between the 115-B/C Gas Recirculation Building (which has been demolished) and the 105-B Reactor. These seal chambers served to protect the gas system from excessive pressure or suction.

Radiological surveys of the control house, diesel oil tank, and the interior/exterior service lines connecting them indicated no direct or smearable contamination was present. Radiological surveys of the seal pit identified no loose contamination. However, due to high radon levels, no direct readings were taken. Minor amounts of hazardous materials (i.e., mercury, lead, and asbestos) are present. The building has been de-energized.

2.2.2 100-D/DR Area Facilities

The facilities located within the 100-D/DR Area that are included are numerically designated as 105-DR and 190-DR. The location of these facilities within the 100-D/DR Area is shown in Figure 2-8. BHI (2002a) provides a summary description of these facilities and additional ancillary facilities associated with the 105-DR Reactor Building. BHI (2002a) includes the number, name, purpose, and current status (e.g., active, deactivated, or demolished) of each of the structures. Also provided, if applicable, is the name of the managing contractor, agreements established by the MOU between BHI and FDH, and information regarding hazard identification/evaluation documentation. The table puts the building/structure function and interfaces in perspective to the hazards identification (see Appendix A). The table is not inclusive of waste site designations of demolished structures that are addressed under the BHI RARA Program. Each BHI-managed above-grade facility within the scope of the ASA is described in the following subsections.

2.2.2.1 105-DR Reactor Building. As a result of D&D activities, the reactor building, designated as the 105-DR Building, consists only of a reactor block and adjacent work areas. The original FSB was partially removed. The top 15 ft of wall was removed while the remaining wall sections were coated with a fixative and covered with soil. The fuel examination facility adjacent to the FSB; inner and outer HCR rooms; fans and ducts for ventilation and recirculating inert gas systems; water cooling systems; and supporting offices, shops, and laboratories were all demolished and removed during the D&D efforts associated with the ISS Project. Module 2, as highlighted in Figure 2-3, is all that remains (above ground) of the facility.

The 105-DR Building is a reinforced concrete and concrete block structure with steel framing with corrugated asbestos cement (transite) covering major portions of the building exterior. The lower levels of the building and the central portion surrounding the reactor block are constructed of reinforced concrete walls 0.9 m to 1.5 m thick. The structure is topped by a steel roof.

The original footprint area of the 105-DR Building was 2,973 m^2 (43,200 ft^2). The final footprint resulting from ISS activities is 892 m^2 (9,600 ft^2). Thus, the footprint area of the 105-DR Reactor was reduced by 70% (BHI 2003a). The footprint area includes only the areas at-grade and excludes any square footage below ground level or above grade level.

2.2.2.1.1 Module 2. Module 2 is the area inside the shield walls, including the reactor block. Areas and rooms within module 2 include the inner rod room, front-face work area, ball 3x system, laboratories, and other support areas. Figure 2-3 provides a plan view of module 2.

Reactor block. The reactor block is located near the center of the building. The reactor block consists of a graphite moderator stack (36 ft high by 36 ft wide by 28 ft deep) encased in a cast iron thermal shield (8 to 10 in. thick) and a biological shield consisting of alternating layers of steel and Masonite (52 in. thick). The entire block rests on a massive concrete foundation. The block weighs approximately 8,930 tons. Figure 2-5 shows the typical reactor block construction.

- **Graphite moderator stack.** The graphite moderator stack is composed of 4-ft-long interlocking graphite blocks, which are stacked to provide a central region for fuel loading and an outer region for a neutron reflector. The 105-DR Reactor contains 2,004 process tube openings. The reactor also has openings for HCRs, VSRs, test facilities, and instrumentation. The HCR penetrations are on the left side of the reactor block (when facing the reactor front face), and the VSR penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor block. Experimental test penetrations are located on the right side of the reactor block.

- **Thermal shield.** The cast iron thermal shield surrounding the graphite stack isolates the biological shield from the core. The 105-DR Reactor thermal shield is constructed of overlapping sheets, and the shield varies in thickness from 8 to 10 in. on the sides, top, bottom, front, and rear.. Stainless-steel 3/4-in. schedule-40 tubes were imbedded in the thermal shield and provided cooling water to the shields. Gunbarrels, steel tube connections to the process tubes for the cooling water and instrumentation, also ran through the thermal shield.

- **Biological shield.** The biological shield of the 105-DR Reactor consists of alternating laminated layers of steel and Masonite. A breakdown of the lamination pattern for the biological shield is provided in Figure 2-6. The figure shows two layers of steel at the surface, followed by a layer of Masonite. There are seven layers of steel plate; the first six layers consist of two 1.9-in.-thick steel plates, while the layer closest to the thermal shield is a single 2.5-in.-thick plate. The six layers of Masonite are each 4.5 in. thick. The massive concrete foundation that the reactor rests on is also considered part of the biological shield. The roof of the facility is shielded by a 2.1- (84-in.)-thick heavy aggregate poured concrete shield.

- **Process tubes.** Process tubes contained the uranium fuel elements and provided channels for cooling water flow. The 105-DR Reactor used process tubes made of 1100 aluminum alloy.

- **Safety and control systems.** The reactor control system included the HCRs, VSRs, and ball 3x system. The HCRs moved into and out of passages in the graphite core. The HCRs were used for controlled startup transients and power level during equilibrium operation. The VSRs were located on top of the reactor. Electromagnets held the VSRs with just the tips in the top of the thermal shield. The ball 3x system served as a separate emergency shutdown system. The ball 3x system consisted of hoppers that were full of boron-steel balls that would automatically drain into channels if the VSRs did not terminate the chain reaction after receiving a shutdown signal.

All penetrations through the block outer shielding (e.g., the process tubes, HCR/VSR/ball 3x channels, and instrumentation/experimental channels) were provided with cover gas seal designed tubes/sleeves/thimbles to maintain cover gas containment.

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. The process used at the 105-DR Reactor was assumed to be similar to the process used at the 105-KE/105-KW Reactors. The procedures used at the 105-KE and 105-KW Reactors can be found in the reactor deactivation manuals (BHI 1998a, 1998b). Examples of the activities performed include the following: process tube caps were installed, cover gas lines were drained, drain valves were closed, and all water lines were drained.

2.2.2.2 190-DR Pumphouse. The 190-DR Pumphouse supplied treated water to the reactor for cooling and to other equipment requiring cooling water. The building is energized and is currently used for warehouse purposes, and includes a radioactive materials area (RMA) used to store plastic-wrapped tools used in D&D. The building, approximately 420 ft by 120 ft, is a single-story, steel frame building on a concrete foundation with concrete floors, pressed steel and transite siding, and concrete roof with tar and gravel surfacing.

2.2.3 100-F Area Facilities

The location of this facility within the 100-F Area is shown in Figure 2-9. BHI-00981 (BHI 2002a) provides a summary description of the 105-F Reactor Building. BHI (2002e) includes the number, name, purpose, and current status (e.g., active, deactivated, or demolished) of each of the structures. Also provided, if applicable, is the name of the managing contractor, agreements established by the MOU between BHI and FDH, and information regarding hazard identification/evaluation documentation. The table puts the building/structure function and interfaces in perspective to the hazards identification (see Appendix A). The table is not inclusive of waste site designations of demolished structures that are addressed under the BHI RARA Program. Each BHI-managed above-grade facility within the scope of the ASA is described in the following subsections.

2.2.3.1 105-F Reactor Building. As a result of D&D activities, the reactor building, designated as the 105-F Building, consists only of a reactor block and adjacent work areas. The original FSB, the inner and outer HCR rooms; fans and ducts for ventilation and recirculating inert gas systems; water cooling systems; and supporting offices, shops, and laboratories were all demolished and removed during the D&D efforts associated with the ISS Project. Module 2, as highlighted in Figure 2-3, is all that remains (above ground) of the facility.

The 105-F Building is a reinforced concrete and concrete block structure with steel framing with corrugated asbestos cement (transite) covering major portions of the building exterior. The lower levels of the building and the central portion surrounding the reactor block are constructed of reinforced concrete walls 0.9 m to 1.5 m thick. A steel roof tops the structure.

The original footprint area of the 105-F Building was 4,994 m^2 (53,750 ft^2). The final footprint resulting from ISS activities is 999 m^2 (10,750 ft^2). Thus, the footprint area of the 105-F Reactor was reduced by 80%. The footprint area includes only the areas at-grade and excludes any square footage below ground level or above grade level.

2.2.3.1.1 Module 2. Module 2 is the area inside the shield walls, including the reactor block. Areas and rooms within module 2 include the inner rod room, front face work area, ball 3x system, laboratories, and other support areas. Figure 2-3 provides a plan view of module 2.

Reactor block. The reactor block is located near the center of the building. The reactor block consists of a graphite moderator stack (36 ft high by 36 ft wide by 28 ft deep) encased in a cast iron thermal shield (8 to 10 in. thick) and a biological shield consisting of alternating layers of steel and Masonite (52 in. thick). The entire block rests on a massive concrete foundation. The block weighs approximately 8,930 tons. Figure 2-5 shows the typical reactor block construction.

- **Graphite moderator stack.** The graphite moderator stack is composed of 4-ft-long interlocking graphite blocks, which are stacked to provide a central region for fuel loading and an outer region for a neutron reflector. The 105-F Reactor contains 2,004 process tube openings. The reactor also has openings for HCRs, VSRs, test facilities, and instrumentation. The HCR penetrations are on the left side of the reactor block (when facing the reactor front face), and the VSR penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor block. Experimental test penetrations are located on the right side of the reactor block.

- **Thermal shield.** The cast iron thermal shield surrounding the graphite stack isolates the biological shield from the core. The 105-F Reactor thermal shield is constructed of overlapping sheets, and the shield varies in thickness from 8 to 10 in. on the sides, top, bottom, front, and rear. Stainless-steel 3/4-in. schedule-40 tubes were imbedded in the thermal shield and provided cooling water to the shields. Gunbarrels, steel tube connections to the process tubes for the cooling water and instrumentation, also ran through the thermal shield.

- **Biological shield.** The biological shield of 105-F Reactor consists of alternating laminated layers of steel and Masonite. A breakdown of the lamination pattern for the biological shield is provided in Figure 2-6. The figure shows two layers of steel at the surface, followed by a layer of Masonite. There are seven layers of steel plate; the first six layers consist of two 1.9-in.-thick steel plates, while the layer closest to the thermal shield is a single 2.5-in.-thick plate. The six layers of Masonite are each 4.5 in. thick. The massive concrete foundation that the reactor rests on is also considered part of the biological shield. The roof of the facility is shielded by a 2.1- (84-in.)-thick heavy aggregate poured concrete shield.

- **Process tubes.** Process tubes contained the uranium fuel elements and provided channels for cooling water flow. The 105-F Reactor used process tubes made of 1100 aluminum alloy.

- **Safety and control systems.** The reactor control system included the HCRs, VSRs, and ball 3x system. The HCRs moved into and out of passages in the graphite core. The HCRs were used for controlled startup transients and power level during equilibrium operation. The VSRs were located on top of the reactor. Electromagnets held the VSRs with just the tips in the top of the thermal shield. The ball 3x system served as a separate emergency shutdown system. The ball 3x system consisted of hoppers that were full of boron-steel balls that would automatically drain into channels if the VSRs did not terminate the chain reaction after receiving a shutdown signal.

All penetrations through the block outer shielding (e.g., the process tubes, HCR/VSR/ball 3x channels, and instrumentation/experimental channels) were provided with cover gas seal designed tubes/sleeves/thimbles to maintain cover gas containment.

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. The process used at the 105-F Reactor was assumed to be similar to the process used at the 105-KE/105-KW Reactors. The procedures used at the 105-KE and 105-KW Reactors can be found in the reactor deactivation manuals (BHI 1998a, 1998b). Examples of the activities performed include the following: process tube caps were installed, cover gas lines were drained, drain valves were closed, and all water lines were drained.

2.2.4 100-K Area Facilities

The facilities located within the 100-K Area that are included are numerically designated as 105-KE (excluding process water tunnels), 105-KW (including process water tunnels), 182-K, 183-K, 1720-K, 110-KE, 115-KE, 116-KE, 117-KE, 118-KE-2, 150-KE, 166-KE, 110-KW, 115-KW, 116-KW, 117-KW, 118-KW-2, 119-KW, 150-KW, 165-KW, 166-KW, 181-KW, 183-KW, and 190-KW. The location of all above-grade facilities within the 100-K Area are shown in Figure 2-10. BHI-00981, Rev. 4 (BHI 2002a) provides a summary description of these facilities and additional ancillary facilities associated with the 105-KE and/or 105-KW Reactor Buildings. BHI (2002a) includes the number, name, purpose, and current status (e.g., active, deactivated, or demolished) of each of the structures. Also provided, if applicable, is the name of the managing contractor, agreements established by the MOU between BHI and FDH, and information regarding hazard identification/evaluation documentation. BHI (2002a) puts the building/structure functions and interfaces in perspective to the hazards identification (see Appendix A) and is not inclusive of waste site designations of demolished structures that are addressed under the BHI RARA Program. Each of the BHI-managed above-grade facilities within the scope of the ASA is described below.

2.2.4.1 105-KE and 105-KW Reactor Buildings. The 105-KE and 105-KW Reactor Buildings were third-generation design plutonium production reactors. The reactors are larger in size than the six older reactors and had about twice the production capacity. An expanded special irradiations test loop and corrosion study facility were incorporated into the design of the 105-KE and 105-KW Reactors.

The 105-KE/105-KW Reactor Buildings provided housing for the nuclear reactor and equipment directly associated with reactor operations. Construction of the 105-KE Reactor Building began in 1953, with the initial startup of the reactor occurring on April 17, 1955. The final shutdown of the reactor occurred on January 28, 1971. Construction of the 105-KW Reactor Building began in 1952, with the initial startup of the reactor occurring on January 4, 1955. The final shutdown of the reactor occurred on February 1, 1970.

The buildings are concrete and structural steel multistory structures (275 ft by 213 ft by 120 ft high; 58,675 ft^2 total area) having reinforced-concrete or transite siding and reinforced concrete or corrugated transite paneled roofs with built-up asphalt and gravel surfacing. The buildings contain a reactor block; FSB; fuel examination facility adjacent to the FSB; inner and outer HCR rooms; front-face work area; fans and ducts for ventilation and recirculating inert gas systems; water cooling systems; and supporting offices, shops, and laboratories. Figures 2-11 and 2-12 show the ground-level layout of the 105-KE and 105-KW Reactor Buildings, respectively. Note that the layouts delineate those areas of the facilities that are the responsibility of BHI from those areas that are the responsibility of the SFP as specified in the MOU. Figure 2-13 shows a cut-away view of a typical newer reactor building. These figures are general in nature and do not include all of the areas that are included in this description. The ventilation system was designed such that air flowed from office and service areas to potentially contaminated areas. The air was exhausted from the buildings through a high-efficiency filter system (located in the 117-KE and 117-KW Exhaust Air Filter Buildings) to the atmosphere through the 116-KE and 116-KW Reactor Exhaust Stacks. The original reactor building ventilation systems are not in operation; however, the SFP maintains heating, ventilation, and air conditioning systems for those areas of the buildings within their responsibility. These systems are described in *K Basins Safety Analysis Report* (DESH 1998).

The reactor buildings can essentially be divided into three areas: (1) those areas within the massive, reinforced-concrete shield walls of the buildings surrounding the reactor process areas (e.g., inner rod room, ball 3x recovery room, and front-face work area) including the reactor block, which is composed of the graphite moderator stack, thermal and biological shields, process tubes, and the safety and control systems; (2) the FSB area; and (3) the general ancillary areas of the reactor buildings (excluding the FSB) located outside the shield walls (e.g., supply fan area, general office areas, and lunchroom). These three areas are designated as module 2, the FSB, and module 1, respectively. The 105-KE Reactor Building contains approximately 58,000 Ci of radionuclides (as of March 1, 1985, according to UNC 1987), 187 tons of lead (WHC 1993a), and 926 yd^3 of asbestos (WHC 1993a), while the 105-KW Reactor Building contains approximately 51,000 Ci of radionuclides (as of March 1, 1985, according to UNC 1987), 173.3 tons of lead (WHC 1993a), and an unknown quantity of asbestos (WHC 1993a). Sections of each of the buildings are energized.

2.2.4.1.1 Module 1. Module 1 provided ancillary support areas during former reactor operations. The prior support areas included office areas, the reactor control room, tool storage rooms, restrooms, cooling water influent areas, change rooms, ventilation equipment areas, electrical systems areas, and other infrastructure support. Figures 2-11 and 2-12 provide a plan view of module 1.

The 105-KE and 105-KW lift stations are not considered within the scope of this ASA because they are still used by the SFP for K Basin operations.

2.2.4.1.2 Module 2. Module 2 is the area inside the shield walls, including the reactor block. Areas and rooms within module 2 include the inner and outer rod rooms, front-face work area, ball 3x system, laboratories, and other support areas. Figures 2-11 and 2-12 provide a plan view of module 2.

Reactor block. The reactor block is located near the center of the building. The reactor block consists of a graphite moderator stack (41 ft wide by 41 ft high by 33.5 ft deep) encased in a cast iron thermal shield (10 in. thick) and a biological shield consisting of high-density aggregate concrete (45 to 83 in. thick). The entire block rests on a massive concrete foundation. The reactor block weighs approximately 12,100 tons (including the base). Except for the biological shield section, the typical reactor block construction shown in Figure 2-5 is generally applicable to the 105-KE and 105-KW Reactors. The biological shield at the 105-KE and 105-KW Reactors is constructed of heavy aggregate concrete rather than a steel/Masonite laminate. Additional differences are noted on the figure.

- **Graphite moderator stack.** The graphite moderator stack is composed of 4-ft-long interlocking graphite blocks, which are stacked to provide a central region for fuel loading and an outer region for a neutron reflector. The 105-KE and 105-KW Reactors each contain 3,220 process tube openings. Each reactor also has openings for HCRs, VSRs, test facilities, and instrumentation. The HCR penetrations are on the left side of the reactor block (when facing the reactor front face), and the VSR penetrations are on the top of the reactor. Fuel discharge and storage areas are located adjacent to the rear face of the reactor block. The 105-KE and 105-KW Reactors contain a variety of in-reactor experimental facilities, including side to side test holes, front-to-rear test holes, and normal process tube channels.

- **Thermal shield.** The cast iron thermal shield surrounding the graphite stack isolates the biological shield from the core. The 105-KE and 105-KW Reactor thermal shields are constructed of overlapping sheets, and the shield is 10-in. thick on the sides, top, bottom, front, and rear. Stainless-steel 3/4-in. schedule-40 tubes were imbedded in the thermal shield and provided cooling water to the shields. Gunbarrels, steel tube connections to the process tubes for the cooling water and instrumentation, also ran through the thermal shield.

- **Biological shield.** The biological shields of the 105-KE and 105-KW Reactors are constructed of heavy-aggregate concrete (45 to 83 in. thick). The massive concrete foundation that the reactor rests on is also considered part of the biological shield.

- **Process tubes.** Process tubes contained the uranium fuel elements and provided channels for cooling water flow. The 105-KE and 105-KW Reactors used process tubes made of either Zircaloy-2 or aluminum.

- **Safety and control systems.** The reactor control system included the HCRs, VSRs, and ball 3x system. The HCRs moved into and out of passages in the graphite core. The HCRs were used for controlled startup transients and power level during equilibrium operation. The VSRs were located on top of the reactor. The VSRs at the 105-KE and 105-KW Reactors are contained in a cylinder with a piston at the top of each rod. The VSR mechanism was air operated. The ball 3x system served as a separate emergency shutdown system. The ball 3x system consisted of hoppers that were full of boron-steel balls that would automatically drain into channels if the VSRs did not terminate the chain reaction after receiving a shutdown signal. The 105-KE and 105-KW Reactor foundations contain a ball 3x recovery room and tunnel used for the retrieval of the boron-steel balls. The room and tunnel locations are shown in Figures 2-14 and 2-15.

All penetrations through the block outer shielding (e.g., the process tubes, HCR/VSR/ball 3x channels, and instrumentation/experimental channels) were provided with cover gas seal designed tubes/sleeves/thimbles to maintain cover gas containment.

During final shutdown of the reactor, a number of procedures were performed to contain contamination within the reactor block. These procedures can be found in the reactor deactivation manuals (BHI 1998a, 1998b). Examples of the activities performed include the following: process tube caps were installed, cover gas lines were drained, drain valves were closed, and all water lines were drained.

2.2.4.1.3 Fuel Storage Basin. The FSB at each reactor served as a collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. It consists of a fuel element pickup area, the storage area, and the transfer area. Irradiated fuel elements were stacked in buckets in the pickup area, transported by monorail to the storage area, and temporarily stored to allow decay of short-lived radionuclides before reprocessing. The basins are 22 ft deep and have a total area of approximately 10,000 ft^2. Figures 2-11 and 2-12 show the layout of the FSBs.

The 105-KE and 105-KW FSBs are active portions of the facilities that are used by the SFP for N Reactor irradiated/nonirradiated fuel storage. The 105-KE FSB stores approximately 1,265 tons of fuel, while the 105-KW FSB stores 1,056 tons. The FSBs are outside the scope of this ASA and are covered by the *K Basins Safety Analysis Report* (DESH 1998). Facility access and control requirements for those facilities having shared responsibility are defined in the MOU (BHI 1996b).

2.2.4.1.4 105-KE/KW Process Water Tunnels. The tunnels were used as an electrical cableway and pipe chase for the intake water lines required for the 105-KE and 105-KW Reactor Buildings cooling systems. The systems are currently used to provide water and power to the 105-KE and 105-KW Reactor Building FSBs.

Each of the water tunnels are two parallel, below-grade, reinforced-concrete, box-shaped structures, each approximately 8 ft by 16 ft, that run between the 190-KE (responsibility of SFP) and 190-KW Process Water Pumphouses and the 105-KE and 105-KW Reactor Buildings. The 105-KE Process Water Tunnels are under FDH management and are not included in this analysis. Nonetheless, the tunnels have no radiation levels above normal background. There are minor amounts of hazardous materials present in the tunnels (e.g., lead bricks or asbestos). Both of the tunnels are energized.

2.2.4.2 182-K Emergency Water Reservoir Pumphouse. The 182-K Emergency Water Reservoir Pumphouse houses diesel engine-driven pumps and associated equipment used for emergency reactor cooling. Water could be pumped from either the 105-KE or 105-KW clearwells to either the 105-KE or 105-KW Reactor Buildings if emergency cooling was required.

The building is a steel-framed structure with reinforced-concrete floors and foundation and an insulated metal roof with a tar and gravel surface. It has approximately 2,610 ft^2 of floor space.

The building is no longer in use, but remains energized. All of the fuel systems in the building interior have been drained and the underground diesel oil storage tanks located adjacent to the building have been removed. A tank in the building still contains 250 to 300 gal of lube oil.

2.2.4.3 183-K Pipe Tunnels. The 183-K Pipe Tunnels are below-grade tunnels housing the pipelines that carried effluent water from the 183-KE (responsibility of SFP) and 183-KW Filter Plants to the 190-KE and 190-KW Process Water Pumphouse Buildings. The tunnels are approximately 20 ft wide by 25 ft high. The tunnels contain a metal walkway and the piping associated with the water delivery system between the filter plants and the pumphouses. The tunnels are noncontaminated and are currently energized.

2.2.4.4 1720-K Administrative Office Building. The 1720-K Administrative Office Building originally provided facilities for the Hanford Security Patrol, duplicating, and mail operations. The building was subsequently used to provide office facilities for 100 Area decommissioning operations and engineering to support the decommissioning programs.

The single-story building is a concrete and steel-frame structure with dimensions of 74 ft by 50 ft by 13 ft. The building has a concrete foundation and floor, corrugated transite siding, and Cemesto board or concrete slab roof with built-up asphalt and gravel surfacing. The building adjoins the 1701-K Building and shares a common wall. The building currently is unoccupied, but still contains active telephone switchgear used for the 100-K Area.

2.2.4.5 110-KE and 110-KW Gas Storage Facilities. The facilities were the gas receiving and storage areas for the 115-KE and 115-KW Gas Recirculation Buildings reactor graphite media (cooling) gas. Both facilities had an outdoor gas unloading and storage area (served by a railroad spur) with equipment for transferring gas at high pressure and a "bunker" structure used to house high-pressure storage tanks. The outdoor storage area at both facilities consisted of four large-diameter tanks used for carbon dioxide storage. The "bunker" (a reinforced-concrete structure attached to the 115 buildings measuring approximately 54 ft by 24 ft) contained a number of high-pressure helium and nitrogen tanks.

The bunker and associated high-pressure storage tanks have been removed at the 110-KE Facility. All four carbon dioxide tanks and their supports remain in place, but the tanks are empty. The bunker structure remains in place at the 110-KW Facility and it contains a number of empty high-pressure tanks. Two of the four carbon dioxide tanks and their supports remain in the outdoor area, but all of the remaining tanks are empty.

2.2.4.6 115-KE and 115-KW Gas Recirculation Buildings. The 115-KE and 115-KW Gas Recirculation Buildings housed gas circulating pumps and associated equipment for the reactor gas coolant system. The buildings still contain gas dryer towers, heaters/coolers, condensers, filters, pumps, silica gel drying beds, heating and ventilation systems, piping, and ductwork.

The buildings are single-story reinforced-concrete structures having dimensions of 114 ft by 34 ft, with 20 ft below grade and 20 ft above grade. The buildings have a reinforced-concrete foundation and floor, and a corrugated transite slab roof with built-up asphalt and gravel.

The buildings are energized and the equipment remains in place. Because of suspected high contamination levels, the buildings are not routinely entered. Therefore, the present conditions inside the buildings are generally unknown.

2.2.4.7 116-KE and 116-KW Reactor Exhaust Stacks. The 116-KE and 116-KW Reactor Exhaust Stacks discharged ventilation air from the 105-KE and 105-KW Reactor Buildings, respectively, 300 ft above grade. All confinement zone exhaust air from the reactor buildings was filtered through the 117-KE and 117-KW Exhaust Air Filter Buildings and then released to the stacks via concrete ducts (tunnels). The confinement zone in the reactor buildings, defined as those ventilated spaces in the building adjacent to the reactor block, was maintained at pressures slightly less than atmospheric to control the spread of contamination. The ventilation systems have been deactivated. In 1982 the stacks were decontaminated to a level less than detectable by portable survey instruments, and the height of each was reduced from 300 to 175 ft. The clean rubble was placed inside the remaining portion of the stacks.

The stacks are monolithic, reinforced-concrete structures that are 175 ft above grade, 10 ft below grade, and have an outside diameter of 16 ft at the base. In general, the wall thickness is 1.5 ft at the base and 1 ft at the top. An opening at the bottom, with a steel door cover, provides access to the interior of the stacks. Each stack is supported by an octagonal-shaped solid concrete base, which is in turn supported by an octagonal-shaped foundation. The bases measure 18 ft side-to-side and are 11.5 ft thick, while the foundations measure 27 ft side-to-side and are 6 ft thick. The stacks are isolated from sources of potential contamination within the reactor building and have no electrical service.

2.2.4.8 117-KE and 117-KW Exhaust Air Filter Buildings. The 117-KE and 117-KW Exhaust Air Filter Buildings filtered ventilation air exhausted from the confinement zone of the 105-KE and 105-KW Reactor Buildings, respectively, before discharge to the atmosphere through the 116-KE and 116-KW Reactor Exhaust Stacks, respectively. The buildings have been deactivated.

The buildings are reinforced concrete structures having dimensions of 59 ft by 39 ft by 35 ft, with only 8 ft being above grade. They contained the reactor building exhaust air filters and airflow control system. Reactor building exhaust gases were directed to the exhaust filters where the air passed through fiber (particulate) and activated charcoal filters before being discharged to the atmosphere via the exhaust stacks. Air flow between the three structures (105, 117, and 116) occurred via underground concrete tunnels.

Each building contains two identical filter cells separated by a two-story operating gallery. The buildings are almost entirely below grade with an earthen berm mounded up the side walls and gunite applied to reduce erosion of the berm. The buildings have reinforced-concrete walls and steel-framed roofs with large, steel hatch covers that provide building access. A sump pump is located at the lowest point of each building. An in-line axial vane fan, contained in a small concrete cell adjacent to the filter buildings, provided ventilation in the buildings during maintenance activities. The main ventilation ducts (tunnels) are approximately 5 ft wide by 11.5 ft high.

The inlet and exhaust ducts have large turning vanes to deflect air into or out of the filter cells. Piping in the buildings includes a minimum amount of small-diameter pipes for service water, compressed air, and instrument lines. A small amount of electrical wiring and switchgear was required for lighting and electrical power service. Concrete covers are provided for each filter frame location. The interior surfaces of the buildings were coated with polyvinyl (Ply-On) to seal cracks to facilitate decontamination. The buildings are energized, but the current interior conditions are generally unknown because the buildings are not entered during routine S&M activities.

2.2.4.9 118-KE-2 and 118-KW-2 HCR Storage Caves. The 118-KE-2 and 118-KW-2 HCR storage caves were used for the temporary storage of radioactive HCR tips to allow for radioactive decay pending subsequent disposal. The structures are reinforced-concrete bunkers that measure approximately 70 ft by 6 ft by 3 ft. The bunkers are covered with an overlay of 3 to 4 ft of dirt and gravel. The bunkers have triangle-shaped cement ends that are 7 ft high.

The north cave of 118-KE-2 is empty and the south cave contains one HCR tip. Four HCR tips are contained within 118-KW-2. The specific location of the HCR tips in 118-KW-2 (i.e., north or south cave) is unknown. All caves are locked and have no electrical service.

2.2.4.10 119-KW Exhaust Air Sample Building. The 119-KW Exhaust Air Sample Building housed instrumentation used to continuously monitor 105-KW Reactor Building exhaust air for radionuclides. The small, pre-fabricated metal building (approximately 15 by 24 ft) is on a concrete slab floor/foundation (at grade). The building is located over the ventilation exhaust ducts leading to the 117-KW Exhaust Air Filter Building.

The building is currently energized. The majority of the equipment has been removed. The building is essentially clean, with only the end of a small pipe tagged as contaminated.

2.2.4.11 150-KE and 150-KW Heat Recovery Stations. The 150-KE and 150-KW Heat Recovery Stations each consist of a small, pre-fabricated metal control building and an outdoor area that contained the motor, heat exchangers, and associated piping used to recover heat from the effluent discharge of the reactor buildings.

The heat exchangers recovered heat from the effluent discharge of the reactors through heating of ethylene glycol. The ethylene glycol was then circulated through the reactor buildings and other ancillary facilities to provide heat.

The heat exchangers have been removed, but the outdoor electric pumps and the control buildings remain. The control buildings, which have been de-energized, are located within contamination areas.

2.2.4.12 165-KW Power Control Building. The 165-KW Power Control Building provided housing for the powerhouse, control room, valve pit, and electrical switchgear for the water supply system.

The building is a single-story concrete structure (240 ft by 110 ft by 15 ft) with reinforced-concrete floors, walls, and a poured roof with built-up asphalt and gravel surfacing. The building is composed of three parts: (1) the pump room and valve pit with steel-grating floor providing work area; (2) the electrical area consisting of two concrete floors; and (3) the oil-fired steam plant and control room. There is an adjacent 230 kV switchyard (151-KW Facility) and subsurface oil storage bunkers/oil pump facilities (166-KW Oil Storage Facility). The building, which shares a common wall with the 190-KW Process Water Pumphouse, has approximately 57,700 ft^2 of space.

The building's electrical system is energized and is generally in good condition. The building contains no radioactive material and minor amounts of hazardous materials, including asbestos, mercury, ethylene glycol, and sodium hypochlorite. The majority of the building is not currently being used. The switchgear room of 165-KW is being used in support of the SFP K Basin operations and is not within the scope of this ASA.

2.2.4.13 166-KE and 166-KW Oil Storage Facilities. The 166-KE Oil Storage Facility was used to store oil for the 165-KE Power Control Building boilers from 1955 to 1971, and was subsequently used to store Bunker C fuel oil for the 100-N Area from 1981 to 1985. The 166-KW Oil Storage Facility was used to store Bunker C fuel oil.

The facilities both have two underground reinforced-concrete storage bunkers, each with dimensions of 116 ft by 44 ft by 21 ft. The useable capacity of the two bunkers is 900,000 gal. In addition, there are two day tanks and a pump room (which is a concrete structure) that was used to transfer fuel oil to the day tanks and recirculate the oil through heat exchangers using boiler steam for heat.

These bunkers have been drained and retired, but approximately 2,000 gal of oil remain in the form of a heel at each facility.

2.2.4.14 181-KW River Pumphouse. The 181-KW River Pumphouse, which has been deactivated, was used to transfer raw water from the Columbia River to the 183-KW Filter Plant. The facility is an open-air reinforced-concrete pad approximately 62 ft by 72 ft at ground level with subsurface pump wells. Electrically driven deep-well pumps are mounted on the concrete pad. The pumps were controlled remotely from the 165-KW Power Control Building. A small guard station, which is not in use, is mounted on top of the facility. There are no identified hazards associated with this facility. The facility is de-energized.

2.2.4.15 183-KW (Process Water) Filter Plant. The 183-KW Filter Plant provided water treatment for the 100-K Area by filtering and chemically treating Columbia River water.

The filter plant consists of a single-story, T-shaped structure referred to as the head house. The head house contains a laboratory and sample room, chlorinator room, switchgear room, and an operational area containing chemical feed equipment, storage tanks, water softeners, heat exchangers, pumps, and other miscellaneous equipment for the remote valving and flow control. The structure is 136 ft by 31 ft by 20 ft high, 70 ft by 60 ft by 20 ft, with a reinforced-concrete foundation and floor, structural steel frame walls and a transite siding, and transite roof with built-up asphalt and gravel surfacing.

The plant also contains a two-bay chlorine storage facility (95 by 35 ft) with a railroad spur to each bay, a flocculation and subsidence basin consisting of open-air reinforced-concrete basins, mixing chambers, and inlet and outlet flumes. The total area of this facility is approximately 288,000 ft^2. There is a filter area constructed of reinforced concrete containing approximately 65,000 ft^2 of filter area. After leaving the filters, the water flowed into two 9-million-gal underground storage tanks. The cover over the tanks is asphalt roofing built-up over a corrugated transite covering.

The building is energized, and the switchgear for the lighting circuits has been updated. The building contains no radioactive material and a minor amount of hazardous material (i.e., mercury in a switch).

The chlorine storage facility (designated as the 183.1 KW Chlorine Vault) is not addressed by this ASA. The facility it is used by the SFP to temporarily store spent ion exchange columns used by K Basins operations to remove cesium-137 from the water in the 105-KE and 105-KW FSBs.

2.2.4.16 190-KW Process Water Pumphouse. The 190-KW Process Water Pumphouse houses process and service water pumps and ventilation equipment. The facility supplied treated water to the 105-KW Reactor Building for cooling and to other equipment requiring cooling water.

The single-story building has a concrete basement, reinforced-concrete floors, and structural steel and corrugated transite walls. The roof is corrugated cement transite on steel girders with 2-in. foam glass insulation and asphalt gravel built-up surface. The building, which shares a common wall with the 165-KW Power Control Building, is approximately 26,000 ft^2.

The building is no longer used to supply treated water. Residual process chemicals have been removed, and the building is currently used to store some electrical/mechanical equipment. The south and east bays are used by the SFP for K Basins equipment staging and are not covered by this ASA. The building is currently energized.

2.3 PROJECT DESCRIPTION

The six inactive reactor buildings and the ancillary facilities included within the scope of this ASA are currently undergoing routine S&M. The objective of routine surveillance is to ensure that any unfavorable conditions or trends are recognized and evaluated such that appropriate corrective actions (i.e., maintenance) can be initiated. The following subsections describe the potential S&M activities.

2.3.1 Surveillance and Maintenance of Barriers and Postings

Barriers and postings are used to prevent unwarranted access to hazardous areas and to inform personnel of conditions that exist at the inactive reactor facilities. Examples include locks and tags, door locks, fencing, confined space postings, and radiological area postings. Inspection of barriers and postings is conducted as part of the routine surveillance of the facilities, as specified in BHI Field Support work instructions or task instructions (TIs). Any abnormal conditions regarding barriers or postings are to be noted on the associated task instruction data sheet (TIDS).

2.3.2 Identification and Removal of Asbestos

Surveillance activities include inspection for potential asbestos concerns. If damaged friable asbestos is found, the area is posted as a regulated area. Depending upon the scope and severity of the damage, repair, encapsulation, or removal is performed through the asbestos abatement program while observing appropriate radiological and industrial hygiene requirements.

2.3.3 Container Management

Surveillance activities include inspection of existing containers and notation of any unidentified or unlabeled containers. The contents of any unlabeled containers are identified and the containers are then labeled. Containers are removed and transported to a permitted storage facility for treatment, storage, and/or disposal. Periodic container inspections are performed to detect any container deterioration or leakage. If deterioration or leakage is identified, the container is repackaged and removed to an appropriate disposal facility.

2.3.4 Equipment Calibration, Testing, Maintenance, and Repair

Maintenance of the emergency lighting system, ventilation system, space heaters, and portable fire extinguishers at the 105-B Reactor Building is the only routine maintenance currently required at the inactive reactors. Routine maintenance, repair, or disconnections may be performed on the electrical supply to the reactor buildings and ancillary facilities. In addition, routine work activities may include skill-of-the-craft work, such as relamping. Elements and schedules for these activities are included in procedures and task instructions. If equipment requiring calibration, testing, maintenance, or repair is installed under appropriate change control/authorization processes, then these activities would be authorized for the new equipment.

The SFP personnel are required to perform regular inspections of SFP-operated equipment located within the BHI lead contractor area of the 105-KE and 105-KW Reactor Buildings, 183-K Pipe Tunnels, and the 165-KW Power Control Building. BHI has agreed that SFP personnel may routinely enter these areas, subject to the conditions and requirements of the MOU.

2.3.5 Repair and Upgrades of Structural Components

Structural components necessary to ensure confinement will be repaired or upgraded as necessary, to maintain control of hazardous materials. Corrective action will be taken in accordance with the safety documentation/requirements governing each activity. Should such changes occur, they will be evaluated to determine if the assumptions used in the FHC of the reactors remain valid.

2.3.6 Inspection for and Response to Spills

The inactive reactors are routinely surveyed for indications of spills of hazardous materials. If a spill is discovered, the affected area will be isolated to prevent personnel exposure, corrective measures will be determined, and the spilled material will be packaged and removed to an appropriate disposal facility.

2.3.7 Removal/Disposal of Hazardous Materials

If required, hazardous materials within the inactive reactors will be properly packaged and removed to an appropriate facility. Any hazardous material removed from the inactive reactors may, after proper waste designation, be disposed of at an appropriate facility.

2.3.8 Nondestructive Assay, Waste Characterization, and Sampling

Nondestructive assay, waste characterization, and sampling may be performed in the inactive reactor facilities. The activities will be performed in accordance with established programs and procedures.

2.3.9 Removal of Nonprocess Equipment

Removal of nonprocess equipment may be performed in the inactive reactor facilities to reduce the risks from known hazards (e.g., removing abandoned conduits or removing deactivated electrical equipment) and to redeploy obsolete equipment as spare and replacement equipment (e.g., switchgear and motor control centers). These structures, systems, and components may contain surface contaminants. The removal process shall not disrupt, intrude, or otherwise alter piping or confinement structures. These activities will be performed in accordance with established programs and procedures.

2.3.10 Radiological Surveys

Radiological surveys will be performed in support of S&M activities. These surveys will be performed in accordance with established programs and procedures.

2.3.11 General Inspections and Tours

General inspections and tours may be performed separate from S&M activities. Inspections and tours will be conducted in accordance with appropriate programs and procedures.

2.4 SEGMENTATION

Each reactor building and its associated ancillary facilities were considered a discrete segment for the purpose of hazard classification determination.

2.5 DEMOGRAPHICS

This section describes demographics consistent with the potential risk of the facilities. The hazard analysis (Appendix A) concluded that the potential for significant consequences as a result of a postulated release of radioactive and/or hazardous materials is limited to the proximity of the reactor buildings. The Tri-Cities (Kennewick, Pasco, and Richland) comprise the nearest population center and are located southeast of the Hanford Site. Richland, the nearest of the three cities to the inactive reactors, is approximately 26.5 mi southeast of the 100-K Area, 27 mi from the 100-B/C Area, 19.8 mi from 100-F Area, and 28 mi from the 100-D/DR Area. According to a 1980 census, approximately 340,000 people lived within a 50-mi radius of the center of the Hanford Site. Approximately 15,000 persons were employed on the Hanford Site in late 1995.

2.5.1 Site Location

The inactive reactors and ancillary facilities are located within the Hanford Site, which occupies 560 mi^2 of land in southeastern Washington State (Figure 2-16). The Hanford Site is located within Benton, Franklin, and Grant Counties. The inactive reactor facilities are located within the 100 Areas in the northern section of the Hanford Site. The 100-B/C Area is the farthest upstream of the 100 Areas at river mile 384 and occupies about 650 ac. The 100-K Area occupies approximately 136 ac at river mile 381.5. The 100-D/DR Area occupies approximately 961 ac at river mile 377.5. The 100-F Area occupies 540 ac at river mile 369 and is located 3.5 mi (5.6 km) down river from the 100-H Area. The specific location of the reactor buildings and associated ancillary facilities within each of the four 100 Areas is provided in Figures 2-2, 2-8, 2-9, and 2-10.

2.5.2 Population Distribution

Because the potential for significant consequences is limited to the proximity of the reactor buildings, the affected population is the personnel in proximity to the reactor buildings. Personnel performing S&M are in proximity to the buildings periodically during these activities. Because the FSBs within the 105-KE and 105-KW Reactor Buildings are currently being used to store irradiated/nonirradiated fuel from N Reactor, non-ERC personnel are regularly present within and in proximity to these buildings.

2.6 SITE FEATURES

This section contains information on the meteorological and geological characteristics of the area. Appendix A evaluates the potential impact of natural phenomena to the inactive reactors and ancillary facilities.

2.6.1 Meteorology and Climate

The climate of the Hanford Site is mid-latitude semi-arid or mid-latitude desert. The summers are generally warm and dry, while the winters are cool with occasional precipitation. Temperature extremes at the Site have varied from -27°F to 115°F (PNNL 1994). Climatological data are available from the Hanford Meteorological Station (HMS), which is located on the 200 Area Plateau near the middle of the Site. Data have been collected at the HMS since 1945.

The average annual precipitation at the HMS is 6.3 in. The majority of the precipitation occurs during winter, with nearly half of the annual precipitation occurring from November through February. Days with greater than 0.51 in. of precipitation occur less than 1% of the year (DOE 1989). For the 100 Areas of concern, the low level of precipitation and resultant run-off do not pose serious hazards to the facilities. Water intrusion from rainfall and melting snow and/or ice occurs regularly within the inactive reactor facilities and has been determined not to result in significant migration of contamination to the environment. Section 4.2.1.1 evaluates the effects of water intrusion on the inactive reactors during S&M activities.

2.6.2 Prevailing Winds

The general surface airflow patterns in the vicinity are significantly influenced by the local topography. Winds at many locations in the western half of the Pasco Basin show a tendency to be aligned with the northwest-southeast-oriented ridgeline of the Rattlesnake Hills. Close to the hills, drainage flows periodically produce winds perpendicular to the ridgeline. At the northern and eastern borders of the Hanford Site, winds show a tendency to follow the Columbia Valley (east/west flow along the northern border and north/south flow along the eastern border) (DOE 1989).

The prevailing near-surface wind, 50 ft above ground at the HMS, has a strong northwest and west northwest component throughout the year. The average wind speed at this elevation is

7.7 mi/hr (PNNL 1994). Wind speeds well above average are usually associated with southwesterly winds. High winds occasionally generate dust storms and have a remote potential to generate airborne missiles (e.g., scrap wood and miscellaneous items). Events associated with high winds have a very limited potential to challenge the integrity of the confinement systems of the inactive reactors. Section 4.2.1.1 evaluates the impact of high winds on the inactive reactors during S&M activities.

2.6.3 Weather Phenomena

Tornadoes are infrequent and generally small in the northwestern section of the United States. A severe tornado (i.e., similar to those typically found in Midwestern states) is highly unlikely to occur under the Pacific Northwest climatological and orographic conditions. The likelihood of a tornado striking a point on the Hanford Site is estimated to be 9.6×10^{-6} per year (DOE 1989), approaching the limit of credibility. Section 4.2.1.1 evaluates the impact of a tornado on the inactive reactors.

Washington State has an annual mean of 10 thunderstorm days, which is considered relatively low (IEEE 1991). The likelihood of a direct lightning strike on one of the inactive reactor facilities is remote. The impact of a lightning strike on the inactive reactors is evaluated in Section 4.2.1.1.

2.6.4 Hydrologic Description

The inactive reactor facilities are situated within the Columbia River drainage basin. Two major rivers within the Columbia River drainage basin, the Columbia and the Yakima, border the Hanford Site.

The maximum historical flood recorded on the unregulated Columbia River occurred on June 7, 1894. The peak flow at the Hanford Site was about 742,000 ft^3/s, which is close to the best available estimate for the 100-year flood (i.e., the maximum flood event during a 100-year period is 750,000 ft^3/s for unregulated flow below Priest Rapids Dam). The largest recent flood, which occurred in 1948, had an observed peak flow of 692,000 ft^3/s at the Hanford Site. The Grand Coulee Dam and other dams upstream of the Hanford Site may reduce major flood flows at the Site by as much as 19% to 43%. Studies of the flooding potential of the Columbia River, based on historical data and on the water-storage capacity of dams on the Columbia River, have been used to determine the peak river flow and associated flood elevations for the dam-regulated standard project flood (SPF) and the dam-regulated probable maximum flood (PMF) (DOE 1989). As discussed in DOE (1989), the dam-regulated SPF, defined as having a recurrence interval of 500 to 1,000 years, would not affect any of the inactive reactor buildings. The elevation of the dam-regulated PMF would not reach the first floor of any of the reactor buildings discussed in this document. The presence of these dams results in a less-than-credible potential for a flooding scenario that could impact the 100 Areas. In accordance with Appendix B of DOE (1989), no further floodplain review is necessary under the provisions of 10 *Code of Federal Regulations* (CFR) 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," because (1) none of the 100 Area reactors are in the

500-year (critical) floodplain, (2) decommissioning will not impact the 500-year floodplain, and (3) decommissioning will not be impacted by the 500-year flood.

Additional flooding scenarios have been evaluated by the U.S. Army Corps of Engineers; specifically, a flood caused by a catastrophic 50% failure of the Grand Coulee Dam (DOE 1989, Appendix B). This event was estimated to result in a peak flow of approximately 8,000,000 ft^3 at the Hanford Site (DOE 1989). The elevation of this flood would reach above the first floor of all of the inactive reactors included within the scope of this ASA. Section 4.2.1.1 evaluates the impact of flooding/water intrusion on the inactive reactors during S&M activities.

2.6.5 Geology and Seismology

The Hanford Site lies within the Pasco Basin, part of the Columbia Plateau in southeastern Washington State (refer to Figure 2-16). The Hanford Site is bounded to the southwest, west, and north by large ridges that trend eastwardly and southeastwardly from the Cascade Mountains. The Site is bounded to the north and east by the Columbia River and the steep bluffs of the Ringold Formation. The dominant geological characteristics of the Columbia Plateau have resulted from flood basalt volcanism and deformation processes.

The Hanford Site is located in a Zone 2b area, as defined by the Uniform Building Code (UBC) (ICBO 1994), where moderate damage might occur from earthquakes. Earthquake records for the Pacific Northwest extend back to the 1850s, and a network of seismographs was installed on the Columbia Plateau in 1969 (DOE 1989). The distribution and intensity of historical earthquakes indicate that the Columbia Plateau is in an area of moderate seismicity. While seismic activity and related phenomena are not believed to be events that could credibly cause a direct release of waste from DOE facilities (DOE 1989), the effects of a seismic event acting upon the inactive reactors are evaluated in Section 4.2.1.1.

2.6.6 Ash and Snow

The stratigraphic record in the Pasco Basin suggests that the only primary product of Cascade Range volcanism that may be expected to reach the Pasco Basin during the next 10,000 years is ash falling from the air. During the May 18, 1980, eruption of Mount St. Helens, approximately 0.3 in. of ash was deposited at the HMS tower. The prevailing winds carried the majority of the ash cloud north of the Hanford Site.

The average annual snowfall at the Hanford Site is approximately 15 in., with a range of 0.3 to 56 in. (PNNL 1995). Snow loading for existing facilities is considered in the Hanford Site design criteria (WHC 1993b) and is specified as 20 lb/ft^2. Existing facilities that are designed for live or snow loading of 20 lb/ft^2 are considered adequate for the combination of live plus ashfall load requirements when factored for extreme environmental loads. Section 4.2.1.1 evaluates the impact of snow and/or ash loading on the inactive reactors during S&M activities.

2.6.7 Range Fire

Range fire represents a minor risk to the reactor buildings of concern. While the probability of a range fire is anticipated (probable), the lack of combustible building materials affords the primary protection from propagation. Additionally, a firebreak is maintained around the buildings in accordance with National Fire Protection Association (NFPA) 299 (NFPA 1997), which is implemented under the BHI Safety and Health Program and procedures.

2.6.8 Adjacent Facilities

The inactive reactors and ancillary facilities included within this ASA have numerous adjacent facilities/structures. The majority of these facilities/structures are retired and the only activities occurring are S&M. At the 100-D/DR Area, the inactive 105-D Reactor is undergoing interim stabilization activities. At the 105-KE and 105-KW Reactor Buildings, the FSB and transfer bay area of each building (refer to Figures 2-11 and 2-12 for a delineation of the reactor building areas) are currently being used by the SFP K Basin operations to store N Reactor fuel. In addition, the SFP is using numerous ancillary facilities within the 100-K Area, primarily water supply/treatment facilities, to support K Basin operations. Section 4.2.1.2 evaluates the impact of activities at adjacent facilities on the inventory of hazardous materials within the reactor buildings.

Figure 2-1. Hanford Site Map.

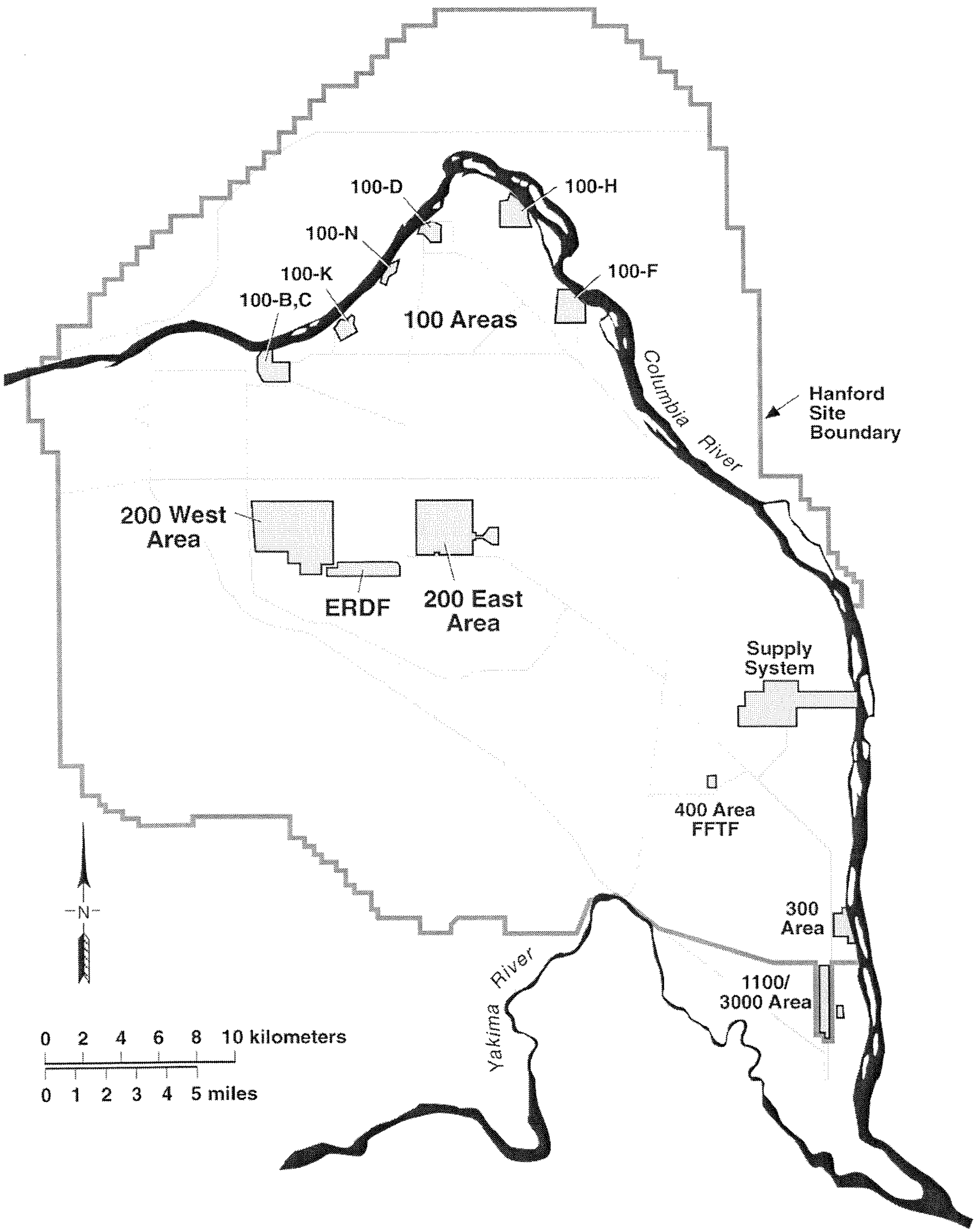


Figure 2-2. 100-B/C Area.

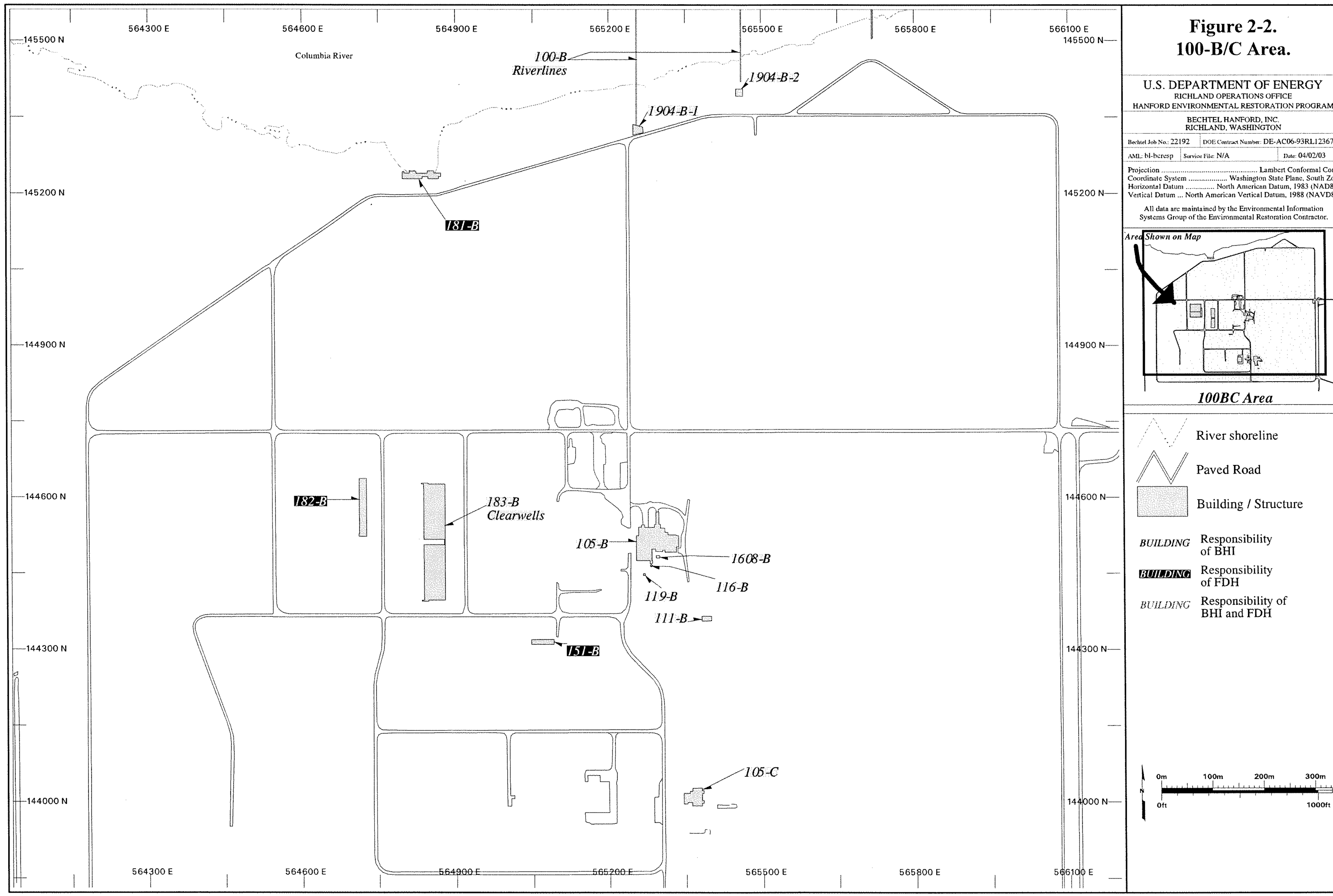


Figure 2-3. 105-B, 105-C, 105-DR, and 105-F, Reactor Building Plan View at Ground Level.

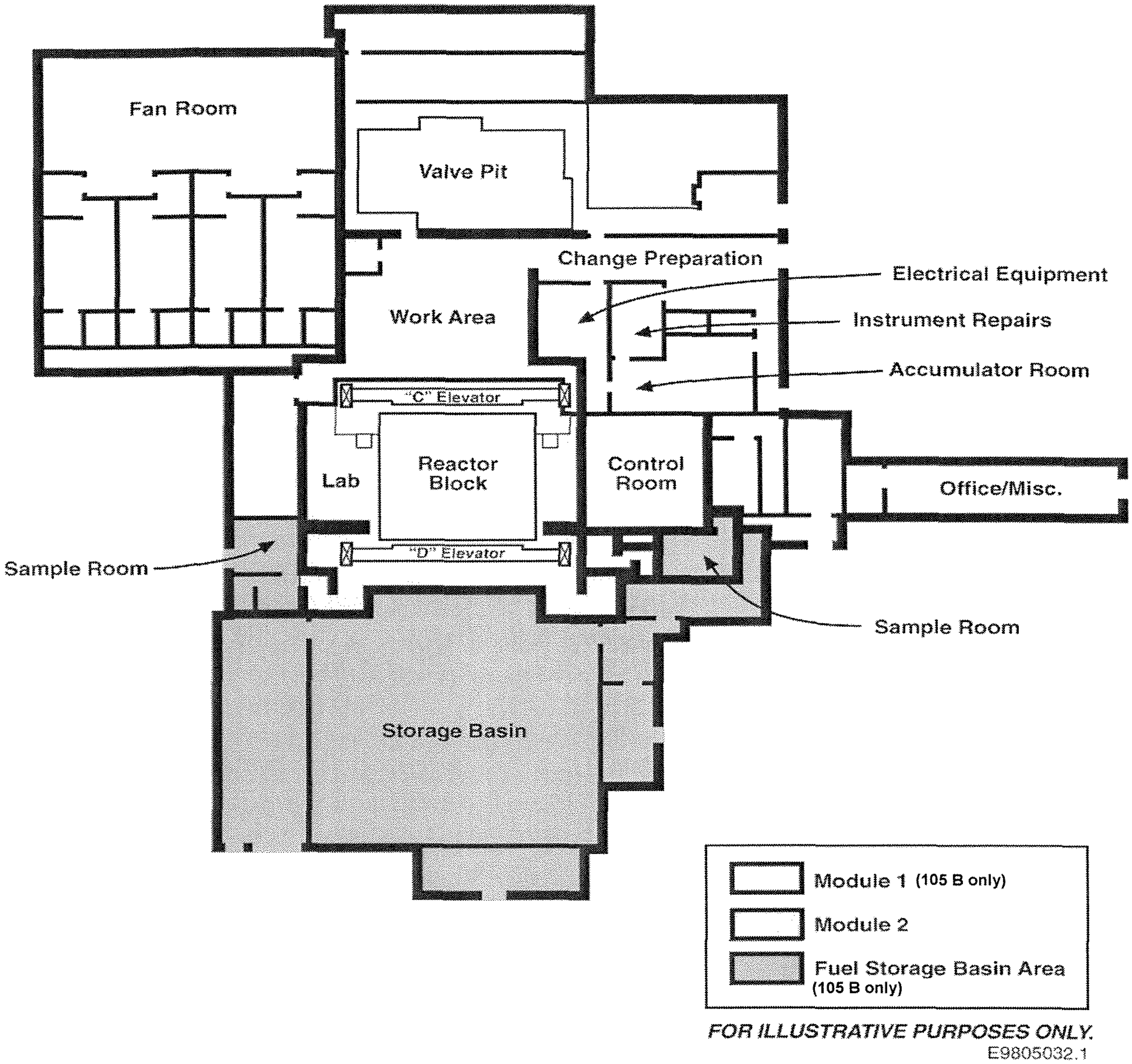


Figure 2-4. Typical Older Reactor Facility Cut-Away View.

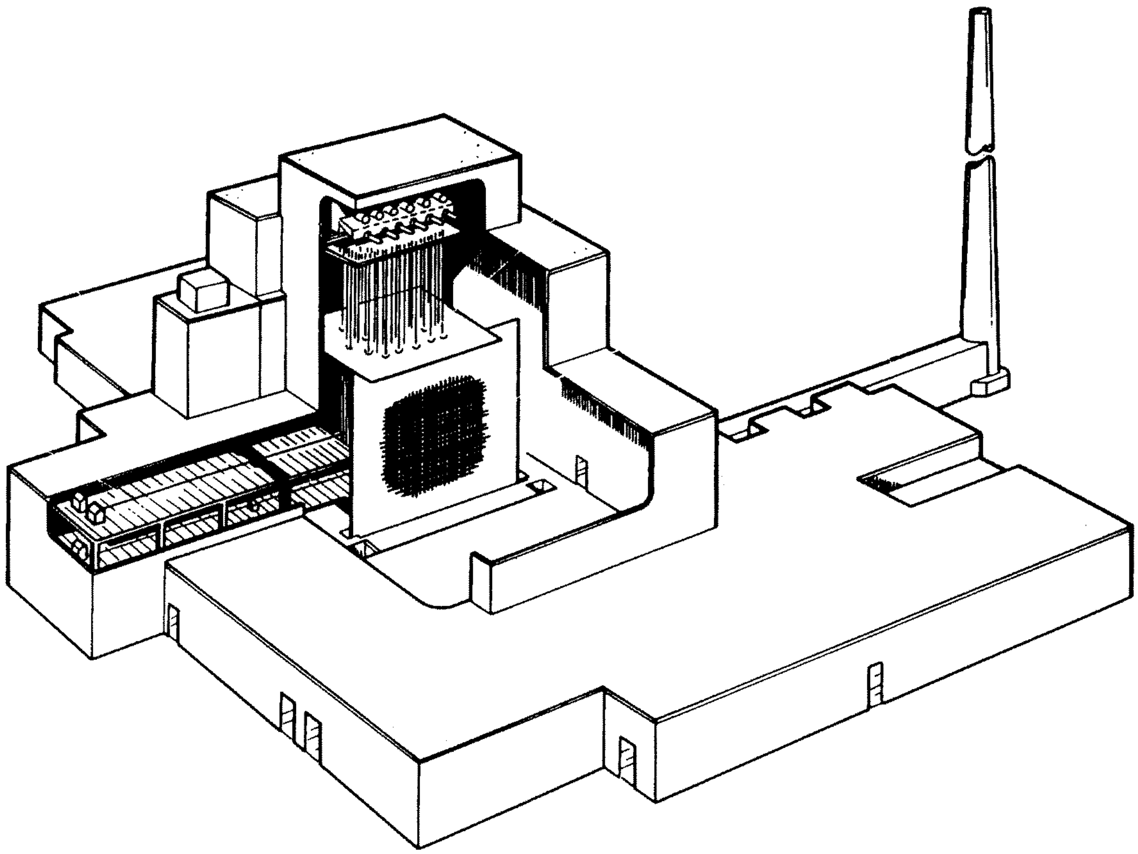
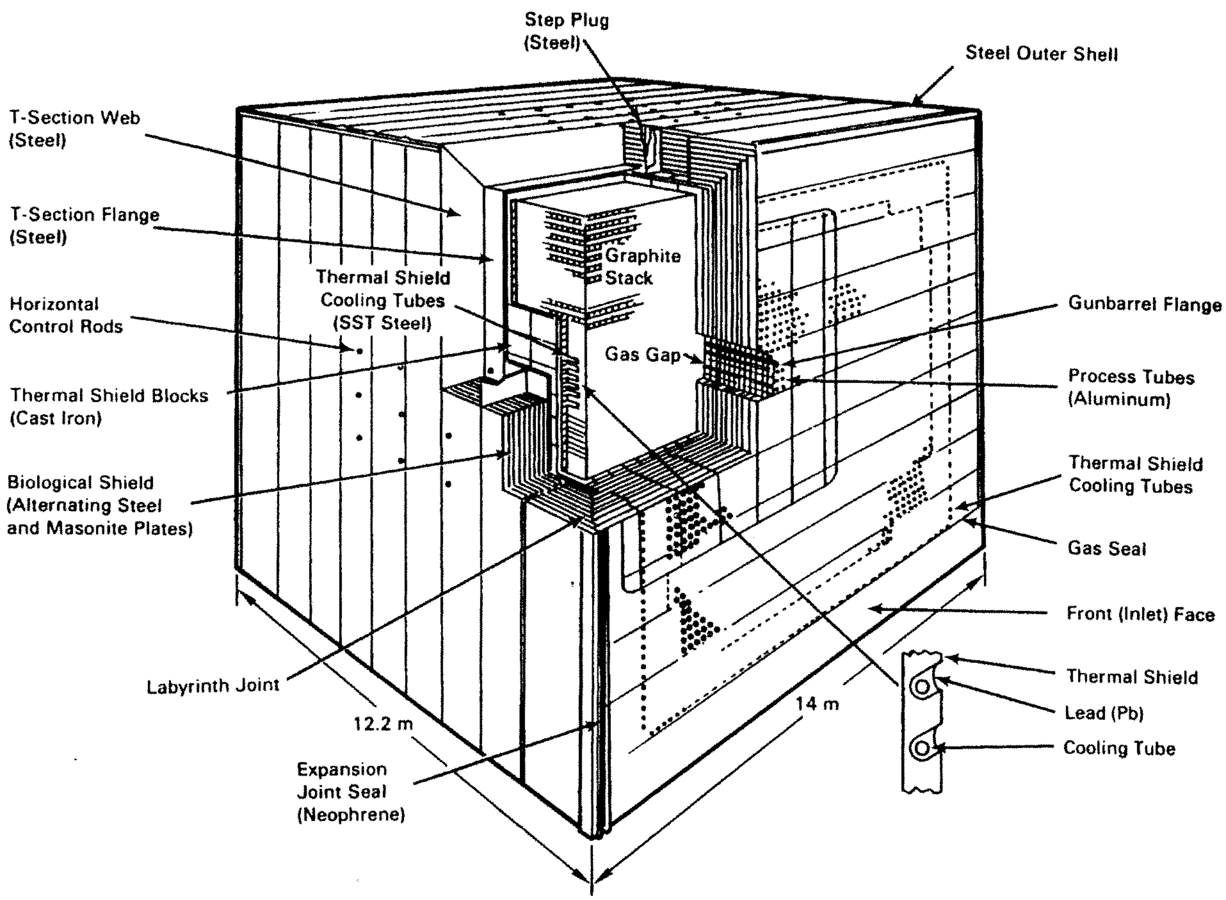


Figure 2-5. Reactor Block Construction (Typical).



105-KE and 105-KW Reactor Design Data
• Graphite stack dimensions 33.5 ft x 41 ft x 41 ft
• Mass of reactor block 12,100 tons
• Number of process tubes 3,200

105-B, C, and F Reactor Design Data
• Graphite stack dimensions 28 ft x 36 ft x 36 ft
• Mass of reactor block 8,930 tons
• Number of process tubes 2,004

NOTE: This figure is representative of the 105-KE and 105-KW Reactor blocks with the following exceptions: (1) biological shield constructed of heavy-aggregate concrete rather than steel/masonite laminate, (2) the size of K Reactor blocks are larger, and (3) the K Reactors had Zircaloy-2 process tubes in addition to aluminum.

Figure 2-6. Biological and Thermal Shield Detail View.

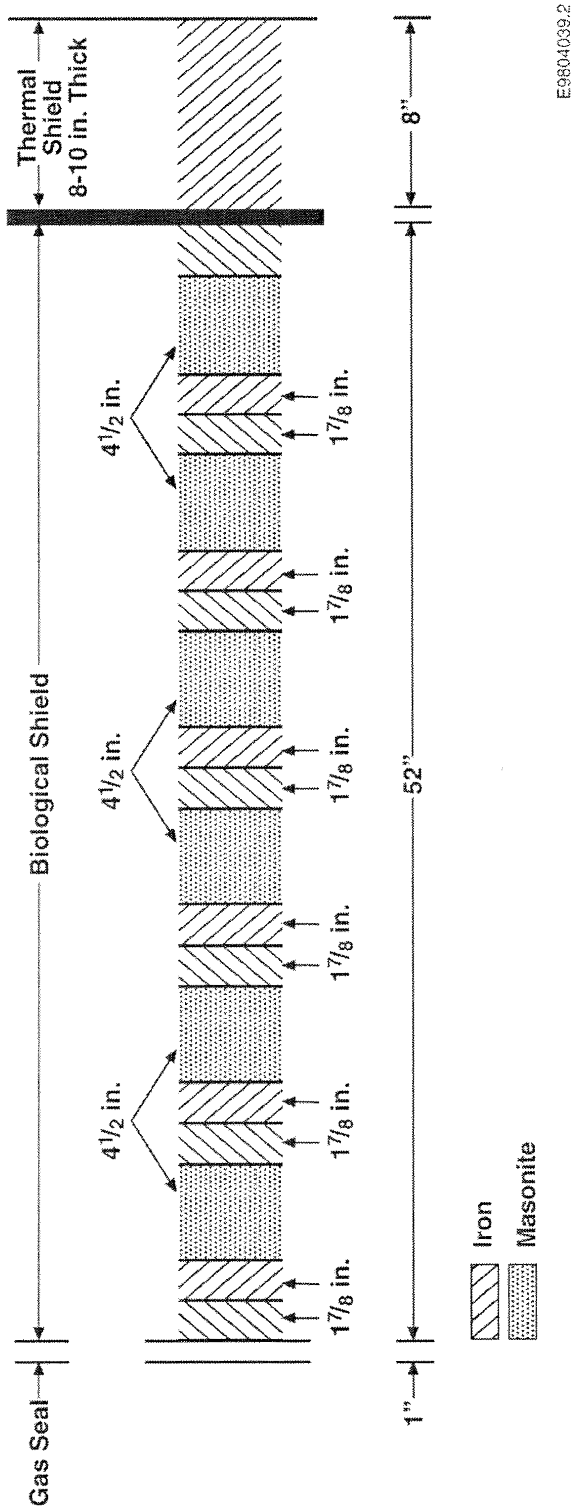


Figure 2-7. Fuel Storage Basin Area Layout (Typical).

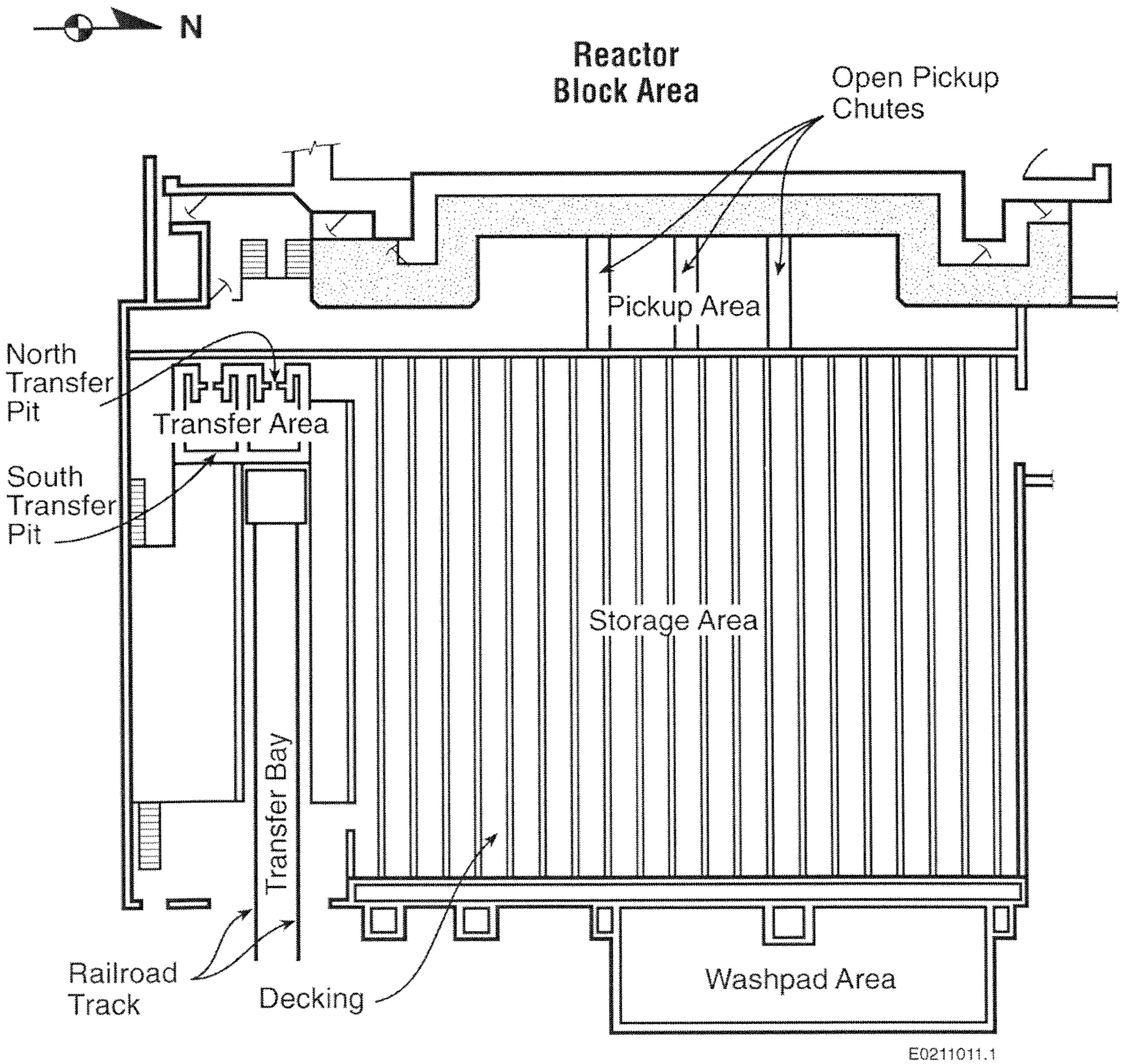


Figure 2-8. 100-D/DR Area.

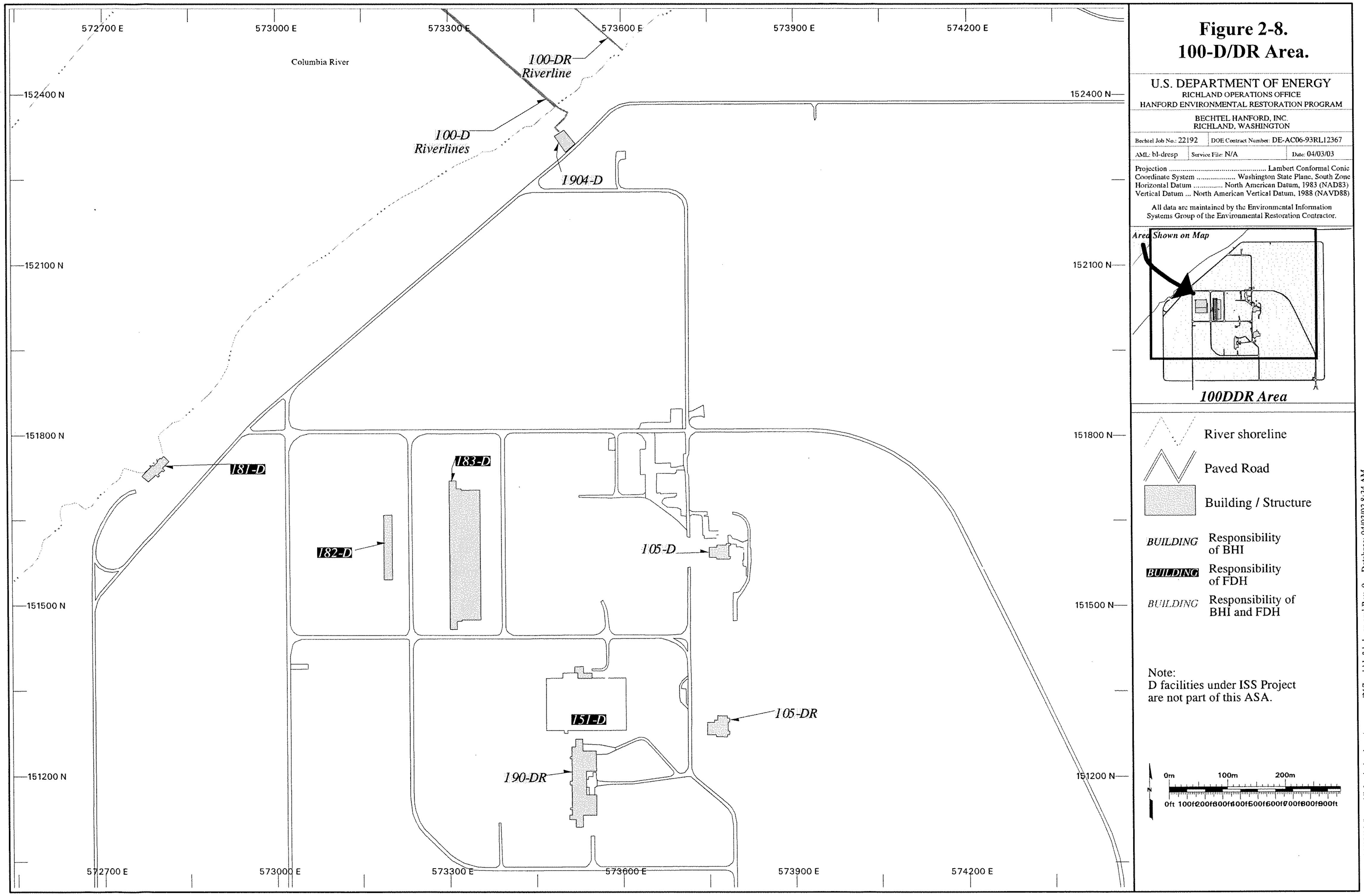


Figure 2-9. 100-F Area.

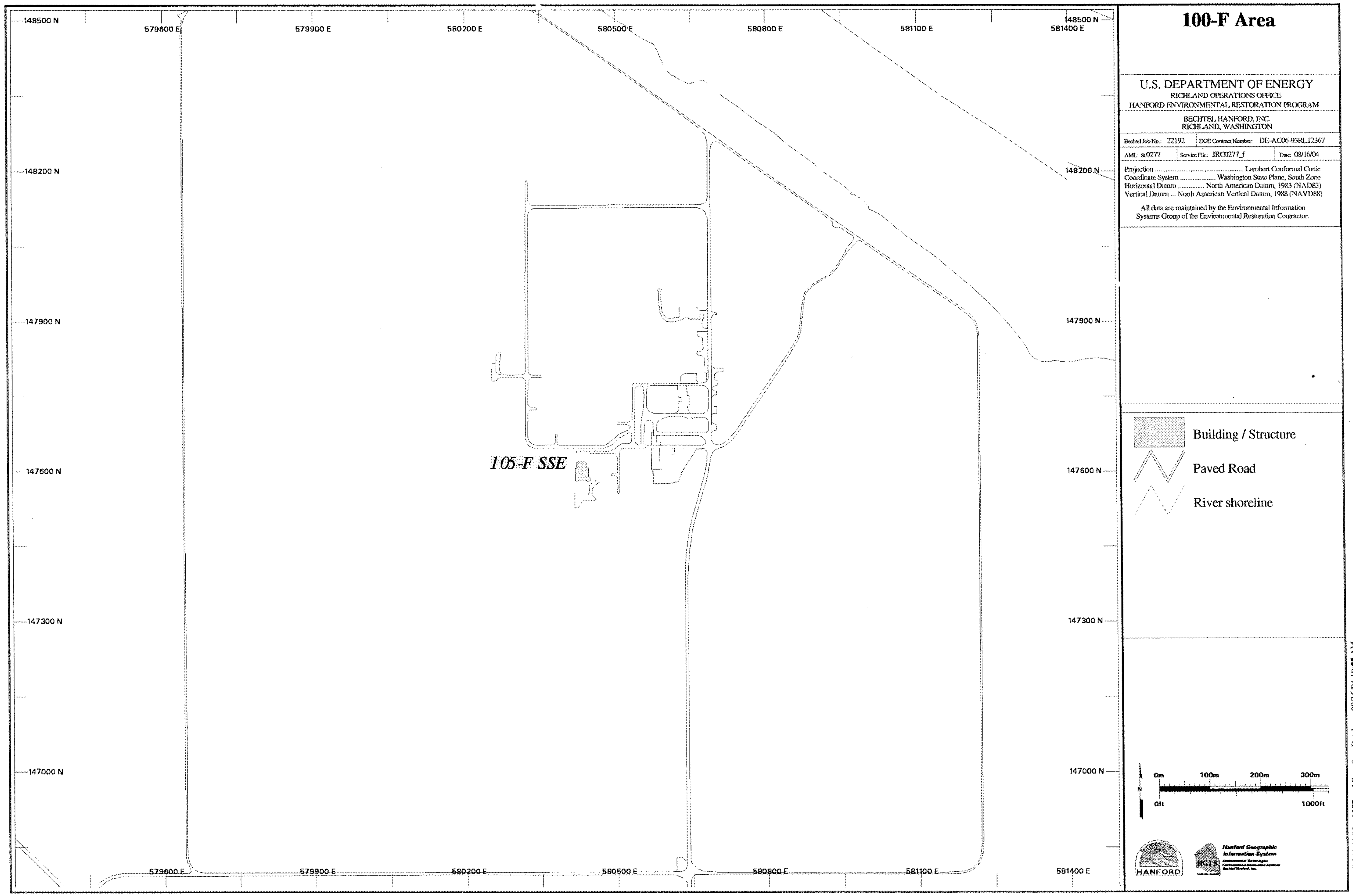
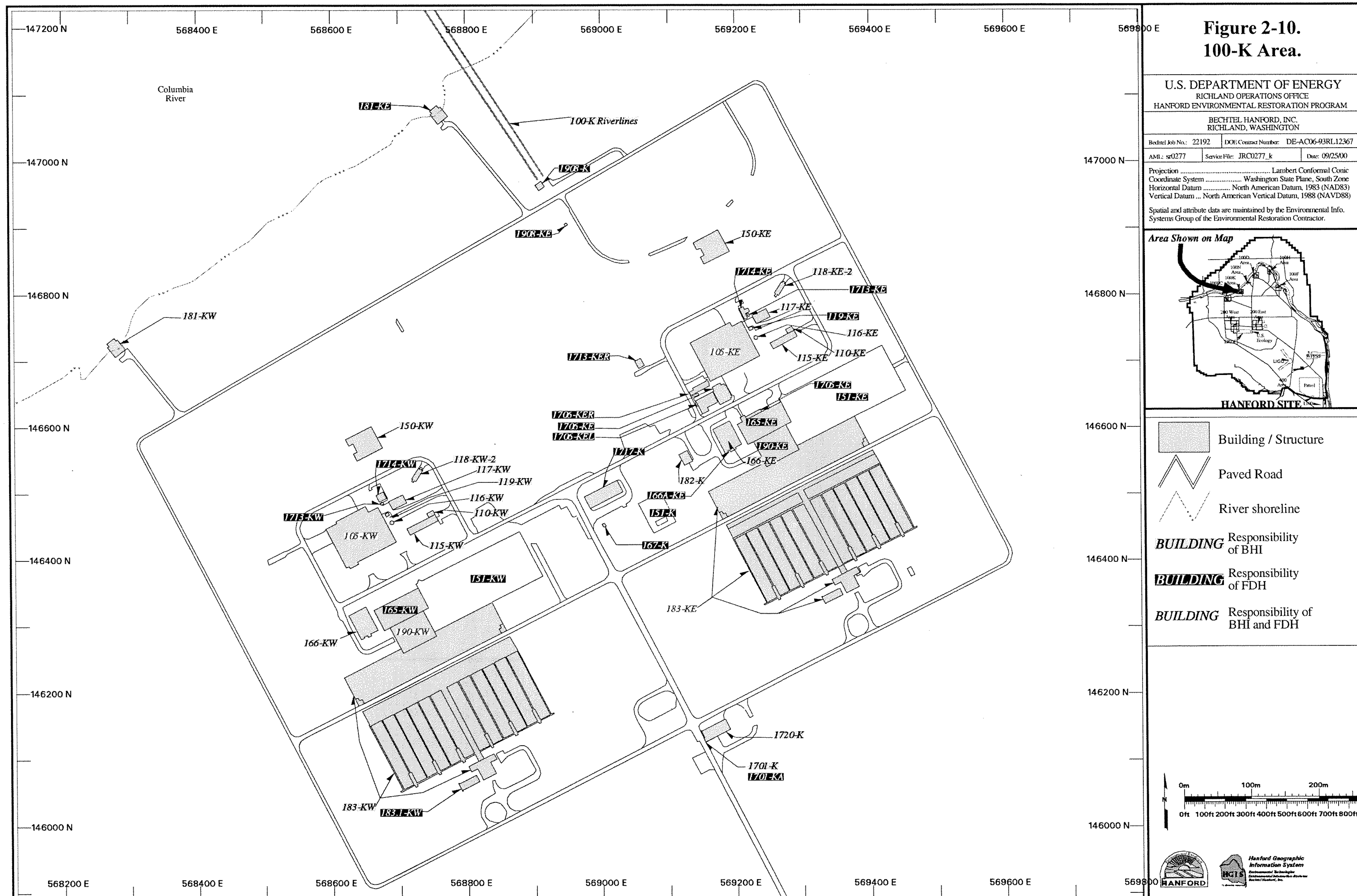


Figure 2-10. 100-K Area.



ERC:dlt:09/20/00:sr0277.aml:Rev. 2 Database: 09/25/00 12:25 PM

Figure 2-11. 105-KE Reactor Building Plan View at Ground Level.

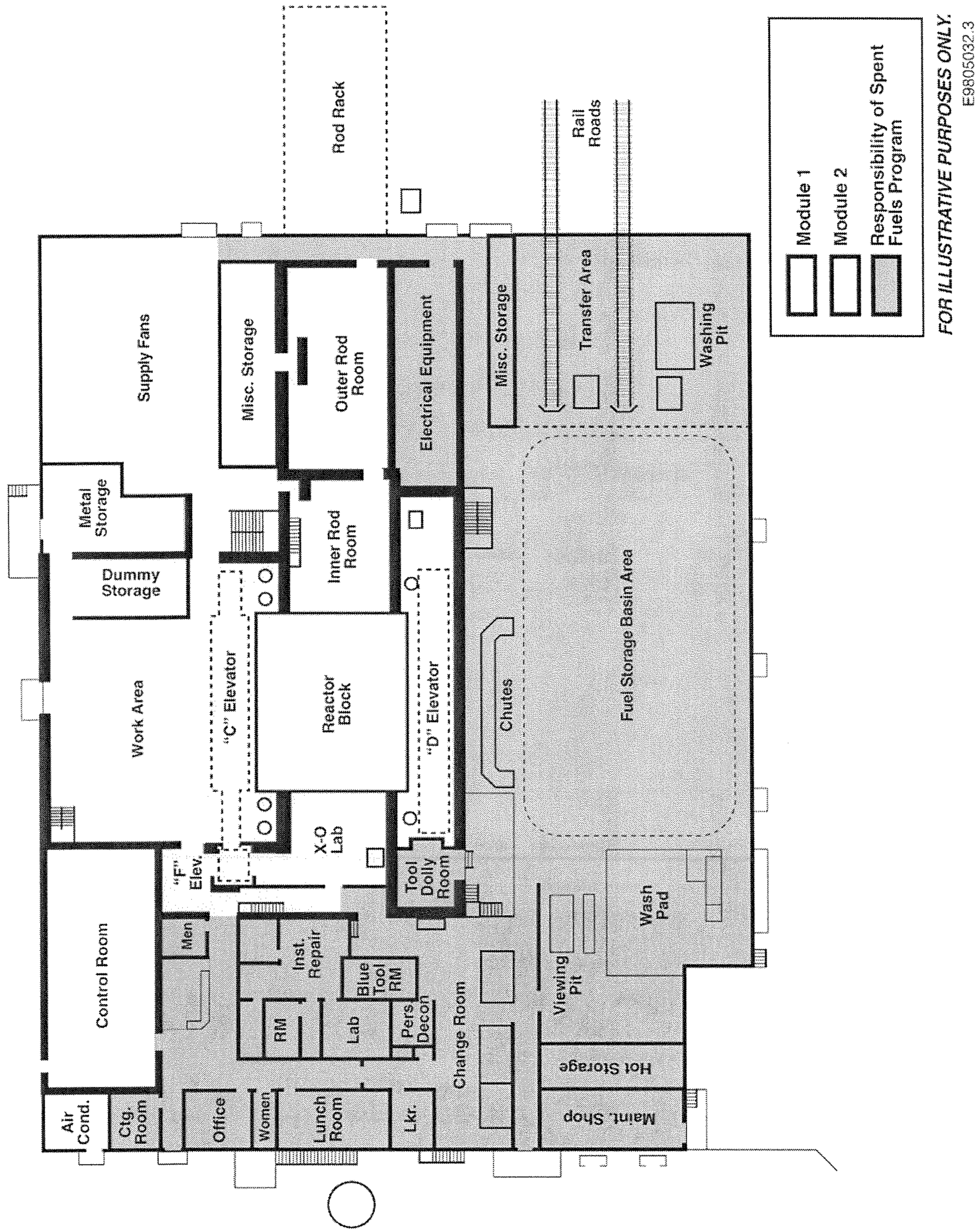


Figure 2-12. 105-KW Reactor Building Plan View at Ground Level.

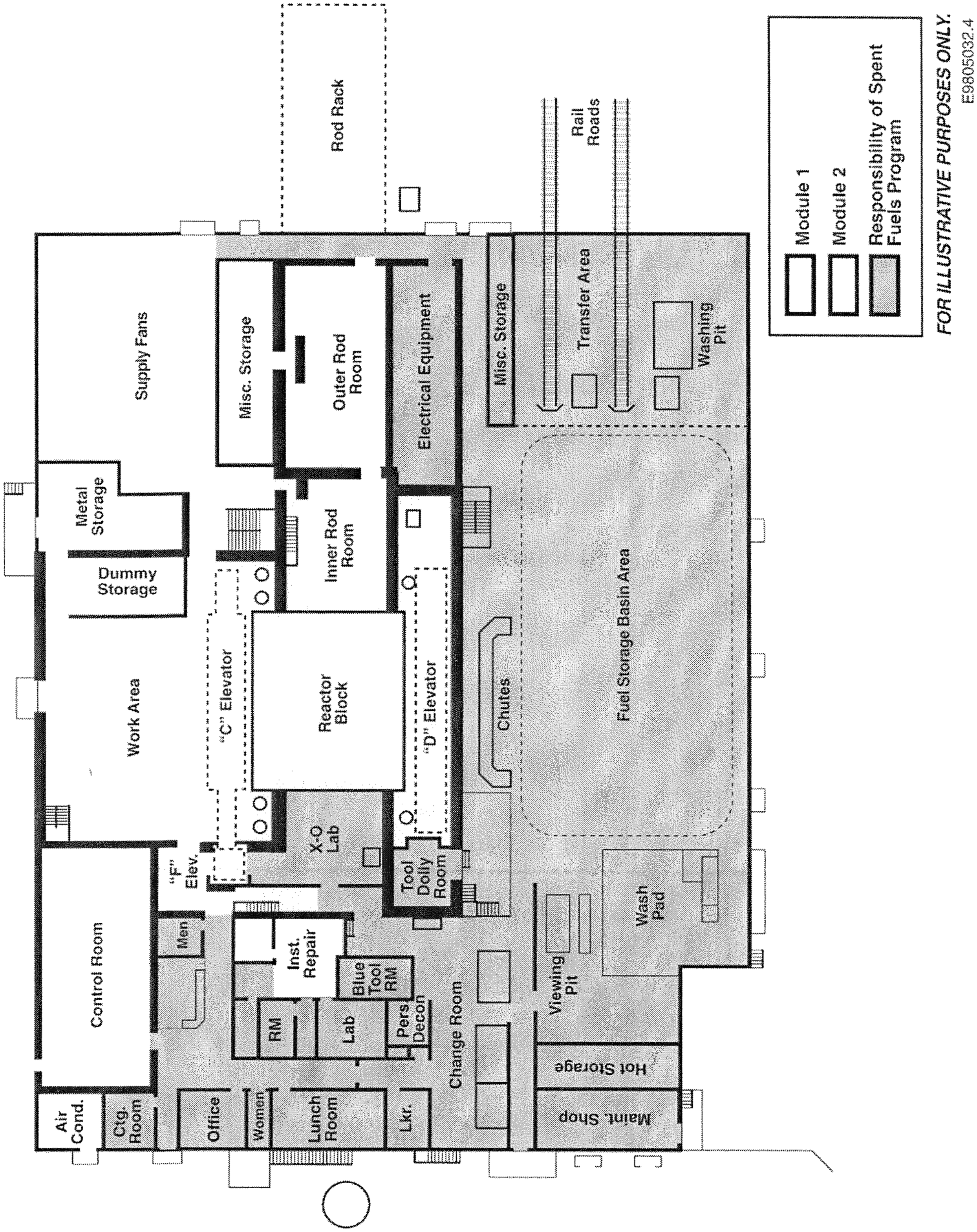


Figure 2-13. Typical Newer Reactor Facility Cut-Away View.

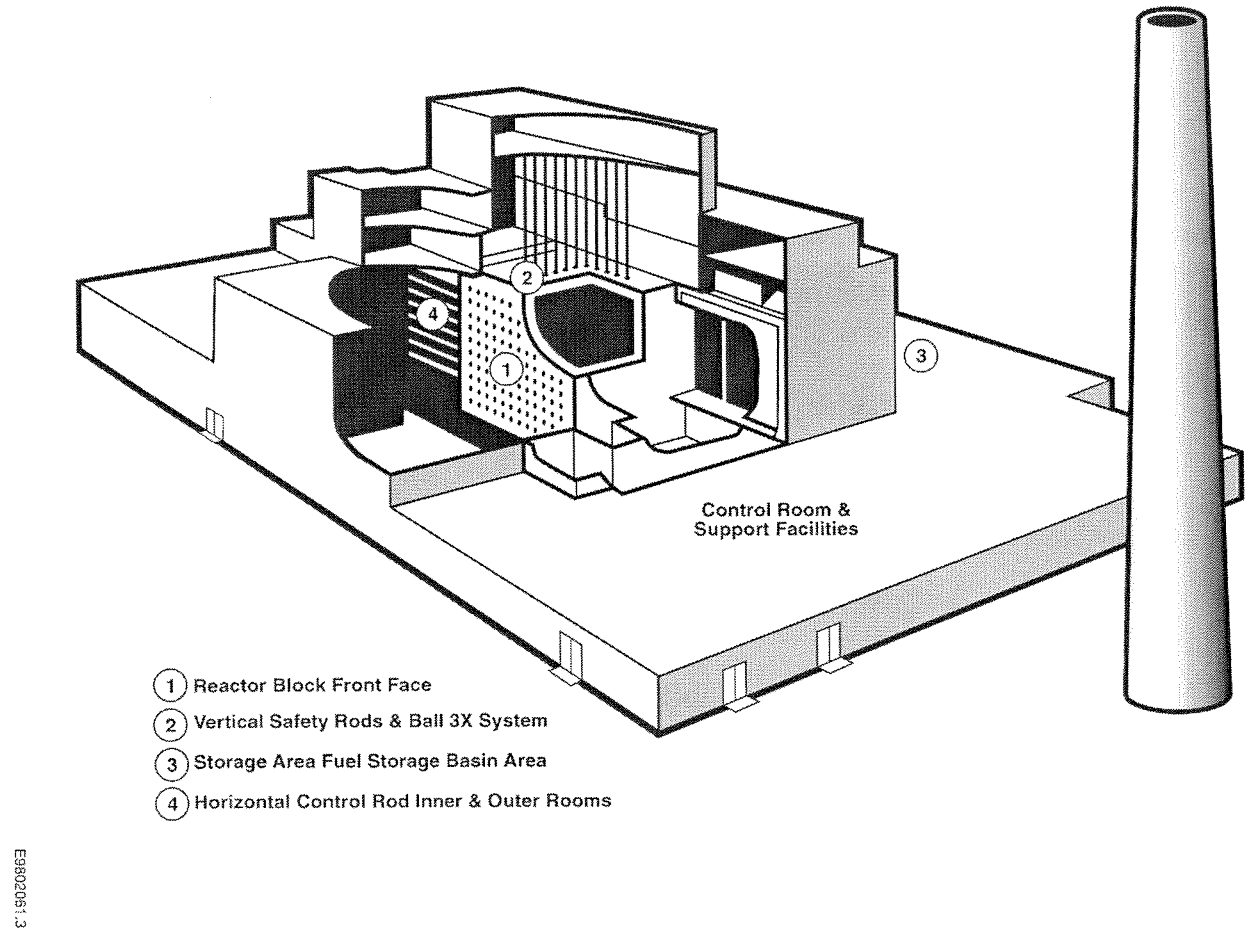


Figure 2-14. 105-KE/KW Reactor Building Below-Grade (0' to –17'6") Section Showing Ball 3x Recovery Room and Water Tunnels.

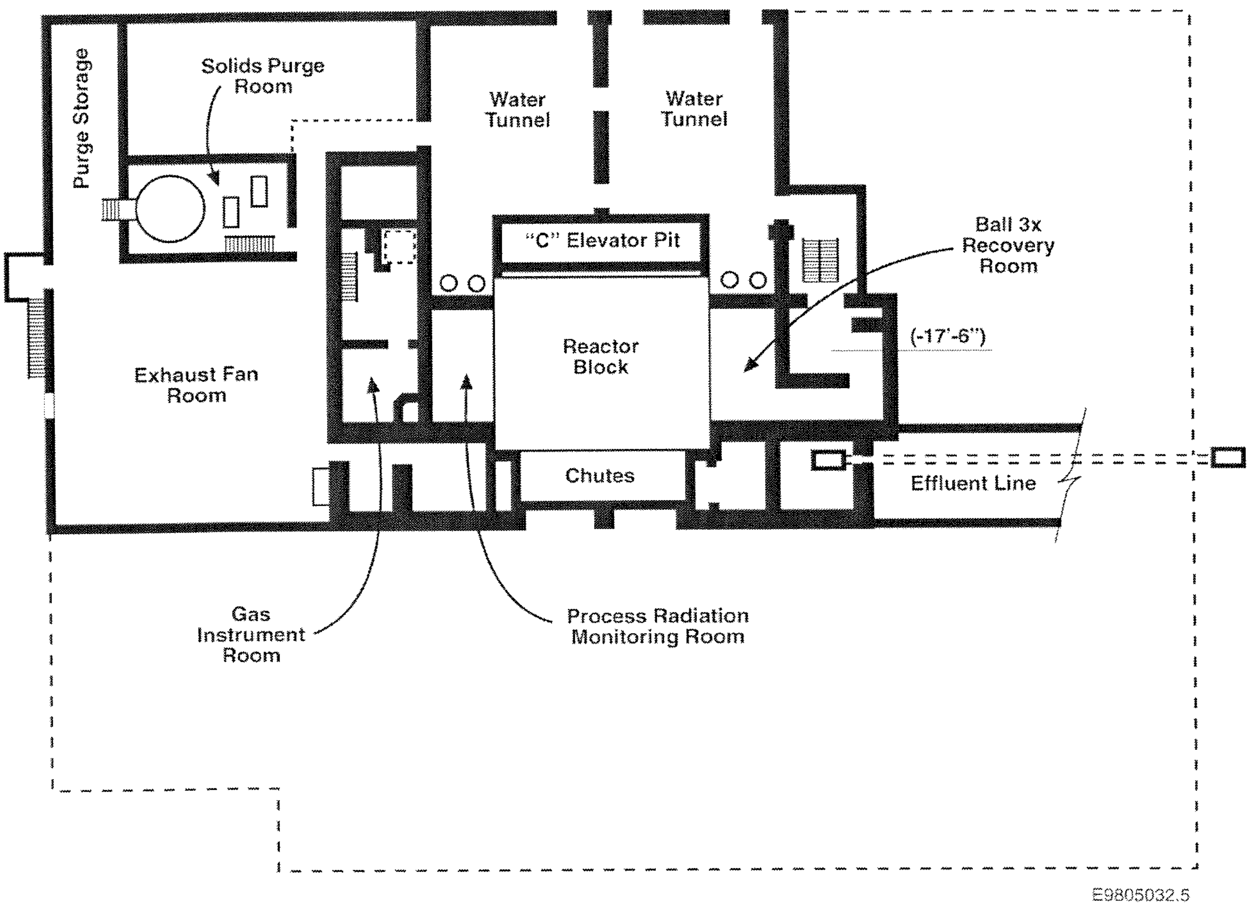


Figure 2-15. 105-KE/KW Below-Grade (-17'6" to –21'6") Section Showing Ball 3x Recovery Room Tunnel and Exhaust/Gas Tunnel.

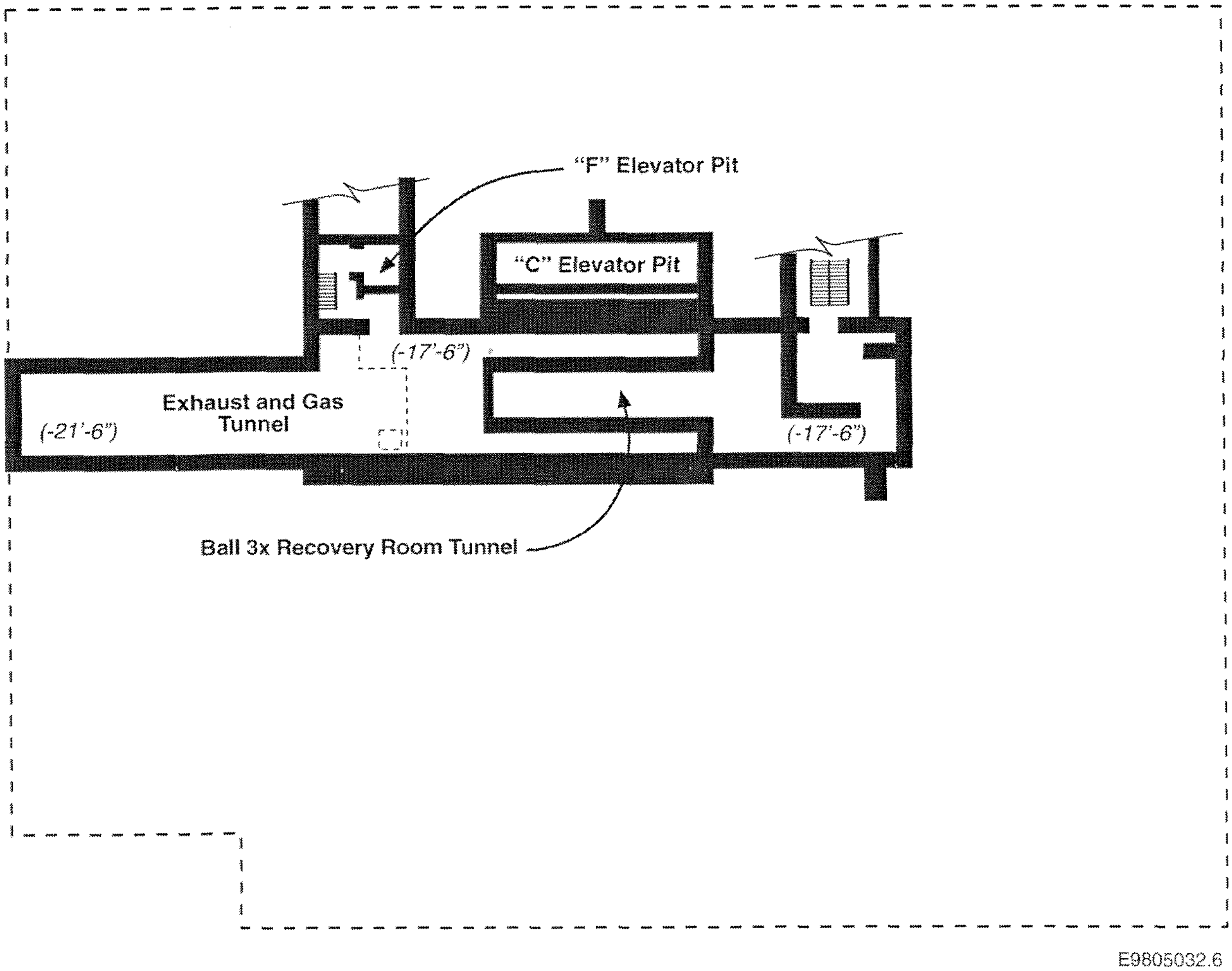


Figure 2-16. The Hanford Site and Washington State.

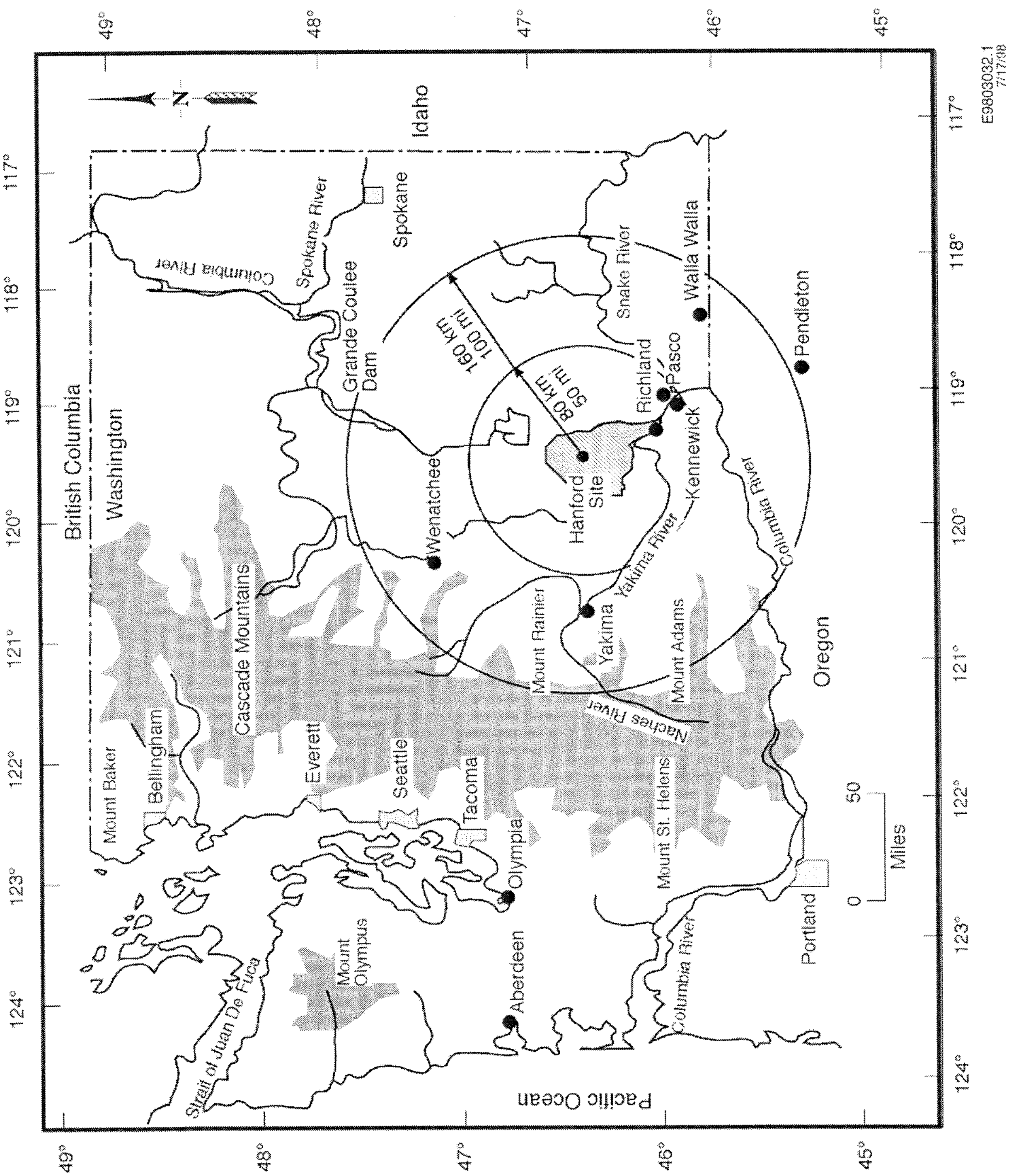


Table 2-1. Reactor Operating Histories.

Area	Reactor	Construction Started	Initial Startup Date	Final Shutdown Date[a]
100-B/C	105-B	1943	09/26/44[b]	02/13/68
100-B/C	105-C	1951	11/18/52	04/25/69
100-D/DR	105-DR	1947	10/03/50	12/30/64
100-F	105-F	1943	2/25/45	6/25/65
100-K	105-KE	1953	04/17/55	01/28/71
100-K	105-KW	1952	1/4/55	02/01/70

[a]Final shutdown date is defined as the last date of critical operation.
[b]The 105-B Reactor was shut down and held in standby from 03/19/46 to 06/02/48, and then restarted and operated until February 1968.

3.0 OPERATIONS

This section describes the activities and operations planned for the inactive reactors and ancillary facilities during this stage of their life cycle, before their ultimate disposition (e.g., D&D). The workscope in this ASA bounds upon preplanned surveillance and preventive maintenance that maintains confinement of hazardous materials and protects workers. This work scope also includes activities that are anticipated but are not defined by pre-approved procedures. Examples of planned activities without pre-approved procedures include specific hazardous material (e.g., asbestos, lead, cadmium, and mercury) abatement actions; replacement or upgrades of postings and barriers; container management; demand repairs to structures, systems, and components; and response or investigation of "abnormal" or "off-standard" conditions noted in surveillance reports. Programmatic controls described in Section 5.0 are in place to ensure that S&M activities are within the authorization basis and to ensure that workers are protected.

3.1 PROJECT ACTIVITIES

3.1.1 Routine Surveillance

Routine surveillance of the 100 Areas inactive reactors and ancillary facilities is performed according to an established frequency to ensure that any unfavorable conditions or trends are recognized and evaluated so appropriate corrective actions can be initiated. Requirements and responsibilities for ensuring that routine surveillance activities are performed in accordance with the applicable DOE orders are established in BHI-FS-01, *Field Support Administration*. All routine surveillances are scheduled/controlled using scheduled maintenance work requests (SMWRs) in accordance with BHI-FS-01.

When a SMWR initiates the performance of a routine surveillance in a radiological area or in an area where the potential exists to encounter radioactive material, a formal request is required for a radiological work permit (RWP) by the individuals planning the work (e.g., the area/field superintendent). The RWP is prepared by Radiological Control personnel in accordance with BHI-SH-02, *Safety and Health Procedures*, and BHI-SH-04, *Radiological Control Work Instructions*. Preparation of an RWP includes an evaluation for as low as reasonably achievable (ALARA) review. Completion of the RWP also requires current radiological survey information to ensure that the expected radiological conditions have not changed since the last surveillance was performed.

A work package is assembled for the facility surveillance in accordance with the requirements and guidance provided by BHI-FS-01. The work package consists of the documents required to implement the SMWR (e.g., TI, safety and protective requirements, and design drawings). The TI is a task-specific description of how the surveillance of the inactive reactor facilities will be performed. After the work package is assembled, it is reviewed and approved per the requirements of BHI-FS-01. Examples of the work organizations potentially involved in the review include Safety and Health, Crafts, and Quality Assurance. The TI is specifically reviewed to verify that the hazards associated with the surveillance are adequately addressed.

Before initiating the surveillance work, a pre-job safety briefing is held as required by BHI-SH-02 to ensure that employees are appraised of the safety and health aspects of the work. In addition, a plan-of-the-day (POD) meeting is held for all ongoing surveillance work to provide a means for discussing safety issues that may arise. Surveillance activities include visually inspecting the exterior portion of the facilities and, where appropriate, entering the facility and performing a walkdown of all accessible areas. The activities performed during the surveillance of a facility include the following: (1) inspection for structural damage, (2) inspection for missing signs, (3) check for water leaks, (4) inspection for subsidence, (5) verification that doors/hatches are locked, (6) check for excess combustible materials, (7) check for excess equipment or material, (8) check for electrical hazards, (9) inspection for potential asbestos concerns, (10) inspection for hazardous materials/unidentified or unlabeled containers, (11) check for occupational hazards, and (12) notation of any needed housekeeping. All "abnormal" conditions discovered during a routine surveillance are noted and documented on the TIDS. Minor corrective actions (e.g., posting hazardous conditions) and light housekeeping (e.g., picking up trash, debris, and materials as time permits) may be performed during a routine surveillance.

The TIDS is reviewed by designated personnel in accordance with BHI-FS-01 to determine if any abnormal conditions were discovered during the routine surveillance. The process used to identify and control items that are judged to be deficient as a result of a surveillance is documented in BHI-FS-01. Incomplete items discovered during a surveillance, which are correctable by further prescribed processing, are controlled and documented by the use of appropriate records prepared by Field Engineering. These records describe the action required before the item is deemed completed, inspected, and accepted. Field items that have been completed and accepted but have subsequently been found to significantly deviate from specified requirements are considered deficient and are documented and controlled by the use of a deficiency report (DR). The disposition of a DR requires the involvement of Field Engineering and Design Engineering personnel and occurs in one of three ways: (1) rework (i.e., item repaired to conform to specified requirements); (2) reject (i.e., item eliminated from specified use); and (3) use as is (i.e., justification provided for acceptance of otherwise unacceptable item). The MOC process is used to evaluate the impact of any proposed changes and/or discovered conditions to this ASA.

3.1.2 Maintenance

Maintenance activities for the inactive reactors and ancillary facilities are almost completely based upon surveillance findings. The only currently scheduled maintenance work for the inactive reactors and ancillary facilities is inspecting the emergency lights, ventilation systems, space heaters, and fire extinguishers at the 105-B Reactor Building, which are present because tours are conducted in the building. If a surveillance indicates that routine work or maintenance activities are required, these activities are performed in accordance with BHI-FS-01.

Routine work is defined as any fieldwork that is included on the routine work list, which is included as an attachment to BHI-FS-01. Examples of routine work performed at the inactive reactors include relamping, removing surplus nonprocess (i.e., equipment not related to the reactor block, fuel storage, and reactor operation), and performing minor electrical work (220 V or less).

If a maintenance activity is identified that does not meet the criteria of routine work, a demand work request (DWR) work package must be prepared. The requirements for preparing, reviewing, approving, and implementing a DWR work package are similar to those described previously for a SMWR (e.g., request RWP and conduct pre-job safety briefing) and are specified in BHI-FS-01. Unlike the SMWR, however, the preparation of a DWR work package may require additional safety documentation, such as a site-specific health and safety plan (SS HASP) and an AHA and/or MOC to adequately address the safety and health controls necessary for the activity (see Section 5.3.2).

3.2 CONFINEMENT

The thermal and biological shields surrounding the graphite moderator stack would serve to mitigate the release of radionuclides from the graphite stack. A description of the reactor blocks' thermal and biological shields is provided in Section 2.0. An assessment of the reactor blocks' ability to withstand natural phenomena and other events is provided in Section 4.0.

3.3 SAFETY-SIGNIFICANT SYSTEMS

There are no active operating systems that are relied upon to control or mitigate the hazards associated with the inactive reactors and ancillary facilities. The lack of safety-significant structures, systems, and components is consistent with the FHC of the inactive reactors and ancillary facilities as "Radiological."

3.4 ACTIVE SYSTEMS

The only active operating systems associated with the S&M portions of the inactive reactors are electrical power provided to the reactor buildings and several of the ancillary facilities; emergency lighting and ventilation system at the 105-B Reactor; and water systems at the 105-B, 105-KE, and 105-KW Reactor Buildings. The emergency lighting at the 105-B Reactor is the only system that would serve to mitigate hazards.

Electrical power is currently used to supply interior lighting, space heaters, and convenience outlets. The 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings have had nearly all of their unacceptable electrical hazards (i.e., those hazards identified as moderate, serious, or critical in the qualitative risk evaluation [WHC 1993a]) mitigated.

The emergency lighting and space heaters at the 105-B Reactor Building are present (1) because public tours are occasionally conducted and (2) to minimize deterioration of the roof as a result of freezing and thawing. The emergency lighting system automatically activates upon loss of power to the building or a loss of the lighting circuit. The space heaters are manually operated as needed.

The ventilation system at the 105-B Reactor Building normally does not provide supply air during occupancy but is used to sweep the area with fresh air during the night as a means to cool down the areas (which may have been heated up by the lights and from people) and reduce the radon levels, as necessary. The air is supplied into the clean areas of the building, which slightly pressurizes the building as the air is released to the outside through the various cracks in this nonairtight industrial structure.

4.0 HAZARD ANALYSIS

This section presents the hazard analysis and FHC process performed for the five inactive reactors and their ancillary facilities. The hazard analysis process applied and the assignation of the FHC, were based on guidance contained in BHI (1998d). The hazard analysis process consists of (1) defining the work activities to be authorized, (2) identifying the hazards associated with the work place (facility), and (3) evaluating the hazards associated with the facility. Given the results of the hazard analysis, an FHC was performed to assess the potential impacts of the inactive reactors and ancillary facilities based on a bounding, unmitigated release of radioactive material.

4.1 HAZARD IDENTIFICATION

The objective of the hazard identification process is to provide a basis for the analysis of the hazards associated with a facility. To achieve this objective, the hazards identification process must address the following:

- Characteristics of the inventory of hazardous materials in the facility
- Internal energy sources capable of interacting with the hazardous materials
- External energy sources capable of interacting with the hazardous materials
- Nonroutine hazards unique to the facility.

4.1.1 Methodology

The hazardous materials associated with the inactive reactors and their ancillary facilities, and the energy sources capable of interacting with the materials, were identified by (1) researching potentially relevant documentation, (2) interviewing personnel familiar with the historic operations and current status of the buildings and structures, (3) performing walkdowns of several facilities, (4) conducting a hazards workshop involving personnel from different disciplines, and (5) engineering judgment. These sources of information were used to obtain historic operations information, S&M information, inventory data, and information regarding the current status of structures and equipment. BHI and DOE, Richland Operations Office (RL) personnel assisted in the hazard identification process by providing information on features and hazards requiring inclusion, defining the level of detail appropriate for the facilities and the long-term S&M mission, and reviewing interim hazard identification documentation.

More than 40 documents and reports, covering approximately 30 years, related to the 100 Area buildings and structures were obtained and examined for information relevant to those facilities being analyzed. The following documents were examined:

- Characterization reports
- Deactivation manuals
- Risk evaluations for retired facilities

- Decontamination and demolition reports
- Environmental impact statements
- Preliminary hazard classification documents
- Surplus facility listing and description manuals.

Interviews of personnel familiar with the historic operations of the facilities were conducted to verify the accuracy of the documented historical information. These interviews were also used to obtain additional historical information that was not contained in the documentation available for review and, for several facilities, to obtain the only historical information available. Interviews of personnel familiar with the current status of the facilities were conducted to determine if the hazards identified in the reviewed documentation were still present. In several cases, a hazard identified in the documentation was eliminated from consideration because the interviews revealed that the hazard had been removed.

Walkdowns were performed to provide information about the current status of select facilities (i.e., those facilities for which information could not otherwise be obtained) and to provide a general perspective on the current status of the facilities and their hazards.

4.1.2 Inventory at Risk

The ERC recognizes that each reactor facility (i.e., inactive reactor and ancillary facilities) can be generally partitioned into four areas, as discussed in Section 2.2:

- Module 1 (excluded from the scope of the 105-C, 105-F, and 105-DR Reactors)
- Module 2 (including the reactor block)
- FSB (excluded from the scope of the 105-KE and 105-KW Reactors)
- Ancillary buildings (e.g., 116-B, 190-DR, 110-KE, 183-KW).

A detailed discussion of the hazardous material inventories for each area described in Section 2.2 is presented in the following sections.

4.1.2.1 Radionuclide Inventory. The two areas in the reactor facilities with the greatest inventory of radionuclide contamination are the reactor block and the FSB. Other areas in the facilities that are contaminated to a lesser extent include module 1, module 2 (excluding the reactor block), and the ancillary buildings. Previous post-closure radiation surveys of the reactor 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 (UNC 1987). It is estimated that the radionuclide inventory for these other areas is less than 5% of the total inventory of the reactor buildings (UNC 1987).

The inventories for all areas in the reactor facilities and the methodology used to determine the inventories are presented in the following subsections.

4.1.2.1.1 Module 1. The inventory in module 1 of the reactor buildings is assumed to be equivalent to the module 1 inventory identified in the PHC for the 105-C ISS Project

(BHI 1996c). The 105-B, 105-KE, and 105-KW Reactor Buildings have generally similar dimensions and process functions. Also, all buildings operated for approximately the same amount of time (105-B operated for 22 years, 105-C operated for 17 years, 105-KE operated for 16 years, and 105-KW operated for 15 years) (UNC 1987). The radionuclide inventories for the 105-C module 1 were calculated in BHI (1996c), based on data from DOE-RL (1994) and CEES (1994), and are repeated in Table 4-1. More recent inventories in Table 4-1 were derived by decaying the original inventories from March 1, 1996 to March 1, 1998. It should be noted that module 1 of 105-C, 105-F, and 105-DR were recently demolished and removed as part of the ISS activities (BHI 1998c, 2002b).

A previous qualitative risk evaluation was performed to characterize the risks associated with the 100 Area surplus facilities at the Hanford Site (WHC 1993a). The risk evaluation considered order-of-magnitude estimates of the likelihood and consequences of potential events. This risk evaluation was then used to estimate risk and facilitate identification of the best risk-reduction measures. The evaluation was based on physical walkdowns and information reviews.

The risk evaluation determined that the radiological conditions of each of the surplus production reactors excluding the 105-K Reactor (105-B, 105-C, 105-F, and 105-DR) were very similar and, therefore, total risks involved were similar. This evaluation provides the basis for the assumption that the radiological conditions in modules 1 and 2 (excluding the reactor block) are similar and, therefore, would share similar inventories.

The risk evaluation determined that the risk of radiation exposure was slightly greater at the 105-KE and 105-KW Reactors than at the other reactors. The basis for this conclusion was the existence of isolated areas of moderate to high exposure rates and the larger inventories of radionuclides available. However, the risk evaluation also determined that the risk associated with the release of radioactive materials was the same for all of the reactors because most of the material is present as part of a stable matrix (i.e., not readily dispersible). In addition, none of the areas of concern for the 105-KE and 105-KW Reactors were located within module 1.

Note also that the module 1 inventory for the 105-C Reactor included the contribution of 5,000 gal of contaminated water in the lift station. The use of this inventory for all reactors is conservative because the 105-B Reactor does not have a lift station, and the 105-KE and 105-KW lift stations are not within module 1 (they are also not within the scope of this ASA because they are still used by the SFP for K Basin operations).

The radionuclide inventory for module 1 is presented in Table 4-1. By comparing the data in Table 4-1 to that presented in Section 4.1.2.1.2, it can be shown that less than 1% of the total radionuclide inventory in the reactor facilities is contained in module 1. See Figures 2-3, 2-11, and 2-12 for the location of the module 1 area in the various reactor buildings.

4.1.2.1.2 Module 2. The module 2 inventory consists of two parts: (1) the reactor block (which holds the majority of the radionuclide inventory in the facility), and (2) the rooms within the shield wall. The estimated inventory of module 2 is given in Tables 4-2 through 4-7. See Figures 2-3, 2-11, and 2-12 for the location of the module 2 area and the reactor block.

Reactor block. The inventories of the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor blocks are presented in UNC (1987). The estimated inventories are based on radionuclide concentration data, which has been derived from samples and adjusted for the operating histories and fluence differences. A review of UNC (1978) and (1987) indicated a discrepancy in the estimated inventory of a few radionuclides (e.g., plutonium-239 and strontium-90) that could not be resolved based on the information contained in the two documents. Resolution of this potential concern involved contacting one of the authors of UNC (1987) and discussing the apparent discrepancy. The author resolved the concern by indicating that additional characterization data became available subsequent to the publication of UNC (1978), and that these data were used to estimate the quantities of the radionuclides in question. BHI has not independently verified the data presented in UNC (1987), but for the purposes of this ASA, BHI assumes that all data taken from UNC (1987) are correct and conservative. The current inventory is derived by decaying the inventory provided in UNC (1987) from March 1, 1985, to March 1, 1998.

UNC (1987) states that the estimated numerical data contained therein were conservatively designed to overestimate the radionuclide and hazardous material inventories present. Impacts of special tests, special fuel loadings, special HCRs, etc., were not calculated in the inventory estimate because their effect on the overall inventory is not considered significant. For the same reason, no attempt was made to examine the spatial effects that occur due to fuel, HCRs, test holes, special loadings, etc. (UNC 1987).

Module 2 (excluding the reactor block). In addition to the inventory of the reactor block, the module 2 area of the reactor buildings includes the module 2 inventory calculated in the PHC for the 105-C ISS Project (BHI 1996c). The radionuclide inventories for module 2 calculated in BHI (1996c) were based on data from DOE-RL (1994) and CEES (1994). These detailed calculations are provided in BHI (1996c). The most current inventory is derived by decaying the inventory provided in BHI (1996c) from October 1, 1996, to March 1, 1998.

The radionuclide inventory for module 2 (excluding the reactor block) is presented in Table 4-8. By comparing the data in Table 4-8 with Tables 4-2 through 4-7, it can be shown that, excluding the reactor block, less than 1% of the total radionuclide inventory in the reactor facilities is contained in module 2 outside the reactor block. See Figures 2-3, 2-11, and 2-12 for the location of the module 2 area in the various reactor buildings.

4.1.2.1.3 Fuel Storage Basin Area. The 105-B, 105-C, 105-F, and 105-DR Reactor Buildings each housed an FSB (the 105-KE and 105-KW FSBs are not included in the scope of this ASA). The basins served as collection, storage, and transfer facilities for fuel elements discharged from the reactor. The basins consisted of a fuel element pickup chute, storage area, and transfer area (Figure 2-7). The storage area portion of the basins measured approximately 72 ft by 94 ft by 20 ft deep (UNC 1986).

In preparation for decommissioning, various efforts were made to clean and stabilize the basins. As described in UNC (1986), the 105-B Reactor FSB contained an estimated 1 to 2 in. of sediment composed of iron oxides and silt. The water was removed from the basin, and approximately 600 ft^3 of sediment was collected and placed in the transfer pits (UNC 1986).

The mass of the sediment is estimated to be 50,000 kg (UNC 1987). UNC (1986) states that containment covers were placed over the sediment. Individuals involved in the project report that before installing these plywood covers, a layer of sand 1 to 3 ft thick was placed over the sediment to provide shielding. Following removal of the water and sediment, the walls and floor of the basin were vacuumed to remove dust and loose particles. An asphalt emulsion was then applied as a surface fixative (UNC 1986).

The 105-C and 105-DR FSBs have been remediated to satisfy standards established for closure, and the residual radioactivity does not pose a hazard. The 105-F FSB was recently demolished and removed as part of the ISS activities (BHI 1998e). Therefore, these FSBs are no longer discussed in relation to radionuclide quantities.

The radionuclide inventories of the 105-B Reactor basin following the cleanup activities described above are presented in Table 4-9. The values in Table 4-9 are from UNC (1987). The values for the 105-B Reactor were determined by multiplying 50,000 kg of sediment by measured radionuclide concentrations. The most current inventory is derived by decaying the inventory provided in UNC (1987) from March 1, 1985, to March 1, 1998.

4.1.2.1.4 Ancillary Buildings. Table 4-10 presents the radiological condition of those ancillary facilities discussed in Section 2.2. The information found in Table 4-10 is a summary of the radiological information provided in the hazard identification tables of Appendix A. These structures were not included in the associated reactor PHCs (BHI 1997e, 1997i). Process knowledge of the reactors and ancillary facilities and characterization data from other buildings with similar purposes (e.g., the 116-C Reactor Exhaust Stack, 117-C Filter Building, 119-C Sampling Building, and 116-F Reactor Exhaust Stack) that were characterized and demolished in the past indicate that only minor amounts of hazardous substances are present.

4.1.2.2 Nonradiological Hazardous Material Inventory. The buildings in this ASA contain a large volume of contaminated and noncontaminated lead, with the majority of the lead contained in the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings. This lead is in the form of bricks, blankets, sheets, pipes, plates, shot, and paint. Table 4-11 summarizes the nonradiological hazardous material inventory.

Asbestos was widely used throughout the reactors and ancillary facilities. Most of the asbestos was used as piping insulation and also in transite panels used as structural components. Previous deactivation activities in the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings removed some of the asbestos piping insulation. Most of the remaining asbestos is considered friable, and some of the material is radiologically contaminated. It is assumed that friable asbestos remains in the ancillary building; however, the quantities are anticipated to be small.

Mercury is found in electrical switches and thermometers throughout the reactors and ancillary facilities, although much of the mercury has been removed during previous deactivation efforts. Polychlorinated biphenyls are anticipated to be found in the control room, valve pits, areas containing light ballast, and in some areas containing oil. Cadmium is present as an alloy with lead (DOE 1989).

Minor quantities of other chemicals are anticipated to be found within these reactor buildings. Following deactivation of the reactors, the majority of chemicals were removed, leaving only trace amounts.

The nonradiological characterization of the ancillary facilities is not as well known as that of the reactor buildings. The ancillary facilities were not included in the PHC (BHI 1997e, 1997h, and 1997i). A combination of process knowledge of the reactors and ancillary facilities and characterization data from other buildings with similar purposes (e.g., the 116-C Reactor Exhaust Stack, 117-C Filter Building, 119-C Sampling Building, and 116-F Reactor Exhaust Stack) that were characterized and demolished in the past show insignificant amounts of nonradiological hazardous materials present.

As discussed in Section 3.1.1, an essential part of the S&M program is the regular inspection of facilities to identify and manage any potentially hazardous chemicals. Under the S&M program, the risk due to exposure to hazardous chemicals has been reduced. Table 4-12 summarizes the nonradiological hazardous material inventory of the ancillary facilities.

4.1.3 Hazards Identified

The results of the hazard identification process are documented in Appendix A, Tables A-1 through A-32. The hazard identification tables present the hazard type, location, form, quantity, remarks, and a reference to where the information was found. The following types of hazards were investigated: radioactive material, direct radiation, fissile material, hazardous material (i.e., toxic or carcinogenic), biohazards, asphyxiant, flammable/combustible material, reactive material, electrical energy, thermal energy, high pressure, and natural phenomena.

4.2 HAZARD EVALUATION

The hazards identification tables (see Appendix A) were evaluated to determine which facilities could be screened from further analysis. The facilities identified as containing insignificant or no radioactive/hazardous materials and/or judged to present only standard industrial or occupational hazards were eliminated from further evaluation. Application of these criteria necessitated additional hazard evaluation of the following facilities:

- 105-B Reactor Building
- 105-C Reactor Building
- 105-DR Reactor Building
- 105-F Reactor Building
- 105-KE Reactor Building
- 105-KW Reactor Building
- 115-KE and 115-KW Gas Recirculation Buildings
- 117-KE and 117-KW Exhaust Air Filter Buildings
- 165-KW Power Control Building
- 166-KE and 166-KW Oil Storage Facilities.

The hazard evaluation process is a systematic examination of the hazards associated with a facility with the following objectives:

- To identify the events that could lead to releases of hazardous substances
- To rank these events based on potential consequences and frequency
- To identify engineered mitigative and preventive features that serve to control the hazards
- To identify the commitments and administrative controls necessary to manage the hazard.

This section evaluates the potential interactions between the hazards identified in Section 4.1 and the project activities described in Section 3.1 that could result in potential consequences to the public, the worker, or the environment.

4.2.1 Hazard Evaluation Summary

Consideration of the magnitude of the hazards being addressed, the complexity of the reactor buildings and the systems relied upon to maintain an acceptable level of risk, as well as the stage of the reactor's life cycle resulted in the use of a qualitative preliminary hazard analysis (PHA) to evaluate the hazards associated with the inactive reactors. The following items were specifically considered to determine the adequacy of the PHA: (1) the PHCs performed for the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings (BHI 1996a, 1997e, 1997f, 1997g, 1997h, and 1997i) determined that they were each a Nuclear Category 3 facility with a potential for significant localized consequences only; (2) the reactor buildings are relatively simple facilities that do not rely on complex systems to maintain an acceptable level of risk; and (3) the reactor buildings are inactive.

The hazards evaluated in this section were selected from those that were identified using the process described in Section 4.1. The hazard evaluation process included a facilitated hazard evaluation workshop involving personnel from different disciplines (e.g., safety analysts, engineering personnel) to provide a broad perspective on the potential hazards. A wide spectrum of events was considered during the hazard evaluation, and it was determined that many events do not have the potential for significant consequences. The hazards associated with these events are adequately controlled by the programmatic controls identified in Section 5.3; thus, these hazards do not require detailed discussion in this ASA. Several of the events determined to have the potential for significant consequences were determined to have an improbable likelihood of occurrence (i.e., $\leq 1 \times 10^{-6}$/yr). Events selected for detailed evaluation have the potential for significant consequences to the worker, the public, or the environment and have a likelihood of occurrence greater than 1×10^{-6}/yr. The detailed hazard evaluation is presented in Appendix A, Tables A-33 through A-45, and the evaluation is summarized below.

The hazardous material inventories for the ancillary facilities were evaluated to determine the potential impacts to workers, the public, and the environment (see Section 4.1.2). The inventories were determined to be insignificant when compared to the inventories in the five reactor buildings. Thus, the potential consequences of any releases of hazardous materials from these ancillary facilities were judged to be bounded by releases from the reactor buildings, as shown in Appendix A, Tables A-33 through A-45. The potential events at the reactor buildings considered for detailed evaluation are discussed (according to type) below.

4.2.1.1 Natural Phenomena. The natural phenomena that could potentially result in the release of hazardous materials from the reactor buildings were discussed in Section 2.6. The phenomena consist of the following:

- Seismic
- High wind/tornado
- Flood
- Snow and ash loading
- Range fire
- Lightning.

4.2.1.1.1 Seismic. Evaluations were made of the seismic stability of the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor blocks against seismic forces. Horizontal and vertical frequencies were calculated (BHI 1998g, sheet 38; BHI 1999a, sheet 55; BHI 1999b, sheet 3) using horizontal and vertical seismic accelerations obtained from the response spectra for a performance Category 3 structure. This category is the highest performance category available to the Hanford Site for facilities that do not have offsite release consequences greater than or equal to the unmitigated release associated with a large (>200 megawatts) Category A reactor severe accident.

The stability calculations verified that the reactor block structure has adequate strength and foundation base anchorage to withstand the overturning and sliding effects due to seismic force. The insignificantly small deflections of the block ensure that the potential for dislodgement of the top biological shield is nonexistent.

Hence, the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor blocks are rigid structures and are stable against both the horizontal and vertical seismic forces defined for an existing performance category 3 structure on the Hanford Site (UBC Zone 2B).

An evaluation of the ability of the graphite stacks of the 105-KE and 105-KW Reactors to withstand an earthquake of Zone 2 intensity (i.e., horizontal acceleration of 0.1g) was performed and is presented in GE (1953). Considering the analyses results, it was concluded that the graphite stack of the 105-KE and 105-KW Reactors could withstand a Zone 2 earthquake with negligible damage even if considerable distortion of the stack occurred via graphite growth. The arrangement of the graphite stack, cast iron thermal shield, and concrete biological shield limits the movement of the graphite and cast iron to central bowing (from front to rear) during an earthquake. The evaluation also determined that an accompanying 0.41g vertical acceleration (assuming a 0.1g horizontal acceleration) would be necessary for slippage to occur at the cast iron-graphite interface at the top of the stack. Finally, the evaluation concluded that the likelihood of the stack ever being vibrated at its resonant frequency is not likely to occur.

The accidental drop of a reactor block during transport for disposal was analyzed in DOE (1989). It is assumed that the release of radioactive material due to the reactor block drop accident would conservatively bound the release from the reactor block resulting from a seismic event. This assumption is based on the reactor block drop event transferring a greater magnitude of kinetic energy to the reactor block than a seismic event. This event is evaluated in Section 4.2.2.

4.2.1.1.2 High Wind/Tornado. Considering the discussion in Section 2.6.3, the likelihood of a tornado striking one of the reactor buildings is 9.6 x 10^{-6}/yr (DOE 1989), which approaches the limit of credibility. The ability of the reactor buildings to withstand a high wind or tornado event is unknown. As indicated in Appendix A, Tables A-33 through A-45, the risk associated with a high wind/tornado event was judged to be bounded by the seismic event. Thus, a detailed evaluation is not required.

4.2.1.1.3 Flooding/Water Intrusion. Water intrusion due to precipitation occurs regularly in the reactor buildings, but has not resulted in significant migration of contamination to the environment. The potential for run-on flooding resulting in a significant release of hazardous materials from the reactor buildings is low given the low annual precipitation amount, the low probability of high intensity (i.e., 2.5 cm/hr for 1 hour) rainfall, and the configuration of the hazardous materials (i.e., primarily contained within the reactor block). The dam-regulated SPF, defined as having a recurrence interval of 500 to 1,000 years (DOE 1987), would not reach the elevation of any of the reactor buildings. Thus, there is no potential for water generated by the SPF or PMF to interact with radiological and hazardous materials within the reactor buildings.

A catastrophic flood (i.e., a flood resulting from a hypothetical 50% breach of the Grand Coulee Dam) would submerge portions of the buildings and provide a means for contamination to potentially migrate to the environment (DOE 1989). However, catastrophic flooding is judged to be an improbable event. Based on this information, it is concluded that flooding does not require further evaluation.

4.2.1.1.4 Snow and Ash Loading. The ability of the roofs of the reactor buildings (except 105-C and 105-DR) to withstand snow and/or ash loading is unknown. As indicated in Appendix A, Tables A-33 through A-45, the risk associated with a snow- and/or ash-loading event was judged to be bounded by the seismic event. The bases for this judgment are (1) the magnitude of structural damage is expected to be less for a snow- and/or ash-loading event, thus the potential consequences are judged to be less significant; and (2) the likelihood rank of a snow- and/or ash-loading event is judged to be less than a seismic event.

4.2.1.1.5 Range Fire. Range fire represents a minor risk to the reactor buildings of concern. While the probability of a range fire is anticipated (probable), the lack of combustible building materials affords the primary protection from propagation. Additionally, a firebreak is maintained around the buildings in accordance with NFPA 299 (NFPA 1997), which is implemented under the BHI Safety and Health Program and procedures.

4.2.1.1.6 Lightning. As discussed in Section 2.6.3, Washington State has a low mean annual number of days with thunderstorms (IEEE 1991). Given the presence of combustible material (i.e., Masonite in the biological shields of the 105-B, 105-C, 105-DR, and 105-F Reactor

Buildings; graphite in all of the reactors) in the reactor blocks of the reactor buildings, and the greater than 1 x 10^{-6}/yr likelihood of lightning striking one of these buildings, a discussion of the potential impact to the reactor block by a lightning strike is warranted.

The reactor buildings have been evaluated and determined to be adequately grounded for lightning protection. The roofs of the buildings are insulated and are connected to the structural steel members of the buildings. The roofs also have metal flashing around their entire perimeters. The lightning protection design for the reactor buildings works by conducting any surge voltage to the ground via the grounded steel frame of the building, while resisting transmission of the voltage to the building interior. A lightning strike to a reactor building would seek ground via the outermost ring of vertical, structural-steel conducting columns; thus, the building would resist transmission of surge currents to its internal components (e.g., reactor block). This phenomenon results from the induction of a magnetic field around the outer perimeter of the building during lightning current. If a lightning current were to enter the reactor block, the current would tend to flow to the ground via the steel outer shell/gas seal and be precluded from traveling along the length of the process tubes to the interior of the block. However, if an electrical surge were to strike the process tubes, the electrical charge would tend to be passed to ground with relatively little heat generation within the reactor block due to the low electrical resistivity of the process tubes and the graphite. In addition, the reactor block and the concrete pedestal that the block rests on would provide a large heat sink to dissipate any heat generated. Based on this information, it is not expected that a lightning strike to a reactor building would generate sufficient heat within the reactor block to significantly impact the combustible materials (e.g., ignition and sustained combustion). Thus, the release of radionuclides due to a lightning strike is judged to be improbable and will not be further evaluated.

4.2.1.2 Site Proximity Events. The only site proximity (i.e., external man-made) event that could credibly result in a release of hazardous material from the reactor buildings is a vehicle crash.

4.2.1.2.1 Vehicle Crash. It is credible for an out-of-control vehicle to strike one of the reactor buildings and breach a wall, particularly in those areas consisting of concrete block construction (e.g., FSB at the 105-B Reactor). While the impact itself would not result in a significant release of hazardous material, a fire could be initiated and potentially result in significant, localized consequences. An evaluation of a fire scenario releasing a fraction of the radionuclide inventory present in the 105-B Reactor FSB is presented in Section 4.2.2.2.

4.2.1.2.2 Aircraft Crash. An aircraft crash is not considered to be a credible initiating event for the release of hazardous materials from a reactor building. Considering that the footprint of each reactor building is similar to that of the Plutonium Finishing Plant (i.e., each footprint is approximately 200 ft by 300 ft), use can be made of the aircraft crash analysis performed in WHC (1996). That analysis determined that an aircraft crashing into the Plutonium Finishing Plant is an improbable event with a likelihood of occurrence of 1.28 x 10^{-08}/yr; thus, this event does not require a detailed evaluation.

4.2.1.2.3 Activities at Adjacent Facilities. For the 105-B, 105-C, 105-DR, and 105-F Reactor Buildings, there are no activities being performed at adjacent facilities that have a potential for interacting with the inventory of hazardous materials. At the 105-KE and 105-KW Reactor Buildings, the FSB and transfer bay area of each building (refer to Figures 2-11 and 2-12 for a delineation of the reactor building areas) are currently in operation to store irradiated N Reactor fuel. An uncontrolled release from the fuel storage operation could potentially have significant consequences to ERC personnel in proximity to the event. However, the release does not have the potential to interact with the hazardous materials present within the remainder of the reactor buildings because of the form and distribution of the hazardous material inventories. An interruption of the activities occurring at the reactor buildings due to an event (e.g., a Site emergency) would not result in a release of hazardous material from the reactor buildings.

4.2.1.3 Internal Events. The internal events that could credibly results in a release of hazardous material from the reactor buildings include the following:

- Fire
- Explosion/chemical reaction
- Spills
- Structural fatigue
- Internal flooding
- Exposure hazards.

There is no electrical equipment within the reactor buildings that is relied upon to control or mitigate the hazards that are present. Thus, the loss of power is not a credible initiating event. Because the reactor buildings are not actively ventilated, the loss of ventilation and/or a filter failure could not credibly result in a release of hazardous material. Since S&M activities at the reactor buildings do not involve the lifting of heavy loads, the impact of a heavy load drop resulting in a release of hazardous materials is an improbable event. These events will not be further evaluated.

4.2.1.3.1 Fire. The combustible loading and the number of potential ignition sources (i.e., space heaters, electrical short) within the reactor buildings is generally low. Tables A-1 through A-32 in Appendix A indicate that there are some areas within the reactor buildings that contain significant combustible loading. The following are noted specifically: Wooden planking in the FSB at the 105-B Reactor Building. In addition, the graphite in the reactor block of all of the reactors and the Masonite present in the biological shields of the 105-B, 105-C, 105-DR, and 105-F Reactors (the biological shields for 105-KE and 105-KW are constructed of heavy aggregate concrete) represent a significant combustible loading. As stated in Section 4.3.1.1, it is assumed an event in the FSB will not effect the inventory in the reactor building (i.e., no effect on the reactor block). A fire within an FSB is addressed in Section 4.2.2.2.

A fire within those areas mentioned for the 105-KE and 105-KW Reactor Buildings would not have the potential to release a significant amount of hazardous material, and is bounded by the FSB fire. A fire involving the graphite in the reactor block is not a credible event because there are no ignition sources present within the reactor buildings with sufficient energy to ignite the graphite.

The biological shields of the 105-B, 105-C, 105-DR, and 105-F Reactors are 52-in. thick and are constructed of alternating laminated layers of steel and Masonite between two layers of steel (see Figure 2-6 for a cross-section of the biological shield). The likelihood of the Masonite igniting and sustaining ignition is improbable due to an insufficient supply of oxygen, the presence of massive heat sinks (i.e., steel layers surrounding the Masonite and the concrete reactor block pedestal), and the relatively high auto-ignition temperature (943°F) of Masonite. Also, characterization of the reactor block indicated that no measurable contamination is found in the Masonite layers of the biological shield (UNC 1978). Thus, even if ignition and complete combustion of the Masonite occurred, the release of hazardous materials would be insignificant.

Based on the above discussion, a significant release of radionuclides, as a result of a fire involving the reactor block, is an improbable event. Thus, this event will not be given a detailed evaluation.

4.2.1.3.2 Explosion/Chemical Reaction. BHI has evaluated the inactive reactor facilities to determine if any potentially reactive or unstable chemicals are present. That evaluation, which is documented in *Preliminary Facility Chemical Inventory Evaluation* (BHI 1997d), concluded that the reactor buildings in the scope of this ASA contain no identified or suspected inventories of reactive or unstable chemicals.

An explosion concern results from the potential presence of flammable gases within the reactor buildings. Flammable gases are not typically present within the reactor buildings, but the potential exists for them to be brought in on a limited basis for certain work activities. An additional potential source of flammable gas is the lead-acid batteries at the 105-B Reactor Building. The batteries have the potential to generate hydrogen gas, which can be explosive within a limited concentration range in air. While an explosion could credibly result in a release of hazardous materials, the potential risk is judged to be bounded by both the seismic event and the FSB fire. Thus, an explosion will not be further evaluated.

4.2.1.3.3 Spills. Degradation of a storage container (including the tanks in 105-KE and 105-KW Reactor Buildings that contain dilute ethylene glycol) or the mishandling of a container could result in a spill within a reactor building. However, because one of the major elements of the S&M program has been the identification and removal of excess hazardous materials, few containers remain within the reactor buildings. Because there are only residual quantities of liquids remaining in the reactor buildings, the consequences of a spill would be insignificant and further evaluation is unwarranted.

4.2.1.3.4 Structural Fatigue. Structural fatigue of the reactor buildings is a concern because all of the buildings have exceeded their design life and the presence of moisture has appeared to have advanced the degradation of certain components. The inspection for structural damage during facility surveillance operations is specifically intended to identify deterioration such as damaged floors, walls, ceilings, and stairways that could result in failure. Should structural fatigue cause components of the reactor buildings to fail (e.g., portion of roof or wall collapsing or plywood covers dropping into the transfer pit), a release of hazardous materials could occur due to the resultant impact. While structural fatigue could result in the release of hazardous materials, this event is judged to be bounded by the release of hazardous material caused by a seismic event.

4.2.1.3.5 Internal Flooding. The potential for internal flooding exists only at the 105-B, 105-KE, and 105-KW Reactor Buildings. The 105-B Reactor Building has one active waterline within the module 1 area, while the 105-KE and 105-KW Reactor Buildings have active water lines that are used to support the spent fuel storage operation in the FSBs. The 105-C, 105-DR, and 105-F Reactor Buildings do not have active water systems. Internal flooding could potentially result in the release of hazardous materials, but the consequences would be low due to the form and distribution of the materials (e.g., majority entrained with the reactor block, FSB contamination covered by an asphalt emulsion, sludge in the 105-B transfer pits covered with 1 to 3 ft of sand and capped with plywood, additional radioactive material predominantly nonsmearable surface contamination). Thus, this event does not require a detailed evaluation.

4.2.1.3.6 Exposure Hazards. The following exposure hazards are typically associated with S&M activities:

- Spills (including pipe or vessel ruptures) of chemicals
- Corrosion
- Spread of contamination
- Exposure to external radiation
- Uptake of radioactive materials
- Exposure to toxic materials
- Biohazards
- Extreme temperatures.

These hazards are adequately managed by institutional controls, such as the radiological control program and the safety and health program (see Section 5.3). Although the reactor blocks contain very high radiation levels (>500 R/hr), personnel will not be exposed to these levels because there are no S&M activities planned for the reactor blocks. These hazards are not evaluated further.

4.2.1.4 Nuclear Criticality. The two areas in the reactor buildings that contain the greatest quantities of radionuclides are the reactor blocks and the FSBs. The sum of the fractions of the subcritical limits for each of these areas in each reactor building (except the 105-KE and 105-KW FSBs, which are excluded from this ASA) was determined to be below 4% of the subcritical mass limits. These calculations are given in the following criticality evaluations: 0100B-CE-N0007 (BHI 1997a), 0100D-CE-N0004 (BHI 2001), 0100F-CE-N0002 (BHI 2003f), 0100K-CE-N0001 (BHI 1997b), and 0100K-CE-N0002 (BHI 1997c). Thus, criticality safety limits and controls are not needed for the reactor buildings. No further evaluation will be performed for nuclear criticality.

4.2.2 Detailed Hazard Evaluations

This section provides a more detailed evaluation of those hazards identified as requiring further evaluation in Section 4.2.1.

4.2.2.1 Seismic Event Involving the Reactor Block.

4.2.2.1.1 Associated Hazards. The inventory affected by this event is the inventory contained within the reactor block. See Section 4.1.2.1.2 for details of the reactor block inventory.

4.2.2.1.2 Applicable Activities. This is a natural phenomena hazard.

4.2.2.1.3 Radiation Exposures. An analysis was performed previously for the drop of a reactor block during one-piece transport for disposal (DOE 1989). For the purposes of this hazard analysis, it is assumed that the radiological consequences to the public and workers from such an event would adequately bound any potential releases from the 105-B, 105-C, 105-DR, 105-F, 105-KE, or 105-KW Reactor blocks during a seismic event. The 105-KE Reactor Building is analyzed as its reactor block has the largest inventory of the five inactive reactors. It is conservatively assumed that the building will collapse. The impact of the building collapse onto the reactor block is assumed to breach the biological and thermal shields, releasing graphite powder and process tube scale into the environment.

4.2.2.1.4 Nonradiological Hazardous Material Exposures. Nonradiological hazardous materials would be released during the reactor block breach, which is assumed to occur during a seismic event. This potential release would consist of metal particles, such as cadmium alloyed with the lead shielding and nickel alloyed with the aluminum within the process tube. A small fraction of these particulates could be dislodged and released to the environment. However, the consequences of a release of toxic materials would be bounded by the release of radionuclides during the seismic event scenario.

4.2.2.1.5 Mitigative Features. No activities will be performed on the reactor block during the S&M activities. No activities will be conducted that require penetrating the steel outer shell/gas seal of the reactor block. Water and gas piping may be cut and capped if (1) an AHA is performed, (2) a hot work permit is in place, and (3) radiological control requirements are met. The potential flammability of the Masonite in the biological shield of the 105-B, 105-C, 105-F, and 105-DR Reactors will be considered while preparing the required permitting, and pathways for heat and burning will be addressed.

4.2.2.1.6 Controls. The following are the project-specific and programmatic controls necessary to manage the hazards associated with the reactor block.

- Project-specific controls. No activities will be performed that penetrate the reactor block shielding, and no flame sources are allowed in proximity to the reactor core without DOE approval.

- Programmatic controls are addressed in Section 5.3.

4.2.2.2 Fire in the Fuel Storage Basin.

4.2.2.2.1 Associated Hazards. The inventory affected by this event is the inventory contained within the FSB. See Section 4.1.2.1.3 for details of the FSB inventory.

4.2.2.2.2 Applicable Activities. All S&M activities are bounded by this scenario.

4.2.2.2.3 Radiation Exposures. The following assumptions were made when evaluating the potential exposure mechanism of a fire within the FSB:

- The fire is assumed to start with the ignition of the wooden planking. Even though the planking has been treated so it is fire resistant, it is assumed that the age of the wooden planks will have lessened the effectiveness of the fire treatment.

- The burning wood is assumed to burn the asphalt emulsion, uncovering all the contamination underneath.

- The contamination underneath will then become airborne.

- While the residual basin contamination that is currently in the FSB is embedded in the concrete basin walls and floor, this analysis assumes that all the contamination in the basin is a thin surface layer of nonreactive powder.

The 105-B Reactor FSB is analyzed as it has the largest dispersible inventory of the five inactive reactors. A fire in the FSB would free radionuclide contamination from underneath the asphalt emulsion and release the contamination to the environment. It is conservatively assumed that the entire inventory of contamination in the FSB is in the form of loose powder that will be available for dispersion.

4.2.2.2.4 Nonradiological Exposures. The consequences of a release of toxic materials would be bounded by the release of radionuclides during the fire in the FSB event scenario.

4.2.2.2.5 Mitigative Features. Electrical energy is a potential initiator for an FSB fire. The 105-B Reactor Building has had all of its identified unacceptable electrical hazards mitigated. Removing the wooden planking and the asphalt, and controlling combustible material loading via ERC facility surveillance procedure requirements will significantly reduce the likelihood of a fire occurring within the basin that would result in a release of contamination.

4.2.2.2.6 Controls. Programmatic and project-specific controls are necessary to manage the fire hazard related to the FSB. Programmatic controls are addressed in Section 5.3, and the project-specific controls are identified below.

- Flammable gases and oxygen and the use of these gases will be controlled by ERC Safety and Health fire protection requirements.
- Personnel must evacuate during a fire involving the basin that would reduce any onsite exposures.

4.3 FINAL HAZARD CLASSIFICATION

The PHC analyses have been performed for the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors. The PHCs were determined by comparing the radionuclide inventories present within the reactor buildings to the threshold quantities in DOE (1992). The PHC results concluded that the 105-B, 105-C, and 105-DR Reactors were Nuclear Category 3 based on either the FSB or reactor block inventories, and that 105-KE and 105-KW Reactors were Nuclear Category 3 based on their reactor block inventories.

Based on a review of the FHC analyses performed for other surplus reactors (e.g., 105-C and 105-DR Reactors), it was suspected that a PHC of Nuclear Category 3 overstates the severity of the hazards associated with the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors. Accordingly, the FHC analyses were performed in accordance with DOE (1992), which states that such analyses are performed considering the quantity, form, location, and dispersibility of the radionuclide inventory and its interaction with available energy sources.

Three scenarios (i.e., an FSB fire and two seismic events) were selected for analysis based on the hazard identification and PHA performed for the above-identified surplus reactors and their associated ancillary facilities. The bounding analysis of these three scenarios forms the basis for the FHC determination. The radiological consequences of these three scenarios are such that the FHC of the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors and associated ancillary facilities is "Radiological."

The following three subsections summarize the FHC analyses. A more complete description of the analyses is contained in Appendix B.

4.3.1 Fuel Storage Basin Fire

The 105-B Reactor Building houses an FSB (the 105-KE and 105-KW FSBs are not included in the scope of this ASA). The basin served as a collection, storage, and transfer facility for fuel elements discharged from the reactor. The basin consists of a fuel element pickup chute, storage area, and transfer area (see Figure 2-3). In preparation for decommissioning, various efforts were made to clean and stabilize the basin. These efforts are described in UNC (1986). Table 4-9 presents the radionuclide inventories of the basin following the cleanup activities.

4.3.1.1 Summary of Assumptions and Methods – Fuel Storage Basin Fire. A fire is postulated to occur in the 105-B Reactor FSB. Although the basin is constructed of noncombustible materials, wood planking covers are present, and the asphalt emulsion placed on the basin walls and floor as a fixative during basin cleanup activities is marginally combustible. It is postulated that the wood planking ignites, burns, and falls into the basin, thus providing sufficient energy to burn the asphalt fixative and disperse the underlying contamination. The quantity of radioactive material underlying the fixative is conservatively estimated by BHI (1996c, sheet 5) to be 20% of that present in the basin sediments, which were placed in the storage basin transfer pits during cleanup activities.

The fire could spread and involve the FSB transfer pit plywood covers; however, no significant release of radioactive material from the sediments contained therein is postulated because suspension would occur via aerodynamic entrainment (which is a surface phenomenon) and the sediments are covered with sand. It is assumed that the fire does not to spread to other portions of the 105-B Reactor Building based on the facility materials of construction and relatively low combustible loading.

At the time the asphalt fixative was applied, the inventory remaining in the basin was bound to the concrete walls. For the purposes of this analysis, it is assumed that the inventory is present as a layer of chemically nonreactive powder. DOE (1994) specifies a bounding airborne release fraction (ARF) of 6×10^{-3} and a respirable fraction (RF) of 1×10^{-2} for nonreactive compounds subjected to thermal stress. Radiological consequences are calculated assuming a ground-level, point source release and adverse atmospheric dispersion conditions based on 100-N Area joint frequency data. Table 4-13 lists the assumptions used in the analysis.

4.3.1.2 Parameters and Calculated Results – FSB Fire. The dose consequences are calculated from the following equation:

$$Dose = \sum_i Inv_i \cdot ARF \cdot RF \cdot \left(\frac{X}{Q}\right) \cdot BR \cdot DCF_i$$

where:
Dose = dose consequence resulting from the accident (rem)
Inv_I = inventory of isotope I involved in the accident (Ci)
ARF = airborne release fraction
RF = respirable fraction (fraction of the released inventory that is present on respirable particles)
X/Q = atmospheric dispersion factor (s/m^3)
BR = breathing rate of the receptor (m^3/s)
DCF_I= dose conversion factor for isotope I (rem/Ci).

The atmospheric dispersion factor is a function of distance from the point of release. For FHC calculations, radiological consequences are calculated at a distance of 30 m. For information purposes, consequences were also calculated at 100 m and at the near shoreline of the Columbia River, a distance of 820 m. Table 4-14 lists the parameters used in the calculations.

Applying the values in Table 4-14, the radiological consequences of an FSB fire are as follows:

- 30 m = 1.9 rem
- 100 m = 0.24 rem
- Shoreline = 1.4×10^{-3} rem.

4.3.1.3 Conclusions – FSB Fire. The radiological consequence of a fire in the 105-B Reactor FSB is less than the 10 rem at a distance of 30 m used by DOE (1992) to define threshold quantities. Based on this analysis, the FHC for the FSB segment of the 105-B Reactor is Radiological. The degree of conservatism in the FSB inventory estimate, as provided by UNC (1987), is unknown. A back-calculation determined that the radionuclide concentrations would have to be increased by a factor of 5 before the calculated total dose to the maximally exposed individual would reach the 10 rem threshold at 30 m in a 24-hour period. This estimate bounds the possibility that higher than anticipated radionuclide concentrations may be discovered in the basin than those concentrations given in UNC (1987). To maintain the total dose below 8 rem, the basin inventory could only be increased by a factor of 4.2. If concentrations are greater than 4.2 times the estimate, the hazards involving the FSB will be reevaluated.

4.3.2 Seismic Event

A seismic event could result in structural failure of the reactor buildings. Within the buildings, the largest inventories of radioactive material are located in the FSBs and the reactor blocks.

It is assumed that the collapse of walls and roof panels into the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors and 105-B FSB would not result in significant releases of radioactive material. This assumption is based on the relative nondispersability of the material at risk. The inventory of radioactive material associated with the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor blocks is also relatively well protected from forces related to structural failure of the reactor buildings.

DOE (1989) analyzed the accidental drop of a reactor block during transport for disposal. The accident postulates that a reactor block (weighing approximately 8 million kg) is dropped from a height of 14.5 ft with the result that 1% of the graphite stack is crushed to a powder. It is assumed that the release of radioactive material from the reactor block drop accident conservatively bounds potential releases from the reactor block that might occur during a seismic event. This assumption has been previously applied to 105-DR Reactor seismic event analyses (BHI 1998f).

4.3.2.1 Summary of Assumptions and Methods – Seismic Event. A seismic event is postulated to occur resulting in structural failure of the 105-KE and 105-C Reactor Buildings. The 105-KE Reactor was selected for analysis because its graphite stack inventory is larger than the 105-B, 105-C, 105-DR, 105-F or 105-KW graphite stack inventories. The 105-C Reactor Building was selected because of its high cobalt-60 inventory (see Tables 4-2 through 4-7). Additionally, the 105-C seismic analysis performed in BHI (1996a) conservatively assumed that the cobalt-60 in the 105-C Reactor block was dispersible, thereby resulting in a higher receptor dose.

The impact of the building collapse onto the reactor block is assumed to breach the biological and thermal shields and crush 1% of the graphite into a fine (i.e., respirable) powder. Consistent with the analysis documented in DOE (1989), it is assumed that 1% of the graphite powder is resuspended by wind. In addition to crushing a portion of the graphite, it is assumed that the impact similarly dislodges and turns to powder 1% of the scale built-up within the reactor process tubes, and that 1% of powdered scale is resuspended.

The inventory of radionuclides in the graphite stack and process tube scale is not uniformly distributed. The outer edges of the reactor block were exposed to a lower neutron flux and consequently contain a lesser inventory relative to the center. Consistent with DOE (1989), a "10-to-1 peak-to-average ratio" is applied. The source term is therefore 1.0×10^{-5} (1% x 1% x 10%) of the graphite stack and process tube inventory. Radiological consequences are calculated assuming a ground-level, point source release and adverse atmospheric dispersion conditions based on 100-N Area joint frequency data. Table 4-15 lists the assumptions used in the analysis.

4.3.2.2 Parameters and Calculated Results – Seismic Event. The dose consequences are calculated from the following equation:

$$Dose = \sum_i Inv_i \cdot ARF \cdot RF \cdot \left(\frac{X}{Q}\right) \cdot BR \cdot DCF_i$$

The atmospheric dispersion factor is a function of distance from the point of release. For FHC calculations, radiological consequences are calculated at a distance of 30 m. For information purposes, consequences were also calculated at 100 m and at the near shoreline of the Columbia River, a distance of 590 m. Table 4-16 lists the parameters used in the calculations.

Applying the values in Table 4-16, the radiological consequences of a seismic event are as follows:

- 30 m = 1.7 rem
- 100 m = 0.22 rem
- Shoreline = 4.6×10^{-3} rem.

4.3.2.3 Conclusions – Seismic Event. The radiological consequence of a seismic event impacting the 105-KE and 105-C Reactors is less than the 10 rem criterion at a distance of 30 m used by DOE (1992) to define threshold quantities. Based on this analysis, the FHC for the reactor block segment of the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors is Radiological.

4.4 HAZARD SUMMARY

Routine and anticipated activities include S&M of the inactive reactors and ancillary facilities are described in Chapter 3.0. For personnel performing these activities, the principal hazards are exposure to residual quantities of radioactive and hazardous materials and standard industrial hazards. The relative risk associated with S&M activities is at an acceptably low level because of (1) the small quantities of radioactive and hazardous materials present in areas typically occupied for the performance of surveillance and maintenance activities, (2) the relatively low frequency at which facilities are entered for the conduct of routine activities, and (3) the effectiveness of BHI work control processes and safety management programs.

The relative risk to workers, the public, and the environment from potential accidents is also at an acceptably low level, as evidenced by the FHC analyses presented in Section 4.3. These analyses conservatively calculate the consequences of extreme accident conditions, i.e., a FSB fire and a seismic event. The largest dose calculated for a hypothetical worker at a distance of 30 m is 1.9 rem. The largest dose at the near shore of the Columbia River, where a member of the public could conceivably be located, is 0.0046 rem. These consequences are relatively low (e.g., they are both lower than established annual limits for workers and the public) and result in a FHC of Radiological. Although not specifically quantified, the frequency of either an FSB fire or seismic event is estimated to be low or very low such that the relative risk is acceptable.

Based on the hazard evaluation, there are no safety class or safety-significant structures, systems, or components. The absence of such structures, systems, and components is consistent with an FHC of "Radiological." The low relative risk of S&M activities is primarily maintained by passive barriers (e.g., asphalt emulsion covering the FSB walls and floor and the thermal and biological shields surrounding the reactor core) and BHI work control processes and safety management programs.

Table 4-1. Estimated Module 1 Radionuclide Inventory.

Isotope	Inventory (Ci) (October 1, 1996)	Inventory (Ci) (March 1, 1998)
Co-60	2.89 E-05	2.40 E-05
Sr-90	4.42 E-02	4.27 E-02
Cs-137	1.53 E-03	1.48 E-03
Eu-152	1.68 E-04	1.56 E-04
Eu-154	4.25 E-05	3.79 E-05

Source: BHI-00831 (BHI 1996c).

Table 4-2. Estimated Module 2 Radionuclide Inventory for the 105-B Reactor Block Only.

Isotope	Graphite Stack Inventory (Ci)		Thermal Shield Inventory (Ci)		Process Tubes Inventory (Ci)		Control System Inventory (Ci)		Bio-Shield Inventory (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	8.30E+3	4.00E+3	--	--	--	--	--	--	--	--	8.30E+3	4.00E+3
C-14	4.50E+3	4.49E+3	--	--	--	--	--	--	--	--	4.50E+3	4.49E+3
Cl-36	4.20E+1	4.20E+1	--	--	--	--	--	--	--	--	4.20E+1	4.20E+1
Ca-41	1.90E+2	1.90E+2	--	--	--	--	--	--	2.00E+0	2.00E+0	1.92E+2	1.92E+2
Ni-59	1.00E+0	1.00E+0	7.00E+0	7.00E+0	1.00E-1	1.00E-1	--	--	--	--	8.10E+0	8.10E+0
Co-60	1.00E+2	1.81E+1	8.69E+3	1.57E+3	3.00E+2	5.44E+1	1.10E+2	1.99E+1	--	--	9.20E+3	1.67E+3
Ni-63	1.80E+2	1.65E+2	8.40E+2	7.68E+2	1.00E+1	9.14E+0	--	--	--	--	1.03E+3	9.41E+2
Sr-90	1.00E+1	7.32E+0	--	--	2.00E-1	1.46E-1	--	--	--	--	1.02E+1	7.47E+0
Mo-93	--	--	4.00E-2	3.99E-2	--	--	--	--	--	--	4.00E-2	3.99E-2
Zr-93	--	--	--	--	--	--	--	--	--	--	--	--
Nb-94	3.00E-1	3.00E-1	2.00E-2	2.00E-2	--	--	--	--	--	--	3.20E-1	3.20E-1
Tc-99	--	--	2.00E-3	2.00E-3	--	--	--	--	--	--	2.00E-3	2.00E-3
Ag-108	--	--	3.00E-2	--	--	--	--	--	--	--	3.00E-2	--
Ba-133	3.20E+1	1.37E+1	--	--	--	--	--	--	--	--	3.20E+1	1.37E+1
Cs-137	3.00E+1	2.23E+1	--	--	--	--	--	--	--	--	3.00E+1	2.23E+1
Eu-152	4.00E+1	2.02E+1	--	--	1.60E+0	8.09E-1	--	--	--	--	4.16E+1	2.10E+1
Eu-154	2.00E+1	6.93E+0	--	--	1.20E+0	4.16E-1	--	--	--	--	2.12E+1	7.34E+0
Pu-239	1.00E+0	1.00E+0	--	--	--	--	--	--	--	--	1.00E+0	1.00E+0
Am-241	3.00E-1	2.94E-1	--	--	--	--	--	--	--	--	3.00E-1	2.94E-1

Source: UNI-3714, Table 7 and Table 16 (UNC 1987).

Table 4-3. Estimated Module 2 Radionuclide Inventory for the 105-C Reactor Block Only.

Isotope	Graphite Stack Inventory (Ci)		Thermal Shield Inventory (Ci)		Process Tubes Inventory (Ci)		Control System Inventory (Ci)		Bio-Shield Inventory (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	8.9E+3	4.29E+3									8.90E+3	4.29E+3
C-14	4.50E+3	4.49E+3									4.50E+3	4.49E+3
Cl-36	1.20E+1	1.20E+1									1.20E+1	1.20E+1
Ca-41	1.40E+1	1.40E+1							4.00E+0	4.00E+0	1.80E+1	1.80E+1
Ni-59			7.00E+0	7.00E+0	1.00E-1	1.00E-1					7.10E+0	7.10E+0
Co-60	6.00E+1	1.08E+1	9.89E+3	1.78E+3	3.50E+2	6.33E+1	1.10E+2	1.98E+1			1.04E+4	1.87E+3
Ni-63	2.80E+1	2.55E+1	8.40E+2	7.68E+2	1.00E+1	9.13E+0					8.78E+2	8.02E+2
Sr-90	1.00E+1	7.34E+0			2.00E-1	1.46E-1					1.02E+1	7.48E+0
Mo-93			4.00E-2	3.99E-2							4.00E-2	3.99E-2
Zr-93												
Nb-94	3.00E-1	3.00E-1	2.00E-2	2.00E-2							3.20E-2	3.20E-2
Tc-99			2.00E-3	2.00E-3							2.00E-3	2.00E-3
Ag-108			3.00E-2	2.80E-2							3.00E-2	2.80E-2
Ba-133												
Cs-137	3.00E+1	2.22E+1									3.00E+1	2.22E+1
Eu-152	4.00E+1	2.04E+1			1.70E+0	8.70E-1					4.17E+1	2.11E+1
Eu-154	2.00E+1	7.00E+0			1.30E+0	4.60E-1					2.13E+1	7.52E+0
Pu-239	1.00E+0	1.00E+0	--	--	--	--	--	--	--	--	1.00E+0	1.00E+0
Am-241	3.00E-1	2.90E-1	--	--	--	--	--	--	--	--	3.00E-1	2.90E-1

Source: UNI 3714, Table 7 and Table 17 (UNC 1987).

Table 4-4. Estimated Module 2 Radionuclide Inventory for the 105-DR Reactor Block Only.

Isotope	Graphite Stack Inventory (Ci)		Thermal Shield Inventory (Ci)		Process Tubes Inventory (Ci)		Control System Inventory (Ci)		Bio-Shield Inventory (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	4900	2,352	--	--	--	--	--	--	--	--	4900	2352
C-14	3200	3,195	--	--	--	--	--	--	--	--	3200	3195
Cl-36	26	26	--	--	--	--	--	--	--	--	26	26
Ca-41	90	90	--	--	--	--	--	--	2	2	92	92
Ni-59	1	1	5	5	0.1	0.1	--	--	--	--	6.1	6.1
Co-60	30	5.43	4060	735	200	36.2	110	19.9	--	--	4400	797
Ni-63	95	86.8	580	530	10	9.14	--	--	--	--	685	626
Sr-90	10	7.3	--	--	0.2	0.146	--	--	--	--	10.2	7.4
Mo-93	--	--	0.04	0.04	--	--	--	--	--	--	0.04	0.04
Zr-93	--	--	--	--	--	--	--	--	--	--	--	--
Nb-94	0.3	0.3	0.02	0.02	--	--	--	--	--	--	0.32	0.32
Tc-99	--	--	0.002	0.002	--	--	--	--	--	--	0.002	0.002
Ag-108	--	--	0.03	0	--	--	--	--	--	--	0.03	0
Ba-133	10	4.24	--	--	--	--	--	--	--	--	10	4.24
Cs-137	30	22.3	--	--	--	--	--	--	--	--	30	22.3
Eu-152	40	20.6	--	--	1.3	0.67	--	--	--	--	41.3	21.3
Eu-154	20	7.18	--	--	0.9	0.323	--	--	--	--	20.9	7.5
Pu-239	1	1	--	--	--	--	--	--	--	--	1	1
Am-241	0.3	0.29	--	--	--	--	--	--	--	--	0.3	0.29

Source: UNI-3714, Table 7 and Table 19 (UNC 1987).

Table 4-5. Estimated Module 2 Radionuclide Inventory for the 105-F.

Isotope	Reactor Block (Ci)		Area Within Shield Wall (Excluding Reactor Block (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	5.80E+03	2.79E+03				2.79E+03
C-14	3.70E+03	3.69E+03				3.69E+03
Cl-36	3.30E+01	3.30E+01				3.30E+01
Ca-41	1.40E+02	1.40E+02	2.00E+00	2.00E+00		1.42E+02
Ni-59	2.10E+00	2.10E+00	6.00E+00	6.00E+00		8.10E+00
Co-60	2.80E+02	5.06E+01	4.98E+03	9.00E+02		9.51E+02
Ni-63	2.00E+00	1.83E+02	6.80E+02	6.21E+02		8.04E+02
Sr-90	1.02E+01	7.46E+00		8.22E-05		7.46E+00
Mo-93		0.00	4.00E-02	3.99E-02		3.99E-02
Zr-93		0.00				0.00
Nb-94	3.00E-01	3.00E-01	2.00E-02	2.00E-02		3.20E-01
Tc-99		0.00	2.00E-03	2.00E-03		2.00E-03
Ag-108		0.00	3.00E-02	0.00		0.00
Ba-133	2.60E+01	1.10E+01				1.10E+01
Cs-137	3.00E+01	2.22E+01		3.51E-04		2.22E+01
Eu-152	4.14.E+01	2.09E+01		3.81E-05		2.09E+01
Eu-154	2.10E+01	7.27E+00		9.18E-06		7.27E+00
Pu-239	1.00E+00	1.00E+00				1.00E+00
Am-241	3.00E-01	2.94E-01				2.94E-01

Source: UNI-3714 (UNC 1987) and BHI-01151 (BHI 1998e).

Table 4-6. Estimated Module 2 Radionuclide Inventory for the 105-KE Reactor Block Only.

Isotope	Graphite Stack Inventory (Ci)		Thermal Shield Inventory (Ci)		Process Tubes Inventory (Ci)		Control System Inventory (Ci)		Bio-Shield Inventory (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	3.00E+4	1.45E+4	--	--	--	--	--	--	--	--	3.00E+4	1.45E+4
C-14	7.00E+3	6.99E+3	--	--	--	--	--	--	--	--	7.00E+3	6.99E+3
Cl-36	5.40E+1	5.40E+1	--	--	--	--	--	--	--	--	5.40E+1	5.40E+1
Ca-41	1.00E+0	1.00E+0	--	--	--	--	--	--	1.50E+1	1.50E+1	1.60E+1	1.60E+1
Ni-59	--	--	9.00E+0	9.00E+0	1.30E+1	1.30E+1	--	--	--	--	2.20E+1	2.20E+1
Co-60	5.00E+0	9.06E-1	1.75E+4	3.17E+3	1.90E+2	3.44E+1	1.10E+2	1.99E+1	--	--	1.78E+4	3.23E+3
Ni-63	1.10E+1	1.01E+1	1.20E+3	1.10E+3	1.70E+3	1.55E+3	--	--	--	--	2.91E+3	2.66E+3
Sr-90	1.00E+1	7.32E+0	--	--	3.00E-1	2.20E-1	--	--	--	--	1.03E+1	7.54E+0
Mo-93	--	--	6.00E-2	5.98E-2	2.00E-1	1.99E-1	--	--	--	--	2.60E-1	2.59E-1
Zr-93	--	--	--	--	1.10E+1	1.10E+1	--	--	--	--	1.10E+1	1.10E+1
Nb-94	1.10E+0	1.10E+0	3.00E-2	3.00E-2	6.00E-1	6.00E-1	--	--	--	--	1.73E+0	1.73E+0
Tc-99	--	--	3.00E-3	3.00E-3	3.00E-2	3.00E-2	--	--	--	--	3.30E-2	3.30E-2
Ag-108	--	--	4.00E-2	--	--	--	--	--	--	--	4.00E-2	--
Ba-133	1.00E+0	4.30E-1	--	--	--	--	--	--	--	--	1.00E+0	4.30E-1
Cs-137	3.00E+1	2.23E+1	--	--	--	--	--	--	--	--	3.00E+1	2.23E+1
Eu-152	4.00E+1	2.02E+1	--	--	2.00E+0	1.01E+0	--	--	--	--	4.20E+1	2.12E+1
Eu-154	2.00E+1	6.93E+0	--	--	1.60E+0	5.54E-1	--	--	--	--	2.16E+1	7.48E+0
Pu-239	1.00E+0	1.00E+0	--	--	--	--	--	--	--	--	1.00E+0	1.00E+0
Am-241	3.00E-1	2.94E-1	--	--	--	--	--	--	--	--	3.00E-1	2.94E-1

Source: UNI-3714, Table 7 and Table 22 (UNC 1987).

Table 4-7. Estimated Module 2 Radionuclide Inventory for the 105-KW Reactor Block Only.

Isotope	Graphite Stack Inventory (Ci)		Thermal Shield Inventory (Ci)		Process Tubes Inventory (Ci)		Control System Inventory (Ci)		Bio-Shield Inventory (Ci)		Total Inventory (Ci)	
	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998	March 1, 1985	March 1, 1998
H-3	2.70E+4	1.30E+4	--	--	--	--	--	--	--	--	2.70E+4	1.30E+4
C-14	6.70E+3	6.69E+3	--	--	--	--	--	--	--	--	6.70E+3	6.69E+3
Cl-36	5.20E+1	5.20E+1	--	--	--	--	--	--	--	--	5.20E+1	5.20E+1
Ca-41	5.00E+0	5.00E+0	--	--	--	--	--	--	1.50E+1	1.50E+1	2.00E+1	2.00E+1
Ni-59	--	--	9.00E+0	9.00E+0	1.10E+1	1.10E+1	--	--	--	--	2.00E+1	2.00E+1
Co-60	5.00E+0	9.06E-1	1.45E+4	2.63E+3	1.70E+2	3.08E+1	1.10E+2	1.99E+1	--	--	1.48E+4	2.68E+3
Ni-63	1.50E+1	1.37E+1	1.10E+3	1.01E+3	1.50E+3	1.37E+3	--	--	--	--	2.62E+3	2.39E+3
Sr-90	1.00E+1	7.32E+0	--	--	3.00E-1	2.20E-1	--	--	--	--	1.03E+1	7.54E+0
Mo-93	--	--	6.00E-2	5.98E-2	2.00E-1	1.99E-1	--	--	--	--	2.60E-1	2.59E-1
Zr-93	--	--	--	--	1.00E+1	1.00E+1	--	--	--	--	1.00E+1	1.00E+1
Nb-94	1.10E+0	1.10E+0	3.00E-2	3.00E-2	6.00E-1	6.00E-1	--	--	--	--	1.73E+0	1.73E+0
Tc-99	--	--	3.00E-3	3.00E-3	3.00E-2	3.00E-2	--	--	--	--	3.30E-2	3.30E-2
Ag-108	--	--	4.00E-2	--	--	--	--	--	--	--	4.00E-2	--
Ba-133	1.00E+0	4.30E-1	--	--	--	--	--	--	--	--	1.00E+0	4.30E-1
Cs-137	3.00E+1	2.23E+1	--	--	--	--	--	--	--	--	3.00E+1	2.23E+1
Eu-152	4.00E+1	2.02E+1	--	--	2.00E+0	1.01E+0	--	--	--	--	4.20E+1	2.12E+1
Eu-154	2.00E+1	6.93E+0	--	--	1.60E+0	5.54E-1	--	--	--	--	2.16E+1	7.48E+0
Pu-239	1.00E+0	1.00E+0	--	--	--	--	--	--	--	--	1.00E+0	1.00E+0
Am-241	3.00E-1	2.94E-1	--	--	--	--	--	--	--	--	3.00E-1	2.94E-1

Source: UNI-3714, Table 7 and Table 23 (UNC 1987).

Table 4-8. Estimated Module 2 Radionuclide Inventory (Area Within Shield Walls [Excluding Reactor Block]).

Isotope	Inventory (Ci) (October 1, 1996)	Inventory (Ci) (March 1, 1998)
Co-60	7.02E-06	5.83E-06
Sr-90	8.50E-05	8.22E-05
Cs-137	3.63E-04	3.51E-04
Eu-152	4.10E-05	3.81E-05
Eu-154	1.03E-05	9.18E-06

Source: BHI-00831 (BHI 1996c).

Table 4-9. Estimated Fuel Storage Basin Inventory.

Isotope	105-B FSB Estimated Inventory (Ci)	
	March 1, 1985	March 1, 1998
Ni-59	5.00E-1	5.00E-1
Co-60	1.10E+1	1.99E+0
Ni-63	6.00E+1	5.48E+1
Se-79	--	--
Kr-85	--	--
Sr-90	1.40E+1	1.02E+1
Zr-93	--	--
Nb-94	--	--
Tc-99	--	--
Pd-107	--	--
Cd-113	--	--
Cs-137	1.60E+1	1.19E+1
Sm-151	--	--
Eu-152	1.40E+0	7.08E-1
Eu-154	4.20E+0	1.45E+0
Pu-238	7.50E-2	6.77E-2
U-238	9.00E-3	9.00E-3
Pu-239	1.60E+0	1.60E+0
Pu-240	--	--
Am-241	5.00E-1	4.90E-1
Pu-241	--	--

Source: UNI-3958 (UNC1986) and UNI-3714 (UNC 1987).

Table 4-10. Radioactive Inventories of the Ancillary Facilities. (3 Pages)

Building Name	Inventory (Based on Hazard Identification Tables in Appendix A)
116-B Reactor Exhaust Stack	Minor levels of fixed contamination. No radiation levels were detected above background from the exterior of the stack. The material cannot cause harm unless the stack loses its structural integrity, and is insufficient to cause a significant environmental problem if released.
119-B Building	None.
1608-B Gas Line Pressure/Vacuum Seal House	Pipes leading from the oil pressure control building to the diesel tank are posted as a contaminated area. Any contents would be in the form of residual contamination. Surveys showed no direct or smearable contamination. The diesel oil tank is posted as a contaminated area. Any contents would be in the form of residual contamination. Oil samples from the diesel oil tank showed no hazardous constituents; the oil has since been removed. See estimated inventory shown in Appendix A, Table A-4.
190-DR Pumphouse	Contaminated tools used in D&D. Tools are wrapped in plastic and are believed to be only slightly contaminated.
182-K Emergency Water Reservoir Pumphouse	No radiation levels detected above background. Access to the building is not governed by a RWP.
183-K Pipe Tunnels	The structure is uncontaminated.
1720-K Administrative Office Building	The building is uncontaminated. Access to the building is not governed by a RWP.
110-KE Gas Storage Facility	None. Access to the building is not governed by a RWP.
115-KE Gas Recirculation Building	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media. Radiological characterization (performed in 1976) indicated maximum readings of 30 mR/hr on the condensers in the dryer rooms. The average true limiting dose rate ranged from <1 mR/hr to 2 mR/hr. Smears taken to determine alpha contamination indicate a maximum of 15 dpm/100 cm^2 at the floor drain in the booster blower room.
116-KE Reactor Exhaust Stack	No exterior levels detected above background. Stack interior was decontaminated to unrestricted release levels. No alpha or beta-gamma contamination was detectable with portable instrumentation. Smearable and fixed alpha contamination <100 dpm/100 cm^2.
117-KE Exhaust Air Filter Building	Mixed fission products and plutonium present as surface contamination and holdup in filter media. No exterior levels detected above background. Process equipment (e.g., filters) is contaminated. Interior surfaces of the building have been coated with a sealant. Radiological characterization indicated maximum readings of 5 mR/hr for filters in B cell. The average true limiting dose rate for the various rooms ranged from <1 mR/hr to 1 mR/hr. The maximum smearable alpha and beta contamination levels, 30 dpm/100 cm^2 and 30,000 dpm/100 cm^2, respectively, were measured at the first filter frame in the B cell. The smearable alpha contamination averaged approximately 10 dpm/100 cm^2.
118-KE-2 Horizontal Control Rod Storage Cave	Activated metal. One HCR tip is stored in the south cave. Radiation level at the cave entrance with the door open is 1 mR/hr.

Table 4-10. Radioactive Inventories of the Ancillary Facilities. (3 Pages)

Building Name	Inventory (Based on Hazard Identification Tables in Appendix A)
150-KE Heat Recovery Station	Area surrounding the metal structure is designated as a contamination area due to underground radioactive material. The metal building provided shelter for heat recovery control systems, but did not contain radioactive material. Heat recovery equipment (i.e., heat exchangers, electric pump, and the associated piping) was in the reactor effluent discharge flowpath, but located external to the building. Heat exchangers have been removed. No data regarding contamination of remaining equipment.
166-KE Oil Storage Facility	Vault is uncontaminated.
110-KW Gas Storage Facility	Potential for minor amounts of fixed surface contamination in the bunker portion, which is located within a radiological buffer area. Documentation indicates that there are no radiation levels detected above background in the outdoor gas storage area.
115-KW Gas Recirculation Building	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media. Radiological characterization (performed in 1976) indicated maximum readings of 65 mR/hr on the condensate drainlines and turbine in the #1 dryer room. The average true limiting dose rate ranged from <1 mR/hr to 5 mR/hr. Smears taken to determine alpha contamination indicate a maximum of 6,000 dpm/100 cm^2 on the louvered exhaust duct in the wall to the 105-KW Pipe Tunnel. The average value was approximately 500 dpm/100 cm^2.
116-KW Reactor Exhaust Stack	No exterior levels were detected above background. Stack interior was decontaminated to unrestricted release levels. No alpha or beta-gamma contamination was detectable with portable instrumentation. Smearable and fixed alpha contamination <100 dpm/100 cm^2.
117-KW Exhaust Air Filter Building	Mixed fission products and plutonium present as surface contamination and holdup in filter media. No exterior levels detected above background. Process equipment (e.g., filters) contaminated. Interior surfaces of the building have been coated with a sealant. Radiological characterization indicated maximum readings of 2.5 mR/hr in the inlet tunnel. The average true limiting dose rate for the various rooms ranged from <1 mR/hr to 2 mR/hr. The maximum smearable alpha and beta contamination levels, 1,250 dpm/100 cm^2 and 225,000 dpm/100 cm^2, respectively, were measured at inlet tunnel. The smearable alpha contamination averaged approximately 100 dpm/100 cm^2.
118-KW-2 Horizontal Control Rod Storage Cave	Activated metal. Four HCR tips are stored in the caves. Radiation level at the cave entrance with the door open is 50 mR/hr.
119-KW Exhaust Air Sample Building	None. The building is uncontaminated.
150-KW Heat Recovery Station	Area surrounding the metal structure is designated as a contamination area due to underground radioactive material. The metal building provided shelter for heat recovery control systems, but did not contain radioactive material. Heat recovery equipment (i.e., heat exchangers, electric pump, and the associated piping) was in the reactor effluent discharge flowpath, but located external to the building. Heat exchangers have been removed. No data regarding contamination of remaining equipment.
165-KW Power Control Building	Documentation indicates no radiation levels above background.
166-KW Oil Storage Facility	Documentation indicates that it is uncontaminated.

Table 4-10. Radioactive Inventories of the Ancillary Facilities. (3 Pages)

Building Name	Inventory (Based on Hazard Identification Tables in Appendix A)
181-KW River Pumphouse	The facility is uncontaminated.
183-KW Filter Plant	Documentation provides somewhat conflicting information. Generally indicates that no radioactive material was used or stored, but BHI (1994) indicates the presence of a radiation zone.
190-KW Process Water Pumphouse	Documentation indicates no radiation levels above background. Access to the building is not governed by a RWP.

D&D = decontamination and decommissioning
HCR = horizontal control rod
RBA = radiological buffer area
RWP = radiological work permit

Table 4-11. Nonradiological Hazardous Material Inventory of the 105 Reactor Buildings.

Location	Hazardous Material
Effectively throughout the 105 Reactor Buildings. Also potentially present in the ancillary buildings. Lead-based paint in the exhaust tunnels.	Unknown quantities of lead-based paint and other lead objects (e.g., bricks and blankets). Various types of lead shielding in radiologically controlled area/surface contamination area locations.
	Minor quantities of chemical compounds (e.g., cleaners, solvents, and household brands) left over from operation/partial deactivation activities.
Areas of the 105 Reactor Buildings containing switches and other devices.	Unknown quantities of mercury.
Various pieces of equipment located in all buildings.	Unknown quantities of various heavy metals.
Effectively throughout all buildings (particularly the 105 Reactor Buildings).	Unknown quantities of nonpiping asbestos insulation (including transite wall coverings) that may be friable if degraded or damaged.
Control room, valve pit, areas containing light ballast, and some areas containing oil in the 105 Reactor Buildings. Also possible in ancillary buildings where oils accumulated.	Unknown quantities of polychlorinated biphenyls. Potential exists to find small quantities of sodium dichromate in the valve pits.

Table 4-12. Nonradiological Hazardous Material Inventories of the Ancillary Facilities. (2 Pages)

Building Name	Inventory (Based on hazard identification tables in Appendix A)
116-B Reactor Exhaust Stack	Based on information regarding historical operation, it is anticipated that there are no hazardous materials associated with the stack.
119-B Building	No hazardous materials in the building.
1608-B Gas Line Pressure/Vacuum Seal House	Mercury in thermostat, manometer containing unknown fluid, lead containing light bulb and lead paint, and asbestos in panels and tank gasket.
190-DR Pumphouse	6 mercury switches, asbestos, and 32,000 lb of silica crystalline quartz.
182-K Emergency Water Reservoir Pumphouse	Mercury in thermometers and piping, lead sheet, residual ethylene glycol liquid in pipes.
183-K Pipe Tunnels	Asbestos insulation, friable if degraded or damaged.
1720-K Administrative Office Building	The building contains asbestos, but the staff interview indicated that the building has no known asbestos hazards.
115-KE Gas Recirculation Building	The potential exists for small quantities of mercury to be found in glass containers. There is one mercury switch. The building potentially has asbestos concerns because of piping and ductwork.
116-KE Reactor Exhaust Stack	Based on information regarding historical operation, it is anticipated that there are no hazardous materials associated with the stack.
117-KE Exhaust Air Filter Building	The building contains asbestos insulated piping for service water, compressed air, and instrument lines.
118-KE-2 Horizontal Control Rod Storage Cave	None. The building was used for temporary storage of radioactive HCR tips.
150-KE Heat Recovery Station	None noted.
166-KE Oil Storage Facility	Available references provide no information regarding hazardous materials other than to indicate that it was once used for inactive (nonradioactive) waste material storage.
110-KW Gas Storage Facility	None. Tanks are present but empty.
115-KW Gas Recirculation Building	The building potentially has asbestos concerns because of piping and ductwork.
116-KW Reactor Exhaust Stack	Based on information regarding historical operation, it is anticipated that there are no hazardous materials associated with the stack.
117-KW Exhaust Air Filter Building	The building contains asbestos insulated piping for service water, compressed air, and instrument lines.
118-KW-2 Horizontal Control Rod Storage Cave	None. The building was used for temporary storage of radioactive HCR tips.
119-KW Exhaust Air Sample Building	None.
150-KW Heat Recovery Station	None noted.
165-KW Power Control Building	Asbestos insulation, friable if degraded or damaged. Two mercury switches and one manometer. Residual ethylene glycol in pipe traps, and underground glycol tanks of unknown status. Two 5-gal buckets of sodium hypochlorite.
166-KW Oil Storage Facility	Available references provide no data regarding hazardous materials.
181-KW River Pumphouse	Documentation indicates that there are no hazardous materials associated with this facility.

Table 4-12. Nonradiological Hazardous Material Inventories of the Ancillary Facilities. (2 Pages)

Building Name	Inventory (Based on hazard identification tables in Appendix A)
183-KW Filter Plant	Friable asbestos in piping located adjacent to southeast corner of building. Asbestos insulation, friable if degraded or damaged. Staff interview indicated that all of the residual chemicals have been removed from the building.
190-KW Process Water Pumphouse	Asbestos insulation, friable if degraded or damaged; 95% of facility insulation in good condition. Mercury switches and ethylene glycol residual in pipes. Staff interview indicated that all of the residual chemicals have been removed from the building.

Table 4-13. Assumptions Used in Fuel Storage Basin Final Hazard Classification Evaluation.

Assumption Number	Assumption
1	105-B Reactor FSB inventories are bounding
2	Wood planking ignites and burns
3	Asphalt fixative on basin walls and floor burns
4	Radioactive material in FSB transfer pits does not significantly contribute to release
5	Fire does not spread to reactor block
6	Radioactive material on basin walls and floor present as a loose, nonreactive powder
7	Activity on basin walls and floor equal to 20% of basin sediment activity
8	Respirable release fraction is 6E-5
9	Ground-level, point source release model
10	No building wake dilution
11	100-B Area joint frequency data similar to 100-N Area
12	Contaminated air and smoke is not restricted by the FSB walls and roof

Table 4-14. Parameters Used in Fuel Storage Basin Dose Calculations.

Parameter	Value
Inv_I	See BHI-00981, Rev. 4 (BHI 2002a)
ARF	6E-03
RF	1E-2
X/Q	5.79E-01 at 30 m 7.32E-02 at 100 m 4.45E-04 at 820 m
BR	3.33E-04
DCF_I	See BHI-00981, Rev. 4 (BHI 2002a)

ARF = airborne release factor
BR = breathing rate
DCF_I = dose conversion factor for isotope i
INV_I = *inventory of isotope i involved in the accident* (Ci)
RF = respirable fraction X/Q = atmospheric dispersion factor (s/m^3)

Table 4-15. Assumptions Used in Seismic Event Final Hazard Classification Evaluation.

Assumption Number	Assumption
1	No significant contribution from fuel storage basin inventories
2	105-KE and 105-C Reactor block inventories are bounding
3	Impact of heavy loads (i.e., collapsing structure) on reactor block bounded by DOE (1989) transport drop accident analysis
4	1% of graphite and process tube scale crushed to respirable powder
5	1% of graphite powder and powdered scale resuspended by wind action
6	10% factor applied to radionuclide inventory to account for nonuniform neutron flux
7	Ground-level, point source release model
8	No building wake dilution
9	100-KE Area joint frequency data similar to 100-N Area

Table 4-16. Parameters Used in Seismic Event Dose Calculations.

Parameter	Value
Inv_I	See BHI-00981, Rev. 4 (BHI 2002a)
ARF	1E-05
RF	1
X/Q	5.79E-01 at 30 m 7.32E-02 at 100 m 1.52E-03 at 590 m
BR	3.33E-04
DCF_I	See BHI-00981, Rev. 4 (BHI 2002a)

ARF = airborne release factor
BR = breathing rate
DCF_I = dose conversion factor for isotope i
INV_I = inventory of isotope i involved in the accident (Ci)
RF = respirable fraction
X/Q = atmospheric dispersion factor (s/m^3)

5.0 CONTROL AND COMMITMENTS

5.1 SPECIAL CONTROLS

To ensure that the FHC of Radiological remains valid, no activities will be conducted that require penetrating the steel outer shell/gas seal of the reactor blocks. Water and gas piping may be cut and capped if (1) an AHA is performed, (2) a hot work permit is in place, and (3) radiological control requirements are met. The potential flammability of the Masonite in the biological shield at the 105-B, 105-C, 105-DR, and 105-F Reactors will be considered while preparing the required permitting, and pathways for heat and burning will be addressed.

5.2 PROJECT-SPECIFIC CONTROLS

5.2.1 Occupational Safety Controls

Operations performed during the S&M of the inactive reactors and ancillary facilities that potentially involve significant nonradiological hazards include the following:

- Removal of asbestos
- Removal of lead paint
- Removal of PCBs from existing equipment
- Removal of lead and mercury containing items.

These activities are controlled with established BHI procedures and through the work control process. Specifically, the following are applicable: (1) asbestos removal (BHI-FS-01, Section 8.1); (2) lead paint removal (BHI-SH-02, Section 4.2.2, Volume 3); (3) removal of PCBs from existing equipment (health and safety plan and AHA); and (4) removal of lead- and mercury-containing items (BHI-SH-02, Section 4.2.2).

5.2.2 Management of Change

All proposed changes and discovered conditions are subjected to a prescreening in accordance with BHI-DE-01, EDPI 4.40-01. If the prescreening is negative, then the proposed change may be implemented on contractor authority without further action. An affirmative response to any prescreening question requires completion of a screening evaluation in accordance with EDPI 4.40-01.

5.3 PROGRAMMATIC CONTROLS

The programmatic controls, as described in the following subsections, were determined to be necessary to control the hazards identified in Section 4.2.

5.3.1 Conduct of Operations

Conduct of operations is imposed to ensure that the work that is performed is controlled and organized, that all aspects of work activities have been considered, and that the necessary documentation is maintained.

Conduct of operations for S&M activities is addressed by the ERC Conduct of Operations Graded Approach Applicability Matrix. This matrix identifies the applicable elements of DOE Order 5480.19, for S&M activities, and the implementing documents for these activities. This graded approach to conduct of operations has been approved by RL. Changes to the ERC Conduct of Operations Program and matrix will occur, subject to appropriate DOE review and approval, and do not require evaluation to this document.

Conduct of operations strongly emphasizes technical competency, workplace discipline, and personal accountability to ensure all activities are performed safely and effectively. All planning for S&M activities shall include appropriate safety analyses to identify the potential safety and health risks associated with the activities and the means to control them.

Conduct of operations requires workers to be alert and aware of the conditions affecting the job site. Workers performing field activities are required to be notified of changes to the facility and/or work area status and of any abnormalities or difficulties encountered in the work area. Similarly, workers are required to notify the appropriate personnel of any unexpected conditions encountered in the work area.

5.3.2 Work Controls

In accordance with BHI-FS-01, one of three work processes is used to schedule and control S&M work (for nonemergency conditions) at the 100 Areas inactive reactors: (1) routine work, (2) SMWR, and (3) DWR. The process used is dependent on the work to be accomplished.

Routine work is defined as any fieldwork that is included on the routine work list, which is provided as an attachment to BHI-FS-01. Routine work tasks are repetitive, familiar, and have a low potential risk of exposing workers to unusual hazards. Examples of routine work include relamping, removal of surplus equipment, and minor electrical work (220 V or less). Routine work does not require a work package unless it has the potential to defeat or compromise special controls in effect from other activities. The process of identifying, planning, and accomplishing routine work is conducted using a graded approach commensurate with the complexity and hazards of the specific task.

A SMWR is a request that initiates the performance of scheduled maintenance work (including routine surveillance) or preventive maintenance. The SMWR uses TIs to direct established, fixed-cycle maintenance activities (e.g., facility surveillance and inspecting emergency lights). Safety and health hazards potentially encountered while performing scheduled maintenance work, along with applicable controls, are addressed in the TIs. If hazards are not addressed within the TI, the TI is revised or a DWR is initiated. The process of identifying, planning, and accomplishing scheduled maintenance work is conducted using a graded approach commensurate with the complexity and hazards of the specific task.

A DWR for the S&M activities at the inactive reactors is any work request other than routine work or scheduled maintenance. Thus, a DWR is required if the work is not covered by the routine work list or the SMWR. The DWR defines the workscope and work package contents and contains provisions for appropriate approvals and releases. For demand work, members of appropriate work organizations (e.g., Radiological Controls, Safety and Health, Crafts, Project Engineering) participate in a job walkdown to provide input for work package preparation. Assessments are made regarding the work scope, materials needed, radiological conditions, safety hazards, and waste streams are identified.

As part of DWR development, additional written safety documentation is required to meet the requirements for a site safety and health plan, as specified in 29 CFR 1910.120 and DOE Order 5480.9A. The decision logic regarding the required safety documentation for a specific work activity is given in BHI-SH-02. Dependent on the work activity, a SS HASP or an AHA would be prepared. The preparation, review, and approval processes for both the SS HASP and AHA are given in BHI-SH-02. Safety and Health review and approval is required for each document.

Work packages are a compilation of the documents required to implement the work request. The work package includes documents or references such as TIs, safety and protective requirements, procedures, permits, and the approvals necessary to accomplish a work activity. The packages are reviewed and approved, per the requirements of BHI-FS-01 by appropriate functional groups (e.g., Field Engineering, Safety and Health, and Radiological Control) to ensure that the requirements and documentation are appropriate for the work to be performed. The review of work packages includes an evaluation under the MOC process to determine the proper approval authority for the activity.

After review and approval, the work package is issued and the work is performed as it is identified in the work package. The work is documented as required. The work package is then reviewed for completeness and data accumulation. If it is determined to be acceptable, the work package is dispositioned in accordance with BHI-FS-01. If the work package is not acceptable because of a deficiency, a DR is prepared in accordance with BHI-FS-01. Disposition of the DR requires the involvement of Field Engineering and Design Engineering and must be completed before closing the work package. Should the disposition of the DR result in a revision to the work package, the revised work package will initiate the MOC process to evaluate the impact of the discovered deficiency to this ASA. Changes to BHI-FS-01 will not require review against this ASA.

5.3.3 Radiological Protection Program Controls

The radiological controls and protection program is defined in DOE-approved programs and BHI-approved procedures BHI-SH-02 (Vols. 1 and 2), BHI-SH-04, and BHI-SH-01. The program implements the ERC policy to reduce safety and health risks to levels that are ALARA and ensures that workers are adequately protected. Appropriate dosimetry, radiological work permits, personnel protective equipment, ALARA planning, periodic surveys, and radiological control technician support are provided.

The standard BHI controls for work in radiological areas are sufficient to control the inactive reactors S&M activities. These controls provide for the preparation (in accordance with BHI-SH-04 and BHI-SH-02) and use of RWPs that inform workers of the minimum requirements to safely perform radiological work. The RWPs identify the expected radiological conditions of an activity and specify controls and precautions pertinent to the activity. Issuance of a RWP requires a radiological survey to determine the radiological conditions of the work area. In addition, all work in radiological areas is periodically or continuously supported by a radiological control technician.

All work in radiological areas is evaluated to determine ALARA planning requirements. 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 performed during the S&M of the inactive reactors.

The Radiological Protection Program implements the requirements of 10 CFR 835 and has been approved by DOE. Changes to the ERC Radiological Protection Program will occur, but review and approval of such changes does not require review of this document.

5.3.4 Worker Health and Safety Controls

The ERC Health and Safety Program is composed of the following 10 elements: radiation protection, industrial safety, industrial hygiene, nuclear safety, fire protection, occupational health, hazardous waste operations, safety and health, emergency management, and ALARA. All of these elements protect the health and safety of the worker, but the elements of particular importance for the majority of S&M activities are radiation protection, industrial safety, and industrial hygiene. Radiation protection was discussed in the preceding section. BHI-SH-01 defines the Industrial Safety Program. Important elements of industrial safety for S&M activities include electrical, lockout/tagout, and vehicle safety. BHI-SH-01 defines the Industrial Hygiene Program and other related programs. Industrial hygiene protects workers by anticipating, recognizing, evaluating, and controlling chemical, biological, physical, and other environmental factors potentially detrimental to worker health. Important elements of industrial hygiene for S&M activities include hazard communication, asbestos control, confined space, respiratory protection, temperature extremes, and lead control.

Implementing procedures have been developed for each element of the Health and Safety Program. These procedures define the scope, applicability, management, employee involvement, worksite analysis, hazard prevention and control, and training requirements associated with the work to be performed. Review and approval of changes to the ERC Health and Safety Program do not require evaluation to this document.

5.3.5 Training Requirements

Personnel are trained and qualified to perform their assigned duties based on job-specific requirements. Training requirements ensure that personnel are properly instructed to work safely in and around radiological areas, and to maintain their radiation exposure and the exposure of others ALARA. Personnel performing special processes must be qualified according to the appropriate codes and standards. Qualifications are established by management. Facility-specific training on hazards associated with the facility is also provided for S&M workers. Special briefings (e.g., pre-job briefings and POD meetings) are conducted when new hazards are encountered or existing hazards are changing.

Procedures define responsibilities and methods to establish training requirements, course work, individual training plans, and training records. The depth of training in any discipline will be commensurate with the potential hazards associated with the work and the knowledge required to complete the work.

5.3.6 Maintenance Requirements

Only four systems currently require routine maintenance within the inactive reactor facilities: (1) the emergency lights for the 105-B Reactor Building, (2) the fire extinguishers located within the 105-B Reactor Building, (3) the ventilation system, and (4) the electric heaters. Should specific repairs be required as a result of a discovery of an off-normal condition during a routine surveillance, demand work packages may be prepared if the activity does not fall under the criteria of routine work in accordance with BHI-FS-01.

5.3.7 Configuration Control

Established configuration/change control processes ensure that proposed changes are reviewed in relation to the specified commitments. If a breach of these commitments is discovered, work ceases to allow stabilization and recovery actions to 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 MOC process and requirements for facilities with a FHC of less than nuclear (e.g., Radiological). Changes to BHI DE-01 will not be required to be reviewed against this ASA.

5.3.8 Quality Assurance

The ERC Quality Program is described in BHI-QA-01, Parts I, II, and III. Part I consolidates the quality program requirements of the BHI-DOE Prime Contract and applicable regulations and DOE orders; Part II describes how the quality program requirements are implemented through a system of manuals and procedures, and Part III describes how the ERC Quality Program will be implemented for nuclear workscopes. BHI-QA-01 has been reviewed and approved by DOE as meeting the requirements of DOE Order 5700.6C, *Quality Assurance*.

5.3.9 Emergency Preparedness

The Emergency Management Plan (EMP) for ERC complies with and implements the requirements of DOE-RL (1996) and applicable DOE orders. The EMP establishes a coordinated emergency response organization (ERO) capable of planning for, responding to, and recovering from industrial, security, or hazardous material incidents.

The EMP ensures these activities are integrated with similar activities of other Hanford Site contractors; RL; and relevant local, tribal, state, and Federal agencies. The EMP provides for organizational control of emergencies; training; emergency preparedness drills, assessment, and classification; preparation of emergency procedures, plans, and guides; and post-accident reentry and recovery.

The EMP defines the ERO that has responsibility for managing emergency incidents affecting ERC facilities and for providing as-needed emergency response assistance elsewhere on the Hanford Site. The ERC ERO provides representatives and support to the Hanford Site ERO and Emergency Operation Center.

6.0 REFERENCES

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10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," *Code of Federal Regulations*, as amended.

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BHI, 1997g, *Preliminary Hazard Classification for the 105-F Reactor*, BHI-01082, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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BHI, 1998b, *100-KW Deactivation Manual*, Ref. No. 0505-625, Bechtel Hanford, Inc., Richland, Washington.

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

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APPENDIX A

PRELIMINARY HAZARDS ANALYSIS

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APPENDIX A

PRELIMINARY HAZARDS ANALYSIS

A.1 INTRODUCTION

This appendix documents the preliminary hazards analysis conducted in support of the 100 Area surplus reactors. The hazards analysis consists of two parts: a hazard identification (Section 3.0) and a hazard evaluation (Section 4.0).

The scope of this analysis includes the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings and ancillary facilities described below. The 105-KE and 105-KW fuel storage basins (FSBs) are excluded from the scope of this analysis.

A.2 FACILITY SUMMARY DESCRIPTIONS

A.2.1 Reactor Buildings

The 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings are very similar in design. For hazards analysis purposes, the buildings have been divided into four areas: module 1, module 2, the reactor blocks, and the FSBs. The locations of the reactor buildings and ancillary facilities are given in Figures 2-2, 2-8, 2-9, and 2-10. Figures 2-3, 2-11, and 2-12 show the layout of the reactor building and designate the module 1, module 2, reactor block, and FSB areas.

Module 1. Module 1 provided support areas during the former reactor operations. These areas included office areas, change rooms, ventilation equipment areas, and other infrastructure support. The retired support areas are free of reactor process areas, except for the outer rod room. The 105-C, 105-DR, and 105-F support areas have been removed as part of the interim safe storage (ISS) activities.

Module 2. Module 2 is the area inside the shield walls, excluding the reactor block. Module 2 includes such areas as the front-face work area, inner rod room, discharge area, sample room, C and D elevators, elevator machinery room, electrical equipment rooms, ball room, process radiation monitoring, gas instrument room, tunnels, laboratory, and tool dolly.

Reactor block. The reactor building consists of a graphite moderator stack encased in an overlapping cast-iron thermal shielding; a welded biological shield consisting of alternating layers of Masonite® and steel on the four sides (excluding the bottom of the stack); and an unwelded, stair-step labyrinth seal shield on top. The 105-KE and 105-KW Reactor biological

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shields are instead made of heavy aggregate concrete. The entire block rests on a concrete foundation. The main components of the block, shown in Figure 2-5, are as follows:

- The reactor moderator stack (an assembly of graphite blocks cored to provide channels for the process tubes, horizontal control rods [HCRs], and other equipment)
- The aluminum and Zircaloy-2 process tubes that held the uranium metal fuel elements and provided channels for cooling water
- HCRs, gun barrels, monitoring equipment, experimental test holes, etc.
- The thermal and biological shields
- A welded steel-plate box that encloses the biological shield and served to confine the gas atmosphere within the reactor.

Entry into the reactor block is excluded from current surveillance and maintenance (S&M) activities.

Fuel storage basins. The FSB served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. The FSB complex consists of a fuel element pickup area, storage area, and transfer area. The 105-B FSB has been drained and cleared of debris, and a fixative has been applied to radiologically contaminated surfaces. The removed sludge was placed in the transfer pit, where it remains covered by a layer of sand and a wood deck. Part of the 105-C and 105-DR FSB was removed as part of the ISS activities. The remainder of the facility was covered with soil. The 105-F FSB was demolished and removed during the decontamination and decommissioning (D&D) efforts associated with the ISS Project. The 105-KE and 105-KW FSBs are not included in this analysis.

A.2.2 Ancillary Facilities

116-B Reactor Exhaust Stack. The stack was used to discharge ventilation air 200 ft above grade from the 105-B Reactor Building. The stack has been isolated from sources of potential contamination within the reactor building.

119-B Building. The unlabeled 119-B Building was used as a storage building and should not be confused with the 119-B Exhaust Sampling Enclosure. A 119-B Exhaust Sampling Enclosure did exist, but is not within the scope of this auditable safety analysis (ASA). The unlabeled 119-B Building was used as a storage building. The building is now empty.

1608-B Gas Line Pressure/Vacuum Seal House. (Effluent waste water pumping station designation number was used because 105-B Reactor facility did not have a lift station building.) The building contained the apparatus to provide a gas line pressure vacuum for the 105-B Reactor gas system. The facility is no longer used.

190-DR Pumphouse. The pumphouse was used to supply treated water to the reactor for cooling and to other equipment requiring cooling water. The building is currently used for warehouse purposes, and includes a radioactive materials area (RMA) for tools used in D&D.

110-KE Gas Storage Facility. The facility was the gas-receiving and storage area for the 115-KE Gas Recirculation Building reactor graphite media (cooling) gas. The facility consisted of a number of high-pressure helium tanks contained within a bunker (an attached structure to the 115-KE Building) and four large-diameter outdoor tanks used for carbon dioxide storage.

110-KW Gas Storage Facility. The facility was the gas-receiving and storage area for the 115-KW Gas Recirculation Building reactor graphite media (cooling) gas. The facility consisted of a number of high-pressure helium tanks contained within a bunker (an attached structure to the 115-KW Building) and four large-diameter outdoor tanks used for carbon dioxide storage.

115-KE Gas Recirculation Building. The 115-KE Gas Recirculation Building housed gas-circulating pumps and associated equipment for the 105-KE Reactor gas coolant system. The building still contains gas dryer towers, heaters/coolers, condensers, filters, pumps, silica gel drying beds, heating and ventilation systems, piping, and ductwork.

115-KW Gas Recirculation Building. The 115-KW Gas Recirculation Building housed gas-circulating pumps and associated equipment for the 105-KW Reactor gas coolant system. The building still contains gas dryer towers, heaters/coolers, condensers, filters, pumps, silica gel drying beds, heating and ventilation systems, piping, and ductwork.

116-KE Reactor Exhaust Stack. The 116-KE Reactor Exhaust Stack discharged ventilation air from the 105-KE Reactor Building, 91.4 m above grade. In 1982, the stack was decontaminated to a level less than detectable by portable survey instruments, the height was reduced, and the clean rubble was placed inside the remaining portion of the stack. The stack has been isolated from sources of potential contamination within the reactor building.

116-KW Reactor Exhaust Stack. The 116-KW Reactor Exhaust Stack discharged ventilation air from the 105-KW Reactor Building, 91.4 m above grade. In 1982, the stack was decontaminated to a level less than detectable by portable survey instruments, the height was reduced, and the clean rubble was placed inside the remaining portion of the stack. The stack has been isolated from sources of potential contamination within the reactor building.

117-KE Exhaust Air Filter Building. The 117-KE Exhaust Air Filter Building filtered ventilation air exhausted from the confinement zone of the 105-KE Reactor Building before discharge to the atmosphere through the 116-KE Reactor Exhaust Stack. The interior surfaces of the building have been coated with polyvinyl (Ply-On) to facilitate decontamination.

117-KW Exhaust Air Filter Building. The 117-KW Exhaust Air Filter Building filtered ventilation air exhausted from the confinement zone of the 105-KW Reactor Building before discharge to the atmosphere through the 116-KW Reactor Exhaust Stack. The interior surfaces of the building were coated with polyvinyl (Ply-On) to facilitate decontamination.

118-KE-2 horizontal control rod storage cave. The 118-KE-2 horizontal control rod storage cave was used to temporarily store radioactive HCR tips to allow for radioactive decay pending subsequent disposal. The structure is a reinforced concrete bunker covered with an overlay of dirt and gravel. The structure currently contains one HCR tip.

118-KW-2 horizontal control rod storage cave. The 118-KW-2 horizontal control rod storage cave was used to temporarily store radioactive HCR tips to allow for radioactive decay pending subsequent disposal. The structure is a reinforced concrete bunker covered with an overlay of dirt and gravel. The structure currently contains four HCR tips.

119-KW Exhaust Air Sample Building. The 119-KW Exhaust Air Sample Building housed instrumentation used to continuously monitor exhaust air from the 105-KW Reactor Building for radionuclides. The building is located over the ventilation exhaust ducts leading to the 117-KW Exhaust Air Filter Building.

150-KE Heat Recovery Station. The 150-KE Heat Recovery Station consists of a small, prefabricated metal control building and an outdoor area that contained the motor, heat exchangers, and associated piping used to recover heat from the effluent discharge of the 105-KE Reactor Building.

150-KW Heat Recovery Station. The 150-KW Heat Recovery Station consists of a small, prefabricated metal control building and an outdoor area that contained the motor, heat exchangers, and associated piping used to recover heat from the effluent discharge of the 105-KW Reactor Building.

165-KW Power Control Building. The 165-KW Power Control Building provided housing for the power house, control room, valve pit, and electrical switchgear for the water supply system. The majority of the building is not currently being used. The switchgear room of 165-KW Building is being used in support of the Spent Fuels Program (SFP) K Basins operations and is not within the scope of this ASA.

166-KE Oil Storage Facility. The 166-KE Oil Storage Facility was used to store oil for the 165-KE Power Control Building boilers from 1955 to 1971 and was subsequently used to store Bunker C fuel oil for the 100-N Area from 1981 to 1985. The facility has two underground reinforced-concrete storage bunkers that have been drained and retired, but approximately 2,000 gal of oil remains in the form of a heel.

166-KW Oil Storage Facility. The 166-KW Oil Storage Facility was used to store Bunker C fuel oil. The facility has two underground reinforced-concrete storage bunkers that have been drained and retired, but approximately 2,000 gal of oil remains in the form of a heel.

1720-K Administrative Office Building. The 1720-K Administrative Office Building originally provided facilities for the Hanford Security Patrol, duplicating, and mail operations. The building was subsequently used to provide office facilities for 100 Areas decommissioning operations and engineering to support the decommissioning programs. The building is unoccupied.

181-KW River Pumphouse. The 181-KW River Pumphouse was used to transfer raw Columbia River water from the river to the 183-KW Filter Plant.

182-K Emergency Water Reservoir Pumphouse. The 182-K Emergency Water Reservoir Pumphouse houses diesel engine-driven pumps and associated equipment used for emergency reactor cooling. Water could be pumped from either the 105-KE or 105-KW clearwells to either the 105-KE or 105-KW Reactor Buildings if emergency cooling was required. The building is no longer in use, but remains energized. The underground diesel oil storage tanks located adjacent to the building were drained and removed. A tank in the building still contains 250 to 300 gal of lube oil.

183-K Pipe Tunnels. The 183-K Pipe Tunnels are below-grade tunnels housing the pipelines that carried effluent water from the 183-KE and 183-KW Filter Plants to the 190-KE and 190-KW Process Water Pumphouse Buildings. The tunnels contain metal walkways and the piping associated with the water delivery system between the filter plants and the pumphouses.

183-KW (Process Water) Filter Plant. The 183-KW Filter Plant provided water treatment for the 100-K Area by filtering and chemically treating Columbia River water. The filter plant consists of a head house, chlorine storage facility, a flocculation and subsidence basin, a filter area, and underground storage tanks. The chlorine storage facility (designated as 183.1 KW Chlorine Vault) is not addressed by this ASA. The facility it is used by the SFP to temporarily store spent ion exchange columns used by K Basin operations to remove cesium-137 from the water in the 105-KE and 105-KW FSBs.

190-KW Process Water Pumphouse. The 190-KW Process Water Pumphouse houses process and service water pumps and ventilation equipment. The facility supplied treated water to the 105-KW Reactor Building for cooling and to other equipment requiring cooling water. The building is no longer used to supply treated water. The building is currently used to store some electrical/mechanical equipment. The south and east bays are used by the SFP for K Basin equipment staging and are not covered by this ASA. The building is currently energized.

A.3 PRELIMINARY HAZARDS IDENTIFICATION

The hazardous materials associated with the inactive reactors and their ancillary facilities, and the energy sources capable of interacting with the materials, were identified by (1) researching potentially relevant documentation, (2) interviewing personnel familiar with the historic operations and current status of the buildings and structures, (3) performing walkdowns of several facilities, (4) conducting a hazards workshop involving personnel from different disciplines, and (5) using engineering judgment. This information was used to obtain historic operations information, S&M information, inventory data, and information regarding the current status of structures and equipment. Bechtel Hanford, Inc. (BHI) and U.S. Department of Energy, Richland Operations Office (RL) personnel assisted in the hazard identification process by providing information on features and hazards requiring inclusion, defining the level of detail appropriate for the facilities and the long-term S&M mission, and reviewing interim hazard identification documentation.

The preliminary hazard identification is documented in Tables A-1 through A-32. These tables have six columns. The column headings and content are described below.

Column 1. Hazard Type

This column identifies the type of hazard investigated. Hazard types investigated include: radioactive material, direct radiation, fissile material, hazardous material (i.e., toxic, carcinogenic), biohazards, asphyxiant, flammable/combustible material, reactive material, explosive material, electrical energy, thermal energy, kinetic energy, and high pressure.

Column 2. Location

This column identifies the location investigated for the presence of the hazard type. Because the 105 Reactor Buildings are relatively large, they are subdivided into specific areas (e.g., module 1, module 2, FSB, and reactor block) for hazards identification purposes. Refer to the facility descriptions for detailed information.

Column 3. Form

This column specifies the form of the hazard type. Note that this column is not intended to provide a detailed identification of the chemical (e.g., oxide) or physical (e.g., crystalline) form of the hazard type. Such detail is not considered at the hazard identification stage of a safety analysis.

Column 4. Quantity

This column quantifies the form of the hazard type. Measured values are presented when relevant and available.

Column 5. Remarks

This column presents information that provides for a better understanding of the hazard type, location, form, and quantity.

Column 6. References

This column lists the information sources used to identify the location, form, and quantity of a given hazard type.

A.4 PRELIMINARY HAZARDS EVALUATION

The hazards identification, which considered all of the buildings and structures contained within the scope of the ASA, was used to determine which facilities required hazard evaluation. Specifically, those facilities identified as containing insignificant or no radioactive/hazardous materials and/or judged to present only standard industrial or occupational hazards were eliminated from further evaluation. Application of these criteria allowed the following facilities to be dismissed from further consideration:

- 116-B Reactor Exhaust Stack
- 119-B Building
- 1608-B Gas Line Pressure/Vacuum Seal House
- 190-DR Pumphouse
- 105-KW Process Water Tunnel
- 182-K Emergency Water Reservoir Pumphouse
- 183-K Pipe Tunnels
- 1720-K Administrative Office Building
- 110-KE and 110-KW Gas Storage Facilities
- 116-KE and 116-KW Reactor Exhaust Stacks
- 118-KE-2 and 118-KW-2 Horizontal Control Rod Storage Caves
- 150-KE and 150-KW Heat Recovery Stations
- 119-KW Exhaust Air Sample Building
- 181-KW River Pumphouse
- 183-KW Filter Plant
- 190-KW Process Water Pumphouse.

The rest of the facilities required additional evaluation based on the hazards identification results.

The preliminary hazards evaluation is documented in Tables A-33 through A-45. These tables have 10 columns. The column headings and content are described below.

<u>Column 1. Item</u>

This column sequentially numbers the table rows for ease of reference.

<u>Column 2. Potential Event</u>

This column identifies an event (e.g., fire) that, if it were to occur, could result in negative consequences to workers, the public, or the environment.

Column 3. Location

This column identifies the building (e.g., 105-B Reactor Building) or a specific location within a building (e.g., module 1) impacted by the potential event. Refer to the facility descriptions for detailed information.

Column 4. Hazard Type

This column identifies the type of hazard (e.g., radioactive material) that could negatively impact workers, the public, or the environment. Column entries are selected from Tables A-1 through A-32, Facility Hazards Identification, as appropriate.

Column 5. Event and Possible Causes

This column describes the impact of the event at the location being evaluated and identifies possible causes. For example, a loss of electrical power caused by equipment failure can result in a loss of negative pressure differential and lead to the migration of contamination.

Column 6. SSCs

This column identifies structures, systems, and components (e.g., building structure) that potentially serve a preventive or mitigative function.

Column 7. Administrative

This column identifies administrative features (e.g., emergency procedures) that potentially serve a preventive or mitigative function.

Column 8. "C"

This column identifies the consequence ranking assigned to the event (see following discussion).

Column 9. "L"

This column identifies the likelihood ranking assigned to the event (see following discussion).

Column 10. Detailed Hazards Eval.

This column identifies (e.g., yes/no) if the event has been selected for detailed evaluation. If an event is not selected, the rationale is provided.

Columns 8 and 9 present the consequence and likelihood rankings for a given event. There are four consequence ranks, as defined below:

Consequence Rank I – Catastrophic

This is the highest consequence rank assigned in the hazards analysis. Included are events that can cause death to individuals from any means, including exposure to radioactive or hazardous materials. No differentiation is made between onsite and offsite individuals.

Consequence Rank II – Severe

This consequence rank encompasses events that could produce severe injury, significant lost work time, or long-term disability. This rank refers to acute consequences, implying radioactive or toxic material exposure must be severe and occur in a relatively short time. For example, radiation doses on the order of 200 rem result in severe debilitating effects that would be considered acute as well as severe. Similarly, contact with hazardous materials, such as acids and bases, could produce severe, acute injury. As was the case for rank I, no differentiation is made between onsite and offsite individuals.

Consequence Rank III – Unplanned Releases

This consequence rank is assigned to events that could release radioactive or hazardous material outside the facility, but would not result in catastrophic or severe impacts. This rank encompasses impacts to onsite and offsite individuals as well as insults to the environment. Consequence rank III is further divided into three subranks: (1) releases resulting in significant environmental contamination, (2) releases resulting in minor environmental contamination, and (3) releases resulting in insignificant environmental contamination that may or may not exceed regulatory guidelines.

Consequence Rank IV – Minor

This consequence rank is assigned to events that result in minor injury, but no release outside the facility. While many events that would receive this designation are screened out of the hazardous analysis, some may be included to provide documentation they were considered as potential event initiators.

There are also five likelihood ranks defined as follows.

Likelihood Rank A – Frequent

Likely to occur frequently. Such an event could occur on an annual basis.

Likelihood Rank B – Probable

Likely to occur several times in the life of an item. Such an event could occur once in 10 years (1×10^{-1}/yr).

Likelihood Rank C - Occasional

Likely to occur sometime in the life of an item. Such an event could occur once in 100 years (1 x 10^{-2}/yr).

Likelihood Rank D – Remote

Unlikely, but possible to occur in the life of an item. Such an event could occur once in 10,000 years (1 x 10^{-4}/yr).

Likelihood Rank E – Improbable

So unlikely that it can be assumed the occurrence will not be experienced. Such an event could occur once in 1 million years (1 x 10^{-6}/yr).

The methodology used to assign likelihood and consequence rankings is based on the methodology developed in WHC (1993) and applied in BHI (1994a). In BHI (1994a), the consequence and likelihood rankings were combined to derive the overall risk associated with a given facility. The risk associated with differing facilities could then be compared and factored into resource allocation decisions. Risk estimates for the facilities were not developed, as the goal of the safety analysis is to identify and analyze hazards to ensure that all authorized activities are accounted for and adequately controlled.

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Table A-1. Summary of 105-B Reactor Building Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-B Reactor Building: Module 1 (general ancillary area of the reactor building, excluding the FSB)	Mixed fission products (primarily Sr-90); minor amount of fixed surface contamination.	<0.046 Ci total activity.	The radionuclide inventory for module 1 is assumed to be equivalent to the inventory determined for the 105-C Reactor Building module 1. The majority of the inventory in module 1 of the 105-C Reactor Building is found in the lift station sump. The 105-B Reactor Building does not have a lift station sump as dirty drain water was discharged into the effluent system. Therefore, the inventory assumed is known to be conservative.	BHI-00831 (BHI 1996a), Appendix A, provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-B Reactor Building inventory is further developed in Section 4.1.2.1.
	105-B Reactor Building: Module 2 (area within reactor shield excluding reactor block)	Mixed fission products, primarily present as surface contamination.	<5.1E-04 Ci total activity (excluding the reactor block).	The radionuclide inventory for module 2 is assumed to be equivalent to the inventory determined for the 105-C Reactor Building module 2 (excluding the reactor block).	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-B Reactor Building inventory is further developed in Section 4.1.2.1.
	105-B Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields)	Primarily activated material in the graphite stack, thermal shield, and corrosion film on process tubes.	2.34E+04 Ci total activity. 1.3 Ci alpha activity.	Contamination entrained in reactor block and shielding.	UNI-3714 (p. 45) (UNC 1987)
	105-B Reactor Building: FSB/transfer pit	Activation and corrosion products.	1.1E+02 Ci total activity. 2.1 Ci alpha activity.	Asphalt emulsion fixative in FSB, sludge has been moved into the transfer pit and covered with a layer of sand and a plywood cap.	UNI-3714 (p. 41) (UNC 1987)
Direct Radiation	105-B Reactor Building: Module 1 (general ancillary area of reactor building excluding the FSB)	Mixed fission products, primarily present as fixed contamination.	<0.046 Ci total activity.	The radionuclide inventory for module 1 is assumed to be equivalent to the inventory determined for the 105-C Reactor Building module 1. The majority of the inventory in module 1 of the 105-C Reactor Building is found in the lift station sump. The 105-B Reactor Building does not have a lift station sump as dirty drain water was discharged into the effluent system. Therefore, the inventory assumed is known to be conservative.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-B Reactor Building inventory is further developed in Section 4.1.2.1.

Table A-1. Summary of 105-B Reactor Building Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Direct Radiation	105-B Reactor Building: Module 2 (area within reactor shield walls excluding reactor block)	Mixed fission products, primarily present as surface contamination. Location is subject to direct radiation emitted from the reactor block.	<5.1E–04 Ci total activity within module 2 (excluding the reactor block).	The radionuclide inventory for module 2 is assumed to be equivalent to the inventory determined for the 105-C Reactor Building module 2 (excluding the reactor block). Moderate to high exposure rates in the immediate vicinity of the inner control rod rooms, reactor rear face, mezzanine, and top of reactor vertical safety control rod actuators, due to nearby radioactively contaminated reactor block.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-B Reactor Building inventory is further developed in Section 4.1.2.1.
	105-B Reactor Building: Module 2 reactor block	Activated material in moderator stack, thermal and biological shields, and corrosion film on process tubes.	2.34E+04 Ci total activity. 1.3 Ci alpha activity.	Energetic gamma emitters possible in immediate vicinity (e.g., Ball 3X system) of activated structures (e.g., graphite stack, thermal shield); however, breach of the reactor block is excluded from current S&M activities.	UNI-3714 (p. 45) (UNC 1987)
	105-B Reactor Building: FSB/transfer pit	Activation and corrosion products.	1.1E+02 Ci total activity. 2.1 Ci alpha activity.	Asphalt emulsion fixative in FSB, sludge has been moved into the transfer pit and covered with a layer of sand and a plywood cap.	UNI-3714 (p. 41) (UNC 1987)
	105-B Reactor Building: Tour route (control room, hallway, and front face)	Mixed fission products.		Periodically 105-B is toured by members of the public. CCN 052780 (letter by T. N. Turpin, 1997) states that adolescents (between the ages of 16 and 18 years) are not allowed in areas where dose rates are greater than 50 μrem/yr.	CCN 052780 (p. 2) (Turpin 1997) 10 CFR 835
Fissionable Material	105-B Reactor Building: Module 2 reactor block	Pu-239 present in the graphite stack.	1.0 Ci (in 1985).		UNI-3714 (p. 45) (UNC 1987)
	105-B Reactor Building: FSB/transfer pit	Activation and corrosion products.	0.075 Ci Pu-238 1.6 Ci Pu-239 0.5 Ci of Am-241 (in 1985).		UNI-3714 (p. 41) (UNC 1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-B Reactor Building: All areas	Asbestos in the form of piping insulation, transite wall board, ventilation components, and insulation (friable if degraded or damaged).	Unknown quantities.	Abatement program in place to remove asbestos from facility. Majority of asbestos is in nonfriable form, and is located in radiation zones and in transfer area where S&M activities occur infrequently.	BHI-00066 (p.2-3) (BHI 1997a) BHI-00221 (p.3-6) (BHI 1994b) WHC-EP-0619 (p. 3-3) (WHC 1993) WHC-SP-0331, Rev. 1, (p. A-17) (WHC 1994)

Table A-1. Summary of 105-B Reactor Building Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-B Reactor Building: All areas	Lead shielding in the form of lead shot, brick, and cast forms; also lead-based paint.	98.5 tons	Abatement program in place to remove lead from facility. Majority of lead is in nondispersible form and is located in radiation zones and in transfer area where S&M activities occur infrequently. Greater oxidation rates of lead occur than anticipated based on arid climatic conditions, resulting in dispersible lead oxide.	BHI-00066 (p.2-3) (BHI 1997a) BHI-00221 (p. 3-6) (BHI 1994b) WHC-EP-0619 (p. 3-3) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
	105-B Reactor Building: All areas	Mercury contained in switches and instruments.	Unknown quantities.	Not readily dispersible; not significantly impacted by S&M activities.	BHI-00221 (p. 3-6) (BHI 1994b)
	105-B Reactor Building: All areas	PCBs contained in electrical and lighting equipment.	Unknown quantity.	PCBs are contained and do not present a hazardous material concern.	Historical knowledge
	105-B Reactor Building: All areas	Miscellaneous.	Negligible.	Miscellaneous chemicals remaining have been removed during 5-year cleanup campaign. Potential exists to discover old containers of chemicals	Staff interview
	105-B Reactor Building	Tank with heel.	300-gal tank, unknown quantity of heel	Heel emitting strong odor.	BHI-00221 (p. 3-6) (BHI 1994b)
Biohazard	105-B Reactor Building	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 105-B Reactor Building, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	BHI-00066 (p. 2-3) (BHI 1997a) BHI-00221 (p. 3-6) (BHI 1994b) WHC-EP-0619 (p. 3-4) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
Asphyxiant/ Confined Spaces	105-B Reactor Building: All areas	Unventilated below-grade structures as well as above-grade areas.	Not quantified.	Unventilated below-grade structures not appropriately posted as "Confined Spaces." Areas that were checked for oxygen were found safe. Numerous confined spaces under concrete cover blocks; in accessible water basins; and in drains, manways, and valve pits around the building.	BHI-00066 (p. 2-2) (BHI 1997a) WHC-EP-0619 (p. 3-5 and C1-9) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-16) (WHC 1994)
Flammable/ Combustible Material	105-B Reactor Building: Module 2 reactor block	Graphite blocks.	2,086 yd^3.	While graphite can burn, there is no ignition source of sufficient energy present in the facility to ignite the graphite.	Staff interview
	105-B Reactor Building: FSB/transfer pit	Wooden planking over basin.	39 yd^3.	Power is provided to the structure. The wooden planking is fire resistant; however, the ability to resist combustion will have decreased due to the age.	BHI-00066 (p.2-2) (BHI 1997a) WHC-SP-0331, Rev. 1 (p. A-16) (WHC 1994)

Table A-1. Summary of 105-B Reactor Building Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Reactive Material	105-B Reactor Building	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	BHI-00052 (p. B-2) (BHI 1994a) BHI-00066 (p. 2-3) (BHI 1997a)
Explosive Material	105-B Reactor Building	Hydrogen gas.	Unknown quantity of lead-acid batteries.	Hydrogen gas can be generated during charging of batteries.	WHC-EP-0619 (p. 3-7) (WHC 1993)
	105-B Reactor Building	Miscellaneous chemicals.	Negligible.	Miscellaneous chemicals remaining have been removed during 5-year cleanup campaign. Potential exists to discover old containers of chemicals. Only a few chemicals can produce an explosive condition.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
Electrical Energy	105-B Reactor Building	The building is supplied by 480 V.	Not applicable.	Abnormal conditions are presented in WHC-EP-0619 (WHC 1993) (e.g., inconsistencies in tagging and labeling, a lack of regular preventive maintenance). Also note frequent presence of offsite tour groups.	WHC-EP-0619 (p. 3-3) (WHC 1994) BHI-00066 (p. 2-2) (BHI 1997a) WHC-SP-0331, Rev. 1 (p. A-16) (WHC 1994)
Thermal Energy	105-B Reactor Building	Portable space heaters.	Six heaters.	None outside that routinely encountered in industry.	
Kinetic Energy	105-B Reactor Building	Structural components.	Not applicable.	Structure occupied occasionally during S&M activities and for tours; roof structures in fair condition.	BHI-00066 (p. 2-2) (BHI 1997a)
	105-B Reactor Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-B Reactor Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	105-B Reactor Building	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the current phase of the building, it is anticipated that there is no high pressure.	WHC-EP-0331, Rev. 0 (WHC 1988)
Natural Phenomena	105-B Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-B Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-B Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None

Table A-1. Summary of 105-B Reactor Building Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	105-B Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snow has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-B Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-B Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

FSB = fuel storage basin
HCR = horizontal control rod
PCB = polychlorinated biphenyl
S&M = surveillance and maintenance

Table A-2. Summary of 116-B Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	116-B Reactor Exhaust Stack: Interior	Isotopes similar to those at 116-KE and 116-KW are assumed to be present as surface contamination. These isotopes include Co-60, Cs-137, Sr-90, Eu-152, Eu-154, C-14, Pu-239, and H-3.	Minor levels of fixed contamination. No radiation levels detected above background.	The material cannot cause harm unless the stack loses it structural integrity, and is insufficient to cause a significant environmental problem if released.	WHC-EP-0619 (p. 3-7 through 3-8) (WHC 1993) BHI-00221 (p. 3-7) (BHI 1994b)
Direct Radiation	116-B Reactor Exhaust Stack	Fixed contamination.	Not appreciable.	Available references provided no information regarding direct radiation; however, assumed to be low levels of direct radiation.	WHC-EP-0619 (WHC 1993)
Fissionable Material	116-B Reactor Exhaust Stack	Fixed contamination.	Not appreciable.	Available references provided no information regarding fissionable material; however, assumed to be low levels of fissionable material.	WHC-EP-0619 (WHC 1993)
Hazardous Material (e.g., toxic, carcinogenic)	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding hazardous material; however, based on the historical use of the building it is anticipated that there are no hazardous materials.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993)
Biohazard	In and around structure	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 116-B Exhaust Stack, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	WHC-SP-0331, Rev. 1 (p. A-20) (WHC 1994)
Asphyxiant/ Confined Spaces	116-B Reactor Exhaust Stack	Confined space.	Not applicable.	Stack will not be entered under normal S&M.	
Flammable/ Combustible Material	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding flammable materials; however, based on the historical use of the building it is anticipated that there are no flammable materials.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993)
Reactive Material	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding reactive materials; however, based on the historical use of the building it is anticipated that there are no reactive materials.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993)
Explosive Material	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding explosive materials; however, based on the historical use of the building it is anticipated that there are no explosive materials.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993)

Table A-2. Summary of 116-B Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Electrical Energy	116-B Reactor Exhaust Stack	Not applicable.	None.	There is no electrical service to this structure.	BHI-00221 (p. 3-7) (BHI 1994b) WHC-SP-0331, Rev. 1 (p. A-20) (WHC 1994)
Thermal Energy	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding thermal energy; however, based on the historical use of the building it is anticipated that there are no thermal energy sources.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993)
Kinetic Energy	116-B Reactor Exhaust Stack	Structural components.	Not applicable.	Structure unoccupied during S&M activities.	
	116-B Reactor Exhaust Stack	Aircraft crash.	Not applicable.	Probability of such an event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	116-B Reactor Exhaust Stack	Vehicle impact.	Not applicable.	Probability of such an event is low.	
High Pressure	116-B Reactor Exhaust Stack	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the historical use of the building it is anticipated that there is no high pressure.	BHI-00221 (BHI 1994b) WHC-SP-0331, Rev. 1 (WHC 1994) WHC-EP-0619 (WHC 1993)
Natural Phenomena	116-B Reactor Exhaust Stack	Earthquake of sufficient magnitude to result in structural damage to the facility.	Not applicable.	The potential exists for an earthquake to topple the stack, resulting in a release of radioactive materials.	None
	116-B Reactor Exhaust Stack	Flooding of sufficient magnitude to result in structural intrusion.	Not quantified.	Flooding could result in water interacting with the radioactive materials.	None
	116-B Reactor Exhaust Stack	Precipitation infiltrates the building.	Not applicable.	Precipitation could infiltrate the stack and interact with the radioactive materials.	None
	116-B Reactor Exhaust Stack	Lightning strike on stack.	Not applicable.	Lightning could strike the stack and interact with radioactive materials.	None
	116-B Reactor Exhaust Stack	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could potentially topple the stack and impact the radioactive materials.	None

S&M = surveillance and maintenance

Table A-3. Summary of 119-B Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there is no contamination in the building. A RWP is not needed to enter 119-B.	Staff interview Access requirements (BHI 1996b)
Direct Radiation	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there is no contamination in the building.	Staff interview
Fissionable Material	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there is no contamination in the building.	Staff interview
Hazardous Material (e.g., toxic, carcinogenic)	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there are no hazardous materials in the building.	Staff interview
Biohazard	Unlabeled 119-B Building	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the unlabeled 119-B Building, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	Historical knowledge
Asphyxiant/ Confined Spaces	Unlabeled 119-B Building	Not applicable.	None.	The unlabeled 119-B Building is an empty, small wooden building.	Staff interview
Flammable/ Combustible Material	Unlabeled 119-B Building	Wood structural components.	Not quantified.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there are no flammable materials in the building. The structure is constructed of flammable material.	Staff interview
Reactive Material	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there are no reactive materials in the building.	Staff interview

Table A-3. Summary of 119-B Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Explosive Material	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there are no explosive materials in the building.	Staff interview
Electrical Energy	Unlabeled 119-B Building	Not applicable.	None.	There is no electrical service to this structure.	Staff interview
Thermal Energy	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there is no thermal energy in the building.	Staff interview
Kinetic Energy	Unlabeled 119-B Building	Structural components.	Not applicable.	Structure assumed to be occupied infrequently during S&M activities.	Staff interview
	Unlabeled 119-B Building	Aircraft crash.	Not applicable.	Probability of such an event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	Unlabeled 119-B Building	Vehicle impact.	Not applicable.	Probability of such an event is low.	
High Pressure	Unlabeled 119-B Building	Not applicable.	None.	Available references provided no information regarding the unlabeled 119-B Building; however, staff interviews revealed that there is no high pressure in the building.	Staff interview
Natural Phenomena	Unlabeled 119-B Building	Not applicable.	None.	Based on historical use and the assumption that the building is currently empty, there is no potential for a natural phenomena event to interact with radioactive or hazardous materials.	None

RWP = radiological work permit
S&M = surveillance and maintenance

Table A-4. Summary of 1608-B Gas Line Pressure/Vacuum Seal House Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	1608-B Gas Line Pressure/ Vacuum Seal House (Oil Pressure Control House)	Pipes leading from oil pressure control building to diesel tank are posted as a contaminated area. Any contents would be in the form of residual contamination transported from the 115-B/C Gas Recirculation Building via the process tunnel that connected the two structures. Radionuclides present in 115-B/C included tritium, C-14, Co-60, Sr-90, Cs-137, Eu-152, and Pu-239.	Assumed to be minor residual quantities.	A RWP is not needed to enter 1608-B. Surveys showed no direct or smearable contamination. S&M activities will not disturb contents of piping.	BHI-00836 (pp. D-5 and D-8) (BHI 1996c) WHC-EP-0331, Rev. 0 (p. A-29) (WHC 1988)
	1608-B Gas Line Pressure/ Vacuum Seal House (Diesel Oil Tank)	Diesel oil tank is posted as a contaminated area. Any contents would be in the form of residual contamination transported from the 115-B/C Gas Recirculation Building via the process tunnel that connected the two structures. Radionuclides present in 115-B/C included tritium, C-14, Co-60, Sr-90, Cs-137, Eu-152, and Pu-239.	Assumed to be minor quantities.	Oil samples of the tank performed before the tank was drained showed no hazardous constituents.	BHI-00836 (pp. D-5 and D-8) (BHI 1996c)

Table A-4. Summary of 1608-B Gas Line Pressure/Vacuum Seal House Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	1608-B Gas Line Pressure/ Vacuum Seal House (Seal Pit)	Any contents would be in the form of residual fixed contamination transported from the 115-B/C Gas Recirculation Building via the process tunnel that connected the two structures. Radionuclides present in 115-B/C included tritium, C-14, Co-60, Sr-90, Cs-137, Eu-152, and Pu-239.	Unknown quantities.	Background readings were approximately 4,000 to 6,000 dpm beta/gamma. No loose contamination was detected. However, due to high radon levels no direct readings were taken. The seal pit is connected to the gas tunnel. The assumption is made that the 1608-B Seal Pit is contaminated to the same extent as the attached 115-B Pipe Tunnel. Because the 115-B tunnel has greater surface area than the 1608-B Facility, it can be assumed conservatively that the two combined facilities contain less than 2.32E-3 Ci Co-60, 1.50E-3 Ci Cs-137, 2.48E-5 Ci Eu-154, 3.54E-5 Ci Am-241, and 1.53E-4 Ci Sr-90 (which is double the contamination found in 115-B). The sum of the RQ ratios is well under 1, demonstrating a hazard classification of Industrial.	BHI-00836 (p. D-5 and D-8) (BHI 1996c) Brehm (1997)
Direct Radiation	1608-B Gas Line Pressure/ Vacuum Seal House	Any contents would be in the form of residual contamination transported from the 115-B/C Gas Recirculation Building via the process tunnel that connected the two structures. Radionuclides present in 115-B/C included tritium, C-14, Co-60, Sr-90, Cs-137, Eu-152, and Pu-239.	Assumed to be minor residual quantities.	See discussion above on radioactive material.	BHI-00836 (p. D-5) (BHI 1996c)
Fissionable Material	1608-B Gas Line Pressure/ Vacuum Seal House	Any contents would be in the form of residual contamination transported from the 115-B/C Gas Recirculation Building via the process tunnel that connected the two structures. Radionuclides present in 115-B/C included tritium, C-14, Co-60, Sr-90, Cs-137, Eu-152, and Pu-239.	Assumed to be minor residual quantities.	See discussion above on radioactive material.	BHI-00836 (p. D-5) (BHI 1996c)

Table A-4. Summary of 1608-B Gas Line Pressure/Vacuum Seal House Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	1608-B Gas Line Pressure/ Vacuum Seal House (Oil Pressure Control House)	Mercury in thermostat and manometer containing unknown fluid.	Unknown quantities.	Metallic mercury is not readily dispersible; not significantly impacted by S&M activities.	BHI-00221 (p. 3-8) (BHI 1994b) BHI-00836 (p. D-5 and D-10) (BHI 1996c)
	1608-B Gas Line Pressure/ Vacuum Seal House (Oil Pressure Control House)	Lead-containing lightbulb and lead-containing paint.	Minor quantities.	Not readily dispersed. Not significantly impacted by S&M activities.	BHI-00836 (p. D-10) (BHI 1996c)
	1608-B Gas Line Pressure/ Vacuum Seal House (Oil Pressure Control House)	Asbestos.	Minor quantities.	The interior structure is lined with cement asbestos panels. Panels must be broken to make asbestos friable.	BHI-00836 (p. D-9) (BHI 1996c)
	1608-B Gas Line Pressure/ Vacuum Seal House (Diesel Oil Tank)	Asbestos in gasket.	Minor quantities.	75% chrysotile asbestos.	BHI-00836 (p. D-9) (BHI 1996c)
Biohazard	In and around structure	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 1608-B Gas Line Pressure/Vacuum Seal House, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	WHC-SP-0331, Rev. 1 (p. A-32) (WHC 1994)
Asphyxiant/ Confined Spaces	1608-B Gas Line Pressure/ Vacuum Seal House	Below-grade, confined space.	Not applicable.		WHC-EP-0619 (p. 3-10) (WHC 1993)
Flammable/ Combustible Material	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	Available references provided no information regarding flammable material; however, based on the decommissioned status of the building it is anticipated that there are no flammable materials in the building.	BHI-00221 (BHI 1994b)

Table A-4. Summary of 1608-B Gas Line Pressure/Vacuum Seal House Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Reactive Material	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	Available references provided no information regarding reactive material; however, based on the known chemical inventory it is anticipated that there is no reactive material.	BHI-00221 (BHI 1994b)
Explosive Material	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	Available references provided no information regarding explosive material; however, based on the known chemical inventory it is anticipated that there is no explosive material.	BHI-00221 (BHI 1994b)
Electrical Energy	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	There is no electrical service to this structure.	BHI-00221 (p. 3-8) (BHI 1994b) WHC-SP-0331, Rev. 1 (p. A-31) (WHC 1994)
Thermal Energy	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	Available references provided no information regarding thermal energy; however, based on the current phase of the building it is anticipated that there are no thermal energy sources.	BHI-00221 (BHI 1994b)
Kinetic Energy	1608-B Gas Line Pressure/ Vacuum Seal House	Structural components.	Not applicable.	Structure assumed to be occupied infrequently during S&M activities.	
	1608-B Gas Line Pressure/ Vacuum Seal House	Aircraft crash.	Not applicable.	Probability of such an event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	1608-B Gas Line Pressure/ Vacuum Seal House	Vehicle impact.	Not applicable.	Probability of such an event is low.	
High Pressure	1608-B Gas Line Pressure/ Vacuum Seal House	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the current phase of the building it is anticipated that there is no high pressure.	WHC-SP-0331, Rev. 1 (p. A-31) (WHC 1994)

Table A-4. Summary of 1608-B Gas Line Pressure/Vacuum Seal House Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	1608-B Gas Line Pressure/ Vacuum Seal House	Earthquake of sufficient magnitude to result in structural damage to the facility.	Not applicable.	The potential exists for an earthquake to fail portions of the structure and result in interaction with radioactive and hazardous materials.	None
	1608-B Gas Line Pressure/ Vacuum Seal House	Flooding of sufficient magnitude to result in structural intrusion.	Not quantified	Flooding could result in water interacting with the radioactive and hazardous materials.	None
	1608-B Gas Line Pressure/ Vacuum Seal House	Volcanic activity produces sufficient ashfall to result in failure of the roof.	Not quantified.	Ashfall could result in structural members interacting with the radioactive and hazardous materials.	None
	1608-B Gas Line Pressure/ Vacuum Seal House	Precipitation infiltrates the building. Precipitation in the form of snow results in failure of structural members.	Not applicable.	Precipitation could infiltrate the building structure and interact with the radioactive and hazardous materials. Snowfall could result in structural members interacting with the hazardous materials.	None
	1608-B Gas Line Pressure/ Vacuum Seal House	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with the radioactive and hazardous materials.	None
	1608-B Gas Line Pressure/ Vacuum Seal House	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with the radioactive and hazardous materials.	None

RQ = reportable quantity
RWP = radiological work permit
S&M = surveillance and maintenance

Table A-5. Summary of 105-C Reactor Building Hazard Identification. (4 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-C Reactor Building: Module 2 (area within reactor shield excluding reactor block)	Mixed fission products, primarily present as surface contamination.	<5.1E-04 Ci total activity (excluding the reactor block).	None.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory
	105-C Reactor Building: Module 2 Reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields) and FSB	Primarily activated material in the graphite stack, thermal shield; and corrosion film on process tubes. Part of the FSB was removed while the remainder was coated with a fixative and covered with soil.	1.32E+04 Ci total activity. 1.3 Ci alpha activity.	Contamination entrained in reactor block and shielding.	UNI-3714 (p. 46) (UNC 1987) and Table 4-3 of ASA for inventories after decay BHI 01231 (BHI 1998a)
Direct Radiation	105-C Reactor Building: Module 2 (area within reactor shield walls excluding reactor block)	Mixed fission products, primarily present as surface contamination. Location is subject to direct radiation emitted from the reactor block.	<5.1E–04 Ci total activity within module 2 (excluding the reactor block).	Moderate to high exposure rates in the immediate vicinity of the inner control rod rooms, reactor rear face, mezzanine, and top of reactor vertical safety control rod actuators, due to nearby radioactively contaminated reactor block.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-C Reactor Building inventory.
	105-C Reactor Building: Module 2 reactor block and FSB	Activated material in moderator stack, thermal and biological shields, and corrosion film on process tubes.	1.32E+04 Ci total activity. 1.3 Ci alpha activity.	Energetic gamma emitters possible in immediate vicinity (e.g., Ball 3X system) of activated structures (e.g., graphite stack, thermal shield), however, breach of the reactor block is excluded from current S&M activities.	UNI-3714 (p. 46) (UNC 1987) and Table 4-3 of ASA for inventories after decay. BHI-01231 (BHI 1998a)
Fissionable Material	105-C Reactor Building: Module 2 reactor block FSB	Pu-239 present in the graphite stack.	1.0 Ci (in 1985). None.		UNI-3714 (p. 46) (UNC 1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-C Reactor Building: Module 2	Asbestos in the form of piping insulation, transite wall board, ventilation components, and insulation (friable if degraded or damaged).	Unknown quantities.	Vast majority of asbestos removed from facility during ISS activities. Remaining asbestos is in nonfriable form, and is located in radiation zones where S&M activities occur infrequently.	BHI-00066 (p.2-3) (BHI 1997a) BHI-00221 (p.3-6) (BHI 1994b) WHC-EP-0619 (p. 3-3) (WHC 1993) WHC-SP-0331, Rev. 1, (p. A-17) (WHC 1994) BHI-01231, Rev.0 (BHI 1998a)

Table A-5. Summary of 105-C Reactor Building Hazard Identification. (4 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-C Reactor Building: Module 2	Lead shielding in the form of lead shot, brick, and cast forms; also lead-based paint.	133 tons	Approximately 70 tons of lead removed during ISS activities. Remaining lead is in form of lead shot, bricks, and cast forms and considered nondispersible. Remaining lead is located in radiation zones where S&M activities occur infrequently.	BHI-01231 Rev. 0 (BHI 1998a) BHI-00066 (p.2-3) (BHI 1997a) BHI-00221 (p. 3-6) (BHI 1994b) WHC-EP-0619 (p. 3-3) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
	105-C Reactor Building: Module 2	Mercury contained in switches and instruments.	Unknown quantities.	About 1 gal of mercury removed during ISS activities. Remaining mercury not readily dispersible and located in radiation zones where S&M activities occur infrequently.	BHI-01231 Rev. 0 (BHI 1998a) BHI-00221 (p. 3-6) (BHI 1994b)
	105-C Reactor Building: Module 2	PCBs contained in electrical and lighting equipment.	Unknown quantity.	PCBs are contained and do not present a hazardous material concern.	BHI-01231 Rev. 0 (BHI 1998)
	105-C Reactor Building: Module 2	Miscellaneous.	Negligible.	Miscellaneous chemicals remaining have been removed during 5-year cleanup campaign. Potential exists to discover old containers of chemicals.	Staff interview
Biohazard	105-C Reactor Building	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 105-C Reactor Building, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	BHI-00837 Rev. 0 (BHI 1996d) BHI-00066 (p. 2-3) (BHI 1997a) BHI-00221 (p. 3-6) (BHI 1994b) WHC-EP-0619 (p. 3-4) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
Asphyxiant/ Confined Spaces	105-C Reactor Building: Module 2	Unventilated structures.	Not quantified.	ISS activities left the remaining structure unventilated.	BHI-01231 Rev.0 (BHI-1998) BHI-00066 (p. 2-2) (BHI 1997a) WHC-EP-0619 (p. 3-5 and C1-9) (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-16) (WHC 1994)
Flammable/ Combustible Material	105-C Reactor Building: Module 2 reactor block	Graphite blocks.	2,086 yd^3.	While graphite can burn, there is no ignition source of sufficient energy present in the facility to ignite the graphite.	Staff interview
Reactive Material	105-C Reactor Building	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	BHI-00052 (p. B-2) (BHI 1994a) BHI-00066 (p. 2-3) (BHI 1997a)

Table A-5. Summary of 105-C Reactor Building Hazard Identification. (4 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Explosive Material	105-C Reactor Building	Miscellaneous chemicals.	Negligible.	Potential exists to discover old containers of chemicals. Only a few chemicals can produce an explosive condition.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (p. A-17) (WHC 1994)
Electrical Energy	105-C Reactor Building	The building is supplied by 480 V.	Not applicable.	5-year walkdowns of facility will be performed.	BHI-01231, Rev. 0 (BHI 1998)
Thermal Energy	105-C Reactor Building	Decay heat.	Negligible.	No appreciable decay heat in reactor block.	
Kinetic Energy	105-C Reactor Building	Structural components.	Not applicable.	Structure occupied once every 5 years as part of preventive maintenance walkdowns.	BHI-00066 (p. 2-2) (BHI 1997a)
	105-C Reactor Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-C Reactor Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	105-C Reactor Building	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the current phase of the building, it is anticipated that there is no high pressure.	WHC-EP-0331, Rev. 0 (WHC 1988a)
Natural Phenomena	105-C Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-C Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-C Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-C Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snow has the potential to result in structural members interacting with radioactive and hazardous materials.	None

Table A-5. Summary of 105-C Reactor Building Hazard Identification. (4 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	105-C Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-C Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

Table A-6. Summary of 105-DR Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-DR Reactor Building: Module 2 (area within reactor shield excluding reactor block)	Mixed fission products, primarily present as surface contamination.	<5.1E-04 Ci total activity (excluding the reactor block) (1996)	None.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-DR Reactor Building inventory
	105-DR Reactor Building: Module 2 Reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields) and FSB	Primarily activated material in the graphite stack, thermal shield, and corrosion film on process tubes. Part of the FSB was removed while the remainder was coated with a fixative and covered with soil.	7.16E+03 Ci total activity (3/1/98)	Contamination entrained in reactor block and shielding.	UNI-3714 (p. 48) (UNC 1987) and Table 4-4 of ASA for inventories after decay
Direct Radiation	105-DR Reactor Building: Module 2 (area within reactor shield walls excluding reactor block)	Mixed fission products, primarily present as surface contamination. Location is subject to direct radiation emitted from the reactor block.	<5.1E–04 Ci total activity within module 2 (excluding the reactor block) (1996)	Moderate to high exposure rates in the immediate vicinity of the inner control rod rooms, reactor rear face, mezzanine, and top of reactor vertical safety control rod actuators, due to nearby radioactively contaminated reactor block.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-DR Reactor Building inventory
	105-DR Reactor Building: Module 2 reactor block and FSB	Activated material in moderator stack, thermal and biological shields, and corrosion film on process tubes.	7.16E+03 Ci total activity (3/1/98)	Energetic gamma emitters possible in immediate vicinity (e.g., Ball 3X system) of activated structures (e.g., graphite stack, thermal shield); however, breach of the reactor block is excluded from current S&M activities.	UNI-3714 (p. 48) (UNC 1987) and Table 4-4 of ASA for inventories after decay
Fissionable Material	105-DR Reactor Building: Module 2 reactor block and FSB	Pu-239 present in the graphite stack.	1.0 Ci (in 1985)		UNI-3714 (p. 48) (UNC 1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-DR Reactor Building: Module 2	Asbestos in the form of piping insulation, transite wall board, ventilation components, and insulation (friable if degraded or damaged).	Unknown quantities	Vast majority of asbestos removed from facility during ISS activities. Remaining asbestos is in nonfriable form and is located in radiation zones where S&M activities occur infrequently.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1, (WHC 1994)

Table A-6. Summary of 105-DR Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-DR Reactor Building: Module 2	Lead shielding in the form of lead shot, brick, and cast forms; also lead-based paint.		Lead is in form of lead shot, bricks, and cast forms and considered nondispersible. Remaining lead is located in radiation zones where S&M activities occur infrequently.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
	105-DR Reactor Building: Module 2	Mercury contained in switches and instruments.	Unknown quantities.	Most of mercury was removed during ISS activities. Remaining mercury not readily dispersible and located in radiation zones where S&M activities occur infrequently.	BHI-00221 (BHI 1994b)
	105-DR Reactor Building: Module 2	PCBs contained in electrical and lighting equipment.	Unknown quantity.	PCBs are contained and do not present a hazardous material concern.	Staff interview
	105-DR Reactor Building: Module 2	Miscellaneous.	Negligible.	Miscellaneous chemicals remaining have been removed during ISS. Potential exists to discover old containers of chemicals	Staff interview
Biohazard	105-DR Reactor Building	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 105-DR Reactor Building, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	BHI-01150, Rev. 0 (BHI 1998b) BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Asphyxiant/ Confined Spaces	105-DR Reactor Building: Module 2	Unventilated structures.	Not quantified.	ISS activities left the remaining structure unventilated.	BHI-00066 (BHI 1997a) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Flammable/ Combustible Material	105-DR Reactor Building: Module 2 reactor block	Graphite blocks.	~2,086 yd^3 (estimate from 105-C Reactor).	While graphite can burn, there is no ignition source of sufficient energy present in the facility to ignite the graphite.	Staff interview
Reactive Material	105-DR Reactor Building	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	BHI-00052 (BHI 1994a) BHI-00066 (BHI 1997a)
Explosive Material	105-DR Reactor Building	Miscellaneous chemicals.	Negligible.	Potential exists to discover old containers of chemicals. Only a few chemicals can produce an explosive condition.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Electrical Energy	105-DR Reactor Building	The building is supplied with energy for S&M activities.	Not applicable.	5-year walkdowns of facility will be performed.	
Thermal Energy	105-DR Reactor Building	Decay heat.	Negligible	No appreciable decay heat in reactor block.	

Table A-6. Summary of 105-DR Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	105-DR Reactor Building	Structural components.	Not applicable.	Structure occupied once every 5 years as part of preventive maintenance walkdowns.	BHI-00066 (BHI 1997a)
	105-DR Reactor Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-DR Reactor Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	105-DR Reactor Building	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the current phase of the building, it is anticipated that there is no high pressure.	WHC-EP-0331, Rev. 0 (WHC 1988a)
Natural Phenomena	105-DR Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-DR Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-DR Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-DR Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snow has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-DR Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-DR Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

Table A-7. Summary of 190–DR Pumphouse Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	190-DR Pumphouse	Contaminated tools used in D&D.	Slightly.	RMA used for storage of tools used in D&D. Tools are wrapped in plastic and are believed to be only slightly contaminated.	Staff interview
Direct Radiation	190-DR Pumphouse	Contaminated tools used in D&D.	Slightly.	RMA used for storage of tools used in D&D. Tools are wrapped in plastic and are believed to be only slightly contaminated.	Staff interview
Fissionable Material	190-DR Pumphouse	Contaminated tools used in D&D.	Slightly.	RMA used for storage of tools used in D&D. Tools are wrapped in plastic and are believed to be only slightly contaminated.	Staff interview
Hazardous Material (e.g., toxic, carcinogenic)	190-DR Pumphouse	Mercury switches.	Six.	Not readily dispersible; not significantly impacted by S&M activities.	BHI-00081 (p. 3-7) (BHI 1994c)
	190-DR Pumphouse	Asbestos.	Unknown quantities.		BHI-00081 (p. 3-7) (BHI 1994c)
	190-DR Pumphouse	Not applicable.	None.	Four unlabeled drums as well as 26 drums of "soil seal" (discussed in BHI-00081 [BHI 1994c]) have been removed from the building.	Staff interview
	190-DR Pumphouse	Silica crystalline quartz.	32,000 lb.	Stored in bags and used in sand blasting.	Staff interview
Biohazard	190-DR Pumphouse	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the facility, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	Historical knowledge
Asphyxiant/ Confined Spaces	190-DR Pumphouse	Stairs lead to subgrade level, with underground tunnel.	Not applicable.	Tunnel leading to 105-DR Reactor Building contains standing water.	Staff interview
Flammable/ Combustible Material	190-DR Pumphouse	Not applicable.	None.	Staff interview indicated that miscellaneous combustibles in containers discussed in BHI-00081 (BHI 1994c) have been removed along with other flammable materials.	BHI-00081 (p. 3-7) (BHI 1994c) Staff interview
Reactive Material	190-DR Pumphouse	None.	Not applicable.	Available references provided no information regarding reactive material; however, based on staff interviews it is anticipated that there are no reactive materials.	Staff interview
Explosive Material	190-DR Pumphouse	None.	Not applicable.	Available references provided no information regarding explosive material; however, based on staff interviews it is anticipated that there are no explosive materials.	Staff interview

Table A-7. Summary of 190–DR Pumphouse Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Electrical Energy	190-DR Pumphouse	The building is energized.	Not applicable.	Abnormal conditions are presented in BHI-00081 (BHI 1994c) (e.g., unprotected energized wires with taped ends, exposed wires in receptacle box.)	BHI-00081 (p. 3-7) (BHI 1994c)
Thermal Energy	190-DR Pumphouse	Portable heater fans.	Unknown quantities.		BHI-00081 (p. 3-7) (BHI 1994c)
Kinetic Energy	190-DR Pumphouse	Structural components.	Not applicable.	This facility serves a warehouse function and will be periodically occupied.	
	190-DR Pumphouse	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	190-DR Pumphouse	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	190-DR Pumphouse	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on 190-KW it is anticipated that there is no high pressure.	BHI-00081 (BHI 1994c)
Natural Phenomena	190-DR Pumphouse	Earthquake of sufficient magnitude to result in structural damage to the facility.	Not applicable.	The potential exists for an earthquake to fail portions of the structure and result in interaction with radioactive and hazardous materials.	None
	190-DR Pumphouse	Flooding of sufficient magnitude to result in structural intrusion.	Not quantified.	Flooding could result in water interacting with the radioactive and hazardous materials.	None
	190-DR Pumphouse	Volcanic activity produces sufficient ashfall to result in failure of the roof.	Not quantified.	Ashfall could result in structural members interacting with the radioactive and hazardous materials.	None
	190-DR Pumphouse	Precipitation infiltrates the building. Precipitation in the form of snow results in failure of structural members.	Not applicable.	Precipitation could infiltrate the building structure and interact with the radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	190-DR Pumphouse	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive and hazardous materials.	None
	190-DR Pumphouse	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with the radioactive and hazardous materials.	None

D&D = decontamination and decommissioning
RMA = radiological materials area
S&M = surveillance and maintenance

Table A-8. Summary of 105-F Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-F Reactor Building: Module 2 (area within reactor shield excluding reactor block)	Mixed fission products, primarily present as surface contamination.	<5.1E-04 Ci total activity (excluding the reactor block) (1996)	None.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-F Reactor Building inventory.
	105-F Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields)	Primarily activated material in the graphite stack, thermal shield; and corrosion film on process tubes.	7.16E+03 Ci total activity (3/1/98)	Contamination entrained in reactor block and shielding.	UNI-3714 (UNC 1987)
Direct Radiation	105-F Reactor Building: Module 2 (area within reactor shield walls excluding reactor block)	Mixed fission products, primarily present as surface contamination. Location is subject to direct radiation emitted from the reactor block.	<5.1E–04 Ci total activity within module 2 (excluding the reactor block) (1996)	Moderate to high exposure rates in the immediate vicinity of the inner control rod rooms, reactor rear face, mezzanine, and top of reactor vertical safety control rod actuators, due to nearby radioactively contaminated reactor block.	BHI-00831, Appendix A, (BHI 1996a) provides the development of the 105-F Reactor Building inventory.
	105-F Reactor Building: Module 2 reactor block	Activated material in moderator stack, thermal and biological shields, and corrosion film on process tubes.	7.16E+03 Ci total activity (3/1/98)	Energetic gamma emitters possible in immediate vicinity (e.g., Ball 3X system) of activated structures (e.g., graphite stack, thermal shield); however, breach of the reactor block is excluded from current S&M activities.	UNI-3714 (p. 48) (UNC 1987) and Table 4-4 of ASA for inventories after decay.
Fissionable Material	105-F Reactor Building: Module 2 reactor block	Contaminated graphite, biological and thermal shields, process tubes, and safety and control systems.	2.94E-01 Ci Am-241 1.00E+0 Ci Pu-239	No intact fuel in reactor block. Reference estimates Pu-239 and Am-241 only (all other fissionable isotopes were ignored). The sum of the fractions of the subcritical limit is 3.57E-02; thus, criticality limits and controls are not needed.	0100F-CE-N0002 (BHI 2003) UNI (1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-F Reactor Building: Module 2	Asbestos in the form of piping insulation, transite wall board, ventilation components, and insulation (friable if degraded or damaged).	Unknown quantities	Vast majority of asbestos removed from facility during ISS activities. Remaining asbestos is in nonfriable form, and is located in radiation zones where S&M activities occur infrequently.	BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1, (WHC 1994)

Table A-8. Summary of 105-F Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-F Reactor Building: Module 2	Lead shielding in the form of lead shot, brick, and cast forms; also lead-based paint.		Lead is in form of lead shot, bricks, and cast forms and considered nondispersible. Remaining lead is located in radiation zones where S&M activities occur infrequently.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
	105-F Reactor Building: Module 2	Mercury contained in switches and instruments.	Unknown quantities.	Most mercury was removed during ISS activities. Remaining mercury not readily dispersible and located in radiation zones where S&M activities occur infrequently.	BHI-00221 (BHI 1994b)
	105-F Reactor Building: Module 2	PCBs contained in electrical and lighting equipment.	Unknown quantity.	PCBs are contained and do not present a hazardous material concern.	Staff interview
	105-F Reactor Building: Module 2	Miscellaneous.	Negligible.	Miscellaneous chemicals remaining have been removed during ISS. Potential exists to discover old containers of chemicals	Staff interview
Biohazard	105-F Reactor Building	Rodents, insects, snakes; bird and animal feces.	Greater activity than normally occupied facilities.	Because there is very little human activity in and around the 105-F Reactor Building, increased rodent, insect, and snake activity can be expected. Animal feces are considered a health hazard and may be radioactively contaminated.	BHI-01151, Rev. 1 (BHI 2001b) BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Asphyxiant/ Confined Spaces	105-F Reactor Building: Module 2	Unventilated structures.	Not quantified.	ISS activities left the remaining structure unventilated.	BHI-00066 (BHI 1997a) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Flammable/ Combustible Material	105-F Reactor Building: Module 2 reactor block	Graphite blocks.	~2,086 yd^3 (estimate from 105-C Reactor).	While graphite can burn, there is no ignition source of sufficient energy present in the facility to ignite the graphite.	Staff interview
Reactive Material	105-F Reactor Building	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	BHI-00052 (BHI 1994a) BHI-00066 (BHI 1997a)
Explosive Material	105-F Reactor Building	Miscellaneous chemicals.	Negligible.	Potential exists to discover old containers of chemicals. Only a few chemicals can produce an explosive condition.	BHI-00066 (BHI 1997a) BHI-00221 (BHI 1994b) WHC-EP-0619 (WHC 1993) WHC-SP-0331, Rev. 1 (WHC 1994)
Electrical Energy	105-F Reactor Building	The building is supplied with energy for S&M activities.	Not applicable.	5-year walkdowns of facility will be performed.	
Thermal Energy	105-F Reactor Building	Decay heat.	Negligible.	No appreciable decay heat in reactor block.	

Table A-8. Summary of 105-F Reactor Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	105-F Reactor Building	Structural components.	Not applicable.	Structure occupied once every 5 years as part of preventive maintenance walkdowns.	BHI-00066 (BHI 1997a)
	105-F Reactor Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-F Reactor Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	105-F Reactor Building	Not applicable.	None.	Available references provided no information regarding high pressure; however, based on the current phase of the building, it is anticipated that there is no high pressure.	WHC-EP-0331, Rev. 0 (WHC 1988)
Natural Phenomena	105-F Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-F Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-F Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-F Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snow has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-F Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-F Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

ISS = interim safe storage
PCB = polychlorinated biphenyl
S&M = surveillance and maintenance

Table A-9. Summary of 105-KE Reactor Buildings Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-KE Reactor Building: Module 1 (general ancillary support areas of the reactor building excluding the FSB and water)	Mixed fission products (primarily Sr-90); minor amount of fixed surface contamination.	Less than 0.046 Ci.	The radionuclide inventory estimated for module 1 of the 105-C Reactor was 0.046 Ci. Almost all of the inventory at 105-C is located in the lift station sump, which is excluded from 105-KE S&M activities.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-KE Reactor Building inventory is further developed in Section 4.1.2.1. Staff interview
	105-KE Reactor Building: Module 2: General (process area within shield walls excluding reactor block)	Mixed fission products (primarily Sr-90 and Cs-137) present as surface contamination.	Not quantified.		WHC-EP-0619 (WHC 1993)
	105-KE Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields),	Primarily activated material in the moderator stack, thermal shield; and corrosion film of process tubes.	5.8E+04 Ci total activity. 1.3 Ci alpha activity.	Almost all of the activity present in the reactor block is incorporated in the reactor moderator (graphite) stack, thermal shield, process tubes, and the control system.	UNI-3714 (p. 51) (UNC 1987)
	105-KE Reactor Building: Pipe tunnel	Mixed fission products and plutonium present as contamination within piping, ball chute, and as surface contamination on walls and floors.	Not quantified.	Radiological characterization determined direct dose rate readings and smearable contamination levels (both alpha and beta).	UNI-946 (p. 7-4) (UNC 1978)
Direct Radiation	105-KE Reactor Building: Module 1 (general ancillary support areas of the reactor building excluding the FSB and water)	Mixed fission products (primarily Sr-90); minor amount of fixed surface contamination.	Less than 0.046 Ci.	Majority of contamination at 105-C was determined to be present in the lift station sump, which is excluded from S&M activities at 105-KE.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-KE Reactor Building inventory is further developed in Section 4.1.2.1 WHC-EP-0619 (p. C1-197) (WHC 1993)

Table A-9. Summary of 105-KE Reactor Buildings Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Direct Radiation	105-KE Reactor Building: Module 2 (process area within shield walls excluding reactor block).	Mixed fission products, primarily in the form of surface contamination. Location is subject to direct radiation emitted from the reactor block.	Not quantified.	Moderate to high exposure rates in the immediate vicinity of the inner and outer control rod rooms, reactor rear face, mezzanine, and top of reactor vertical safety control rod actuators.	WHC-EP-0619 (p. C1-197) (WHC 1993)
	105-KE Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields)	Activated material in the moderator stack, thermal and biological shields, and corrosion film of process tubes.	5.8E+04 Ci total activity. 1.3 Ci alpha activity.	Energetic gamma emitters possible in immediate vicinity of activated structures (e.g., graphite stack, thermal shield); however, breach of the reactor block is excluded from current S&M activities.	WHC-EP-0619 (p. C1-197) (WHC 1993)
	105-KE Reactor Building: Pipe tunnel	Mixed fission products and plutonium present as contamination within piping, ball chute, and as surface contamination on walls and floors.	Radiological characterization indicated maximum reading of 15 mR/hr on the louvered exhaust vent in wall. The average true limiting dose rate was measured to be 2 mR/hr.	The characterization was conducted in 8/76. Available references provide no indication that a subsequent characterization of the area has been performed.	UNI-946 (p. 7-45) (UNC 1978)
Fissionable Material	105-KE Reactor Building: Module 2 reactor block	Pu-239 and Am-241 present in the moderator stack.	1.3 Ci.	None.	UNI-3714 (UNC 1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-KE Reactor Building: Modules 1 and 2, and water tunnels (e.g., supply fan area, valve pit)	Asbestos in the form of transite siding and wall board, and insulation (friable if degraded or damaged).	707.9 m^3.	Asbestos abatement plan in place to remove noncontaminated asbestos from the buildings. Asbestos normally maintained in a nonfriable condition.	WHC-SP-0331, Rev 1 (p. A-132) (WHC 1994) BHI-00221 (p. 3-36) (BHI 1994b)
	105-KE Reactor Building: Several locations (e.g., X-1 irradiation test facility, inner control rod room)	Lead shielding in the form of lead shot, brick, sheet and cast forms.	170 metric tons.	Majority of lead located in radiation zones where S&M activities occur infrequently. Lead oxidation rates greater than expected based on environmental conditions (i.e., arid climate).	BHI-00221 (p. 3-36) (BHI 1994b) UNI-3714 (UNC 1987) WHC-EP-0619 (p. C1-199) (WHC 1993)

Table A-9. Summary of 105-KE Reactor Buildings Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-KE Reactor Building: Solid purge room and decontamination agent mixing room	Lead-based paint.	Not quantified.	None.	WHC-EP-0619 (p. C1-200) (WHC 1993)
	105-KE Reactor Building: Several locations (e.g., "D" elevator drive platform, southwest area of valve pit)	Mercury contained in switches and instruments.	Not quantified.	Mercury is present in small quantities and is contained.	WHC-EP-0619 (p. C1-200) (WHC 1993)
	105-KE Reactor Building: Room across from control room	Mercury.	Unknown.	Documentation indicates that the room is posted as being mercury contaminated. No inspection of room completed.	WHC-EP-0619 (p. C1-200) (WHC 1993)
	105-KE Reactor Building: Modules 1 and 2	PCBs contained in electrical and lighting equipment.	Not quantified.	PCBs are contained and do not present a hazardous material concern.	Historical knowledge
	105-KE Reactor Building: Module 1	Solvents, grease, oils, and aerosol containers.	Residual quantity.	Majority of these items has been removed.	WHC-EP-0619 (WHC 1993)
	105-KE Reactor Building Modules 1 and 2	Ethylene glycol present in heating system and surge tanks.	Residual quantity.	Ethylene glycol piping used for heating facility has been drained but contains residue.	WHC-EP-0619 (p. C1-201) (WHC 1993)
Biohazard	105-KE Reactor Building: Modules 1 and 2	Insects, rodents, snakes; bird and animal feces.	Greater activity than in normally occupied facilities.	Because of limited activity in and around the building, increased insect, rodent, and snake activity can be expected. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (p. C1-202) (WHC 1993)
Asphyxiant/ Confined Space	105-KE Reactor Building: All areas	Unventilated below-grade structures.	Not quantified.	Unventilated below-grade structures not appropriately posted as "Confined Spaces."	WHC-EP-0619 (p. 3-49) (WHC 1993)

Table A-9. Summary of 105-KE Reactor Buildings Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	105-KE Reactor Building: Module 2 (e.g., front face work area, C elevator drive unit)	Oil and grease.	Stored bottles of motor oil; oil leaking from equipment; oil and grease residue.	Small quantities of oil in most sources.	WHC-EP-0619 (p. C1-207) (WHC 1993)
	105-KE Reactor Building: Module 2 reactor block	Graphite blocks.	Approximately 1,595 m^3.	While graphite can burn, there is no ignition source of sufficient energy present in the facility to cause the graphite to ignite.	Staff interview
Reactive Material	105-KE Reactor Building	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	WHC-EP-0619 (p. 3-50) (WHC 1993)
Explosive Material	105-KE Reactor Building	Not applicable.	Not applicable.	Reference indicates that some unknown chemicals exist in the building. Since only a few chemicals can produce an explosive condition, it is anticipated that this does not represent a hazard.	
Electrical Energy	105-KE Reactor Building	Uncontrolled energized or potentially energized conductors.	Not quantified.	Wiring system in fairly good condition. Staff interview indicates that potential electrical shock hazards (e.g., exposed wires, energized fixtures) discussed in WHC-EP-0619 (WHC 1993) have been corrected.	WHC-EP-0619 (p. 3-48) (WHC 1993) Staff interview
Thermal Energy	105-KE Reactor Building: Module 1	Space heaters.	None outside of that routinely encountered in industry.		
Kinetic Energy	105-KE Reactor Building: All areas	Structural components.	Not applicable.	Building occupied infrequently during S&M activities; roof structures in fair condition.	WHC-EP-0619 (p. 3-43) (WHC 1993)
	105-KE Reactor Building: All areas	Air compressor; miscellaneous rotating equipment.	None outside that routinely encountered in industry.	All equipment, except compressor, is de-energized. However, the equipment is not visibly disconnected from the power source.	WHC-EP-0619 (pp. C1-190, 191) (WHC 1993)
	105-KE Reactor Building: All areas	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-KE Reactor Building: All areas	Vehicle crash.	Not applicable.	Probability of event is low.	

Table A-9. Summary of 105-KE Reactor Buildings Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	105-KE Reactor Building: All areas	Compressed air.	None outside that routinely encountered in industry.	Air compressor located on mezzanine over supply fan area.	WHC-EP-0619 (p. C1-191) (WHC 1993)
Natural Phenomena	105-KE Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-KE Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-KE Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-KE Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	105-KE Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-KE Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

FSB = fuel storage basin
HCR = horizontal control rod
PCB = polychlorinated biphenyl
S&M = surveillance and maintenance

Table A-10. Summary of 105-KW Reactor Building and Water Tunnels Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	105-KW Reactor Building: Module 1 (general ancillary support areas of the reactor building excluding the FSB and water)	Mixed fission products (primarily Sr-90); minor amount of fixed surface contamination.	Less than 0.046 Ci.	The radionuclide inventory determined for module 1 of the 105-C Reactor was 0.046 Ci. Almost all of the inventory at 105-C is located in the lift station sump, which is excluded from 105-KW S&M activities.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-KW Reactor Building inventory is further developed in Section 4.1.2.1.
	105-KW Reactor Building: Module 2: general (area within shield walls excluding reactor block).	Mixed fission products (primarily Sr-90 and Cs-137) present as surface contamination.	Surface contamination not quantified.	Majority of material is contained and not readily dispersible.	WHC-EP-0619 (WHC 1993)
	105-KW Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, gun barrels, thermal and biological shields)	Primarily activated material in the graphite stack, thermal shield, and corrosion film of process tubes.	5.1E+04 Ci total activity. 1.3 Ci alpha activity.	Almost all of the activity present in the reactor block is incorporated in the reactor moderator (graphite) stack, thermal shield, process tubes, and the control system.	UNI-3714 (p. 52) (UNC 1987)
	105-KW Reactor Building: Water tunnels	Not applicable.	None.	No radiation levels detected above background. Access requirements document indicates no RWP needed for entry.	BHI-00221 (p. 3-42) (BHI 1994b) Access requirements
	105-KW Reactor Building: Pipe tunnel	Mixed fission products and plutonium present as contamination within piping, ball chute, and as surface contamination on walls and floors.	Not quantified.	Radiological characterization determined direct dose rate readings and smearable contamination levels (both alpha and beta).	UNI-946 (p. 7-4) (UNC 1978)

Table A-10. Summary of 105-KW Reactor Building and Water Tunnels Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Direct Radiation	105-KW Reactor Building: Module 1 (general ancillary support areas of the reactor building excluding the FSB and water)	Mixed fission products (primarily Sr-90); minor amount of fixed surface contamination.	Less than 0.046 Ci	Majority of contamination at 105-C was determined to be present in the lift station sump, which is excluded from S&M activities at 105-KW.	BHI-00831, Appendix A (BHI 1996a), provides the development of the 105-C Reactor Building inventory. The relationship between the 105-C Reactor Building inventory and the 105-D Reactor Building inventory is further developed in Section 4.1.2.1.
	105-KW Reactor Building: Module 2 reactor block (e.g., reactor moderator stack, process tubes, HCRs, thermal and biological shields)	Activated material in the moderator stack, thermal and biological shields, and corrosion film of process tubes.	5.1E+04 Ci total activity. 1.3 Ci alpha activity.	Energetic gamma emitters possible in immediate vicinity of activated structures (e.g., thermal shield); however, breach of reactor block is prohibited.	WHC-EP-0619 (pp. C1-229 and 230) (WHC 1993)
	105-KW Reactor Building: Water tunnels	Not applicable.	No radiation levels detected above background.	Access requirements document indicates no RWP required for entry.	BHI-00221 (p. 3-42) (BHI 1994b) Access requirements
	105-KW Reactor Building: Pipe tunnel	Mixed fission products and plutonium present as contamination within piping, ball chute, and as surface contamination on walls and floors.	Radiological characterization indicated an average true limiting dose rate of 5 mR/hr.	The characterization was conducted in 8/76. Available references provide no indication that the area has been characterized since then.	UNI-946 (p. 7-45) (UNC 1978)
Fissionable Material	105-KW Reactor Building: Module 2 reactor block	Pu-239 and Am-241 present in the graphite stack.	1.3 Ci.	None.	UNI-3714 (p. 52) (UNC 1987)
Hazardous Material (e.g., toxic, carcinogenic)	105-KW Reactor Building: Module 1 and water tunnels (e.g., exhaust fan room)	Asbestos in the form of transite siding and wall board, and insulation (friable if degraded or damaged).	Not quantified.	Asbestos abatement program to expedite removal of noncontaminated asbestos. Asbestos maintained in a nonfriable condition.	BHI-00221 (p. 3-42) (BHI 1994b) WHC-EP-0619 (p. C1-230) (WHC 1993)

Table A-10. Summary of 105-KW Reactor Building and Water Tunnels Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	105-KW Reactor Building: Several areas (e.g., D elevator drive platform, outer control rod room)	Lead shielding in the form of lead shot, brick, sheet and cast forms; also lead-based paint.	157.5 metric tons	Majority of lead located in radiation zones where S&M activities occur infrequently. Lead oxidation rates greater than expected based on environmental conditions (i.e., arid climate).	UNI-3714 (p. G-8) (UNC 1987) WHC-EP-0619 (p. C1-232, 233) (WHC 1993)
	105-KW Reactor Building: East end of mezzanine level in fan room, exhaust fan room, VSR drive units, D elevator drive unit, X-2 level irradiation test facility	Mercury contained in switches and instruments.	One switch in each area except D elevator, which has two, and VSR drive units, which have an unknown quantity.	Not readily dispersible; not significantly impacted by S&M activities.	WHC-EP-0619 (pp. C1-232, 233) (WHC 1993)
	105-KW Reactor Building: Module 1 and water tunnels	PCBs contained in electrical and lighting equipment.	Not quantified.	PCBs are contained and do not present a hazardous material concern.	Historical knowledge
	105-KW Reactor Building: Module 1	Solvents, grease, oils, and aerosol containers.	Residual quantity.	Majority of these items have been removed.	WHC-EP-0619 (WHC 1993)
	105-KW Reactor Building: Module 1 (fan room x-o level)	Dilute ethylene glycol solution.	Unknown quantity (tank is 40% full).	Solution contained within tank; solution concentration is approximately 14%.	BHI-00066, Rev. 4 (p. 7-10) (BHI 1997a)
	105-KW Reactor Building	Ethylene glycol in heating system and surge tanks.	Residual quantity.	Ethylene glycol piping used for heating facility has been drained but contains residue.	Staff interview
Biohazard	105-KW Reactor Building: Module 1 and water tunnels	Insects, rodents, snakes; bird and animal feces.	Greater than the level for normally occupied buildings.	Building is subject to periodic animal intrusion. Inordinate number of dead birds. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993) BHI-00066 (p. 7-9) (BHI 1997a)
Asphyxiant/ Confined Space	105-KW Reactor Building: All areas	Unventilated below-grade structures.	Not quantified.	Unventilated below-grade structures not appropriately posted as "Confined Spaces."	WHC-EP-0619 (p. 3-49) (WHC 1993)

Table A-10. Summary of 105-KW Reactor Building and Water Tunnels Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	105-KW Reactor Building: Module 1	Oil.	Stored bottles of motor oil; oil leaking from equipment.	None.	BHI-00052 (p. B-35) (BHI 1994a) BHI-00066, Rev. 4 (p. 7-8) (BHI 1997a)
	105-KW Reactor Building: Module 2 reactor block	Graphite blocks.	Approximately 2,086 yd^3	While graphite can burn, there is no ignition source of sufficient energy present in the facility to cause the graphite to ignite.	Staff interview
Reactive Material	105-KW Reactor Building: Module 1 and 2	Residual process and deactivation chemicals.	Residual quantities.	Potential exists to discover old containers of chemicals that, if mixed, could generate heat/gas.	BHI-00066, Rev. 4 (p. 7-10) (BHI 1997a) WHC-EP-0619 (p. 3-50) (WHC 1993)
Explosive Material	105-KW Reactor Building	Not applicable.	None.	Reference indicates that some unknown chemicals exist in the building. Since few chemicals can produce an explosive condition, it is anticipated that this hazard is not a concern.	WHC-EP-0619 (p. C1-236) (WHC 1993)
Electrical Energy	105-KW Reactor Building: Modules 1 and 2	Uncontrolled, energized or potentially energized conductors.	Not quantified.	Wiring system in fairly good condition. Staff interview indicates that potential electrical shock hazards (e.g., exposed wires, energized fixtures) discussed in WHC-EP-0619 (WHC 1993) have been corrected.	BHI-00052 (p. B-32) (BHI 1994a) WHC-EP-0619, (p. 3-48, C1-228, 229) (WHC 1993) Staff interview
Thermal Energy	105-KW Reactor Building: Module 1	Space heaters.	None outside of that routinely encountered in industry.		Building walkthrough
Kinetic Energy	105-KW Reactor Building: All areas	Structural components.	Not applicable.	Facilities occupied infrequently during S&M activities; roof structures in fair condition.	BHI-00066, Rev. 4 (p. 7-7) (BHI 1997a)
	105-KW Reactor Building: All areas	Air compressor; miscellaneous rotating equipment.	None outside that routinely encountered in industry.	All equipment, except compressor, is de-energized. However, the equipment is not visibly disconnected from the power source.	WHC-EP-0619, (p. C1-227) (WHC 1993)
	105-KW Reactor Building: All areas	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	105-KW Reactor Building: All areas	Vehicle crash.	Not applicable.	Probability of event is low.	

Table A-10. Summary of 105-KW Reactor Building and Water Tunnels Hazard Identification. (5 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	105-KW Reactor Building: All areas	Compressed air.	None outside that routinely encountered in industry.	Air compressor located on mezzanine over supply fan area.	WHC-EP-0619 (p. C1-227) (WHC 1993) Building walkthrough
Natural Phenomena	105-KW Reactor Building	Earthquake of sufficient magnitude to result in failure of structural components.	Not applicable.	The potential exists for an earthquake to induce the failure of building structural members, which then can interact with the radioactive and hazardous material inventory.	None
	105-KW Reactor Building	Flood of sufficient magnitude to result in structural intrusion.	Not applicable.	The potential exists for water to interact with radioactive and hazardous materials within the building as a result of flooding.	None
	105-KW Reactor Building	Volcanic activity produces sufficient ashfall to result in the failure of structural members.	Not quantified.	Ashfall has the potential to result in structural members interacting with radioactive and hazardous materials.	None
	105-KW Reactor Building	Precipitation infiltrates the building structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	105-KW Reactor Building	Lightning strike on the building structure.	Not applicable.	Lightning could potentially strike the building and interact with the radioactive and hazardous material inside.	None
	105-KW Reactor Building	High winds of sufficient magnitude to result in the failure of structural members.	Not quantified.	High winds could potentially induce the failure of structural members and a resultant interaction with radioactive and hazardous materials.	None

FSB = fuel storage basin
PCB = polychlorinated biphenyl
RWP = radiological work permit
S&M = surveillance and maintenance
VSR = vertical safety rod

Table A-11. Summary of 110-KE Gas Storage Tanks Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	110-KE Gas Storage Tanks	Not applicable.	None.	Access requirements document indicates that a RWP is not required for this facility.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b) Access requirements
Direct Radiation	110-KE Gas Storage Tanks	Not applicable.	None.	Access requirements document indicates that a RWP is not required for this facility.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b) Access requirements
Fissionable Material	110-KE Gas Storage Tanks	Not applicable.	None.	Access requirements document indicates that a RWP is not required for this facility.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b) Access requirements
Hazardous Material (e.g., toxic, carcinogenic)	110-KE Gas Storage Tanks	Not applicable.	None.	Tanks have been removed except for four 1.8-m-diameter by 5.5-m-long low-pressure CO_2 tanks and their supports.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Biohazard	110-KE Gas Storage Tanks	Insects, rodents, and snakes. Bird and animal feces.	Greater activity than that for normally occupied buildings.	Increased insect, rodent, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	110-KE Gas Storage Tanks	Confined spaces within remaining tanks.	Four large tanks remain.	Caution signs are posted on exterior of tanks. No openings to tank interior observed during walkdown.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b) Facility walkdown
Flammable/ Combustible Material	110-KE Gas Storage Tanks	Not applicable.	None.	No potential for flammable/combustible material to be present.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Reactive Material	110-KE Gas Storage Tanks	Not applicable.	None.	No potential for reactive material to be present.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Explosive Material	110-KE Gas Storage Tanks	Not applicable.	None.	No potential for explosive material to be present.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Electrical Energy	110-KE Gas Storage Tanks	Not applicable.	None.	No electrical service is provided to the tanks.	WHC-SP-0331, Rev. 0 (p. A-99) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Thermal Energy	110-KE Gas Storage Tanks	Not applicable.	None.	No sources of thermal energy.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)

Table A-11. Summary of 110-KE Gas Storage Tanks Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	110-KE Gas Storage Tanks	Structural components.	Four tanks elevated above grade on supports.	Standard industrial hazard.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
	110-KE Gas Storage Tanks	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	110-KE Gas Storage Tanks	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	110-KE Gas Storage Tanks	Not applicable.	None.	Remaining tanks are low pressure and are empty.	WHC-SP-0331, Rev. 0 (p. A-98) (WHC 1988) BHI-00221 (p. 3-37) (BHI 1994b)
Natural Phenomena	110-KE Gas Storage Tanks	Not applicable.	Not applicable.	Since there is no known radioactive material and the remaining tanks historically held CO_2 and are currently empty, there is no potential for a natural phenomena event to interact with radioactive material or hazardous substances at this facility.	None

CO_2 = carbon dioxide
RWP = radiological work permit

Table A-12. Summary of 110-KW Gas Storage Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	110-KW Gas Storage Building: Bunker	Potential for fixed surface contamination.	Not quantified.	Bunker is located within a RBA.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) Facility walkdown
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	Documentation indicates no radiation levels detected above background.	BHI-00221 (p. 3-43) (BHI 1994b)
Direct Radiation	110-KW Gas Storage Building: Bunker	Potential for minor amounts of fixed surface contamination.	Not quantified.	Bunker is located within a RBA.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	Documentation indicates no radiation levels detected above background.	BHI-00221 (p. 3-43) (BHI 1994b)
Fissionable Material	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Historic use of building would indicate that fissionable material is not a hazard.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	Documentation indicates no radiation levels detected above background.	BHI-00221 (p. 3-43) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Facility walkdown revealed that the high-pressure tanks are present but empty. No hazardous materials were identified.	Facility walkdown WHC-EP-0619 (p. 3-50) (WHC 1993)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	Two empty (6 ft in diameter by 18 ft long) low-pressure CO_2 tanks and their supports.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) BHI-00221 (p. 3-43) (BHI 1994b)
Biohazard	110-KW Gas Storage Building: Bunker and outdoor gas storage area	Insects, rodents, and snakes. Bird and animal feces.	Greater than the level encountered at normally occupied buildings.	Increased insect, rodent, and snake activity is expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Documentation indicates that the building interior has not been inspected. Facility walkdown revealed that accessible sections of the bunker do not contain asphyxiants and/or confined spaces.	Facility walkdown WHC-EP-0619 (p. 3-50) (WHC 1993)

Table A-12. Summary of 110-KW Gas Storage Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Asphyxiant/ Confined Space	110-KW Gas Storage Building: Outdoor gas storage area	Confined spaces within remaining tanks.	Two large tanks remain.	All tank openings are closed and appropriate caution sings are posted on tank exteriors.	Facility walkdown BHI-00221 (p. 3-43) (BHI 1994b)
Flammable/ Combustible Material	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Available references provide no information regarding current building content. Facility walkdown revealed that there are no flammable/combustible materials in the building.	Facility walkdown BHI-00221 (p. 3-43) (BHI 1994b)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	No potential for flammable or combustible material.	BHI-00221 (p. 3-43) (BHI 1994b)
Reactive Material	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Available references contain no information regarding current building content. Facility walkdown revealed that there are no reactive materials in the bunker.	Facility walkdown BHI-00221 (p. 3-43) (BHI 1994b)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	No potential for reactive material.	BHI-00221 (p. 3-43) (BHI 1994b)
Explosive Material	110-KW Gas Storage Building: Bunker	Not applicable.	None.	Available references provide no information regarding current building content. Facility walkdown revealed no explosive materials in the bunker.	Facility walkdown WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) BHI-00221 (p. 3-43) (BHI 1994b)
	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	None.	No potential for explosive material.	BHI-00221 (p. 3-43) (BHI 1994b)
Electrical Energy	110-KW Gas Storage Building	None beyond that normally encountered in industry.	None beyond that normally encountered in industry.	No electrical service is provided to the outdoor storage area. The bunker is energized.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) BHI-00221 (p. 3-43) (BHI 1994b)
Thermal Energy	110-KW Gas Storage Building	Not applicable.	None.	Available references provide no information regarding current building content. Facility walkdown revealed no thermal energy hazards.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) BHI-00221 (p. 3-43) (BHI 1994b)
Kinetic Energy	110-KW Gas Storage Building	Structural components.	Gas storage tanks elevated above grade on supports.	Standard industrial hazard.	WHC-SP-0331, Rev. 0 (p. A-116) (WHC 1988) BHI-00221 (p. 3-43) (BHI 1994b)

Table A-12. Summary of 110-KW Gas Storage Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	110-KW Gas Storage Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	110-KW Gas Storage Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	110-KW Gas Storage Building	Not applicable.	None.	Remaining tanks are empty.	BHI-00221 (p. 3-43) (BHI 1994b)
Natural Phenomena	110-KW Gas Storage Building: Outdoor gas storage area	Not applicable.	Not applicable.	Since the tanks historically contained CO_2 and are currently empty, there is no potential for a natural phenomena event to interact with hazardous material.	None
	110-KW Gas Storage Building: Bunker	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive materials.	None
	110-KW Gas Storage Building: Bunker	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive materials.	None
	110-KW Gas Storage Building: Bunker	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with radioactive materials.	None
	110-KW Gas Storage Building: Bunker	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive materials. Snowfall could result in structural members interacting with the radioactive materials.	None
	110-KW Gas Storage Building: Bunker	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive materials.	None
	110-KW Gas Storage Building: Bunker	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive materials.	None

CO_2 = carbon dioxide
RBA = radiological buffer area

Table A-13. Summary of 115-KE Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	115-KE Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Not quantified.	Radiological characterization indicated maximum readings of 30 mR/hr on condensers in the dryer rooms. The average true limiting dose rate ranged from <1 mR/hr to 2 mR/hr.	UNI-946 (pp. 7-47 to 7-52) (UNC 1978) WHC-EP-0619 (p. C1-214) (WHC 1993)
Direct Radiation	115-KE Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Radiological characterization indicated maximum readings of 30 mR/hr on condensers in the dryer rooms. The average true limiting dose rate ranged from <1 mR/hr to 2 mR/hr.	Sections of the interior of the building apparently have not been radiologically characterized since 1976. Much of the upper area of the building is a radiation zone.	UNI-946 (pp. 7-47 to 7-52) (UNC 1978) WHC-EP-0619 (pp. 3-51 and C1-214) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Fissionable Material	115-KE Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Not quantified.	Smears taken to determine alpha contamination indicate a maximum of 15 dpm/100 cm^2 at the floor drain in the booster blower room.	UNI-946 (pp. 7-47 to 7-52) (UNC 1978) BHI-00221 (p. 3-38) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	115-KE Gas Recirculation Building	Mercury contained in glass containers and switch.	Not quantified.	The potential exists for small quantities of mercury to be found in glass containers. One mercury switch.	WHC-EP-0619 (p. C1-214) (WHC 1993)
	115-KE Gas Recirculation Building	Asbestos pipe insulation, friable if degraded or damaged.	Not quantified.	Building potentially has asbestos concern because of piping and ductwork.	WHC-EP-0619 (p. C1-214) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Biohazard	115-KE Gas Recirculation Building	Insects, rodents, and snakes. Bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. A-101) (WHC 1988) BHI-00221 (p. 3-38) (BHI 1994b)
Asphyxiant/ Confined Space	115-KE Gas Recirculation Building	Building is unventilated and has many confined spaces both above and below grade.	Not quantified.	The atmosphere of most of the confined spaces has not been checked. Confined spaces are not identified.	WHC-EP-0619 (p. C1-213) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)

Table A-13. Summary of 115-KE Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	115-KE Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-213) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Reactive Material	115-KE Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding reactive materials. Based on historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-213) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Explosive Material	115-KE Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding explosive material. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-213) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Electrical Energy	115-KE Gas Recirculation Building	Only that routinely encountered in industry.	Not quantified.	Available references indicate no findings regarding electrical hazards because the building was not entered. Facility is energized.	WHC-EP-0619 (p. C1-214) (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
Thermal Energy	115-KE Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding thermal energy. Based on current building operations it is anticipated that this is not a hazard.	WHC-SP-0331, Rev. 0 (p. A-101) (WHC 1988) BHI-00221 (p. 3-38) (BHI 1994b)
Kinetic Energy	115-KE Gas Recirculation Building	Structural components.	Not applicable.	Building occupied infrequently during S&M activities.	WHC-SP-0331, Rev. 0 (p. A-101) (WHC 1988) BHI-00221 (p. 3-38) (BHI 1994b)
	115-KE Gas Recirculation Building: Booster blower room, dryer rooms	Rotating equipment (i.e., turbines, motors).	None outside that routinely encountered in industry.	Available references provide no information regarding current status of equipment.	WHC-SP-0331, Rev. 0 (p. A-101) (WHC 1988) WHC-EP-0619 (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)
	115-KE Gas Recirculation Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	115-KE Gas Recirculation Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	115-KE Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding sources of high pressure. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-SP-0331, Rev. 0 (p. A-101) (WHC 1988) WHC-EP-0619 (WHC 1993) BHI-00221 (p. 3-38) (BHI 1994b)

Table A-13. Summary of 115-KE Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	115-KE Gas Recirculation Building	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive and hazardous materials.	None
	115-KE Gas Recirculation Building	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive and hazardous materials.	None
Natural Phenomena	115-KE Gas Recirculation Building	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with radioactive and hazardous materials.	None
	115-KE Gas Recirculation Building	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	115-KE Gas Recirculation Building	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive and hazardous materials.	None
	115-KE Gas Recirculation Building	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive and hazardous materials.	None

S&M = surveillance and maintenance

Table A-14. Summary of 115-KW Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	115-KW Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Not quantified.	Radiological characterization indicated maximum readings of 65 mR/hr on condensers in the dryer rooms. The average true limiting dose rate for the areas ranged from <1 mR/hr to 5 mR/hr.	UNI-946 (pp. 7-58 to 7-66) (UNC 1978) WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Direct Radiation	115-KW Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Radiological characterization indicated maximum readings of 65 mR/hr on condensate drainlines and turbine in the #1 dryer room. The average true limiting dose rate for the various rooms ranged from <1 mR/hr to 5 mR/hr.	Sections of the interior of the building apparently have not been radiologically characterized since 1976. Much of the upper area of the building is a radiation zone.	UNI-946 (pp. 7-58 to 7-66) (UNC 1978) WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Fissionable Material	115-KW Gas Recirculation Building: Pipe tunnel, booster blower room, filter room, dryer rooms, operations room	Surface contamination on equipment, piping, and walls/floors. Contaminated filter media.	Not quantified.	Smears taken to determine alpha contamination indicate maximum of 6,000 dpm/100 cm^2 on louvered exhaust duct in wall to 105-KW Pipe Tunnel. The average value was approximately 500 dpm/100 cm^2.	UNI-946 (pp. 7-58 to 7-66) (UNC 1978) BHI-00221 (p. 3-44) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	115-KW Gas Recirculation Building	Asbestos pipe insulation, friable if damaged or degraded.	Not quantified.	Facility potentially has asbestos concern because it contains piping and ductwork.	WHC-SP-0331, Rev. 0 (p. A-118) (WHC 1988) WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Biohazard	115-KW Gas Recirculation Building	Insects, rodents, and snakes. Bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. A-118) (WHC 1988) BHI-00221 (p. 3-44) (BHI 1994b)
Asphyxiant/ Confined Space	115-KW Gas Recirculation Building	Building is unventilated and has many confined spaces both above and below grade.	Not quantified.	The atmosphere of most of the confined spaces has not been checked. Confined spaces are not identified.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)

Table A-14. Summary of 115-KW Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	115-KW Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Reactive Material	115-KW Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding reactive materials. Based on historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Explosive Material	115-KW Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding explosive material. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Electrical Energy	115-KW Gas Recirculation Building	Only that routinely encountered in industry.	Not quantified.	Available references provide no information regarding electrical hazards. Available references indicate that the building is energized.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Thermal Energy	115-KW Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding thermal energy. Based on current building operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
Kinetic Energy	115-KW Gas Recirculation Building	Structural components.	Not applicable.	Building occupied infrequently during S&M activities.	WHC-SP-0331, Rev. 0 (p. A-118) (WHC 1988) BHI-00221 (p. 3-44) (BHI 1994b)
	115-KW Gas Recirculation Building: Booster blower room; dryer rooms	Rotating equipment (i.e., turbines, motors).	None outside that routinely encountered in industry.	Available references provide no information regarding current status of equipment.	WHC-SP-0331, Rev. 0 (p. A-118) (WHC 1988) WHC-EP-0619 (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)
	115-KW Gas Recirculation Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	115-KW Gas Recirculation Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	115-KW Gas Recirculation Building	Not applicable.	None.	Available references provide no information regarding sources of high pressure. Based on description of historic operations it is anticipated that this is not a hazard.	WHC-EP-0619 (p. C1-245) (WHC 1993) BHI-00221 (p. 3-44) (BHI 1994b)

Table A-14. Summary of 115-KW Gas Recirculation Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	115-KW Gas Recirculation Building	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive and hazardous materials.	None
	115-KW Gas Recirculation Building	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive and hazardous materials.	None
	115-KW Gas Recirculation Building	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with radioactive and hazardous materials.	None
	115-KW Gas Recirculation Building	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	115-KW Gas Recirculation Building	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive and hazardous materials.	None
	115-KW Gas Recirculation Building	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive and hazardous materials.	None

S&M = surveillance and maintenance

Table A-15. Summary of 116-KE Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	116-KE Reactor Exhaust Stack	Mixed fission products and plutonium present as surface contamination.	Undetectable with portable survey instruments.	No exterior radiation levels detected above background. Stack interior was decontaminated. No alpha or beta-gamma contamination was detectable with portable instrumentation.	UNI-2244 (UNC 1982) WHC-EP-0619 (p. 3-46) (WHC 1993) BHI-00221 (p. 3-39) (BHI 1994b)
Direct Radiation	116-KE Reactor Exhaust Stack	Mixed fission products and plutonium present as surface contamination.	Undetectable with portable survey instruments.	No exterior radiation levels detected above background. When stack height was reduced, the stack was decontaminated and the clean rubble was placed inside remaining portion of stack.	UNI-2244 (UNC 1982) WHC-EP-0619 (pp. 3-46) (WHC 1993) BHI-00221 (p. 3-39) (BHI 1994b)
Fissionable Material	116-KE Reactor Exhaust Stack	Plutonium present as surface contamination.	Smearable and fixed alpha contamination less than 100 dpm/100 cm^2 (contamination undetectable with portable alpha survey instrument).	No exterior radiation levels detected above background. Stack interior decontaminated prior to height reduction.	UNI-2244 (UNC 1982) WHC-EP-0619 (pp. 3-46) (WHC 1993) BHI-00221 (p. 3-39) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding hazardous material. Based on information regarding historical operation, it is anticipated that there are no hazardous materials associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) WHC-EP-0619 (p. 3-46) (WHC 1993) BHI-00221 (p. 3-39) (BHI 1994b)
Biohazard	116-KE Reactor Exhaust Stack	Insects, rodents, and snakes. Bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Asphyxiant/ Confined Space	116-KE Reactor Exhaust Stack	Not applicable.	None.	When stack height was reduced the clean rubble was placed inside remaining portion of stack. Therefore, it appears that the stack interior is inaccessible.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Flammable/ Combustible Material	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Reactive Material	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)

Table A-15. Summary of 116-KE Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Explosive Material	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Electrical Energy	116-KE Reactor Exhaust Stack	Not applicable.	None.	The facility is de-energized.	WHC-SP-0331, Rev. 0 (p. B-13) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Thermal Energy	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding thermal energy sources. Based on historic operation, it is anticipated that there are none associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Kinetic Energy	116-KE Reactor Exhaust Stack	Structural components.	Not applicable.	Facility unoccupied during S&M activities. Height of stack reduced from 300 ft to 175 ft in 1982. Clean rubble was placed inside remaining portion of stack.	WHC-SP-0331, Rev. 0 (p. B-12) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
	116-KE Reactor Exhaust Stack	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	116-KE Reactor Exhaust Stack	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	116-KE Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding sources of high pressure. Based on historic operation, it is anticipated that there are none associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-13) (WHC 1988) BHI-00221 (p. 3-39) (BHI 1994b)
Natural Phenomena	116-KE Reactor Exhaust Stack	Not applicable.	Not applicable.	Since the stack was decontaminated and is not currently used, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

Table A-16. Summary of 116-KW Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	116-KW Reactor Exhaust Stack	Mixed fission products and plutonium present as surface contamination.	Undetectable with portable survey instruments.	No exterior radiation levels detected above background. Stack interior was decontaminated. No alpha or beta-gamma contamination was detectable with portable instrumentation.	UNI-2244 (UNC 1982) WHC-EP-0619 (p. 3-51) (WHC 1993) BHI-00221 (p. 3-45) (BHI 1994b)
Direct Radiation	116-KW Reactor Exhaust Stack	Mixed fission products and plutonium present as surface contamination.	Undetectable with portable survey instruments.	No exterior radiation levels detected above background. When stack height was reduced, the stack was decontaminated and the clean rubble was placed inside remaining portion of stack.	UNI-2244 (UNC 1982) WHC-EP-0619 (pp. 3-51) (WHC 1993) BHI-00221 (p. 3-45) (BHI 1994b)
Fissionable Material	116-KW Reactor Exhaust Stack	Plutonium present as surface contamination.	Smearable and fixed alpha contamination less than 100 dpm/100 cm^2 (contamination undetectable with portable alpha survey instrument).	No exterior radiation levels detected above background. Stack interior decontaminated prior to height reduction.	UNI-2244 (UNC 1982) WHC-EP-0619 (pp. 3-51) (WHC 1993) BHI-00221 (p. 3-45) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding hazardous material. Based on description of historic operation it is anticipated that there are no hazardous materials associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) WHC-EP-0619 (p. 3-51) (WHC 1993) BHI-00221 (p. 3-45) (BHI 1994b)
Biohazard	116-KW Reactor Exhaust Stack	Insects, rodents, and snakes. Bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Asphyxiant/ Confined Space	116-KW Reactor Exhaust Stack	Not applicable.	None.	When stack height was reduced the clean rubble was placed inside remaining portion of stack. Therefore, it appears that the stack interior is inaccessible.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Flammable/ Combustible Material	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Reactive Material	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)

Table A-16. Summary of 116-KW Reactor Exhaust Stack Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Explosive Material	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historic operation, it is anticipated that there is no such material associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Electrical Energy	116-KW Reactor Exhaust Stack	Not applicable.	None.	The facility is de-energized.	WHC-SP-0331, Rev. 0 (p. B-16) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Thermal Energy	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding sources of thermal energy. Based historic operation, it is anticipated that there are none associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Kinetic Energy	116-KW Reactor Exhaust Stack	Structural components.	Not applicable.	Facility unoccupied during S&M activities. Height of stack reduced from 300 ft to 175 ft in 1982. Clean rubble was placed inside remaining portion of stack.	WHC-SP-0331, Rev. 0 (p. B-15) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
	116-KW Reactor Exhaust Stack	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	116-KW Reactor Exhaust Stack	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	116-KW Reactor Exhaust Stack	Not applicable.	None.	Available references provide no information regarding sources of high pressure. Based on historic operation, it is anticipated that there are none associated with the stack.	WHC-SP-0331, Rev. 0 (p. B-16) (WHC 1988) BHI-00221 (p. 3-45) (BHI 1994b)
Natural Phenomena	116-KW Reactor Exhaust Stack	Not applicable.	Not applicable.	Since the stack was decontaminated and is not currently used, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

Table A-17. Summary of 117-KE Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	117-KE Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KE stack	Mixed fission products and plutonium present as surface contamination and holdup in filter media.	Not quantified.	No exterior radiation levels detected above background. Process equipment (e.g., filters) contaminated. Interior surfaces of the building have been coated with a sealant.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) UNI-946 (pp. 7-7 to 7-10) (UNC 1978) BHI-00221 (p. 3-40) (BHI 1994b)
Direct Radiation	117-KE Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KE stack	Mixed fission products present as surface contamination, contamination within equipment, and holdup in filter media.	Radiological characterization indicated maximum readings of 5 mR/hr (15,000 c/m) for filters in B cell. The average true limiting dose rate for the various rooms ranged from <1 mR/hr to 1 mR/hr.	No exterior radiation levels detected above background. Equipment within building is contaminated. The maximum smearable alpha and beta contamination levels, 30 dpm/100 cm^2 and 30,000 dpm/100 cm^2, respectively, were measured at the first filter frame in B cell.	UNI-946 (pp. 7-7 to 7-9 and 7-53 to 7-55) (UNC 1978) BHI-00221 (p. 3-40) (BHI 1994b)
Fissionable Material	117-KE Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KE stack	Plutonium present as surface contamination, contamination within equipment, and as holdup in filter media.	The maximum smearable alpha contamination, 30 dpm/100 cm^2, was measured at the first filter frame in the B cell.	Smearable alpha contamination averaged approximately 10 dpm/100 cm^2.	UNI-946 (pp. 7-53 to 7-55) (UNC 1978) BHI-00221 (p. 3-40) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	117-KE Exhaust Air Filter Building	Asbestos insulation, friable if degraded or damaged.	Not quantified.	Building contains piping for service water, compressed air, and instrument lines.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
Biohazard	117-KE Exhaust Air Filter Building	Insects, rodents, and snakes; animal feces.	Greater activity than in normally occupied facilities.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated. Access to facility can only be made via large steel roof hatches that must be removed with the aid of a crane.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
Asphyxiant/ Confined Space	117-KE Exhaust Air Filter Building	Building is unventilated and has many confined spaces both above and below grade.	Not applicable.	Building is properly controlled as a "Confined Space," and building is not routinely entered.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)

Table A-17. Summary of 117-KE Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	117-KE Exhaust Air Filter Building	Polyvinyl.	Not quantified.	WHC-SP-0331 (WHC 1994) indicates that the interior surfaces of the building have been coated with polyvinyl (Ply-On) to seal cracks.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
	117-KE Exhaust Air Filter Building	Activated charcoal in filters.	Not quantified.	There are six banks of filters in the building according to HW-74095 (GE 1963).	HW-74095, Vol. 3 (p. 132) (GE 1963)
Reactive Material	117-KE Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding reactive material.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
Explosive Material	117-KE Exhaust Air Filter Building	Not applicable.	None.	Available references provide no information regarding explosive material. Based on description of historic operations it is anticipated that there are no explosive material hazards.	WHC-SP-0331 Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
Electrical Energy	117-KE Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding electrical hazards, but staff interview indicated that the building is energized.	WHC-SP-0331, Rev. 0 (p. A-104) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b) Staff Interview
Thermal Energy	117-KE Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding thermal energy.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
Kinetic Energy	117-KE Exhaust Air Filter Building	Structural components (e.g., large steel access covers).	Not applicable.	Removal of large steel access covers requires the aid of a crane, which implies a potential load drop. However, the building is not entered during routine S&M activities.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988) BHI-00221 (p. 3-40) (BHI 1994b)
	117-KE Exhaust Air Filter Building	Rotating equipment (i.e., axial vane fan).	One.	A single fan was available to provide ventilation for the facility during maintenance. Available references provide no information regarding current status of equipment.	WHC-SP-0331, Rev. 0 (p. A-103) (WHC 1988)
	117-KE Exhaust Air Filter Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	117-KE Exhaust Air Filter Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	117-KE Exhaust Air Filter Building	Compressed air.	Typical of that found in industry.	Compressed air lines located within facility. Available references provide no information regarding present condition of lines.	WHC-SP-0331 Rev. 0 (p. A-103) (WHC 1988)

Table A-17. Summary of 117-KE Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	117-KE Exhaust Air Filter Building	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive and hazardous materials. The majority of the structure is below grade.	None
	117-KE Exhaust Air Filter Building	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive and hazardous materials.	None
	117-KE Exhaust Air Filter Building	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with radioactive and hazardous materials.	None
	117-KE Exhaust Air Filter Building	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	117-KE Exhaust Air Filter Building	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive and hazardous materials.	None
	117-KE Exhaust Air Filter Building	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive and hazardous materials. The majority of the structure is below grade.	None

S&M = surveillance and maintenance

Table A-18. Summary of 117-KW Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	117-KW Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KW stack	Mixed fission products and plutonium present as surface contamination and holdup in filter media.	Not quantified.	No exterior radiation levels detected above background. Process equipment (e.g., filters) contaminated. Interior surfaces of the building have been coated with a sealant.	UNI-946 (pp. 7-7 to 7-9) (UNC 1978) BHI-00221 (p. 3-46) (BHI 1994b)
Direct Radiation	117-KW Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KW stack	Mixed fission products present as surface contamination, contamination within equipment, and holdup in filter media.	Radiological characterization indicated maximum readings of 2.5 mR/hr in the inlet tunnel. The average true limiting dose rate for the various areas ranged from <1 mR/hr to 2 mR/hr.	No exterior radiation levels detected above background. Equipment within building is contaminated. The maximum smearable alpha and beta contamination levels, 1,250 dpm/100 cm^2 and 225,000 dpm/100 cm^2, respectively, were measured in the inlet tunnel.	UNI-946 (pp. 7-7 to 7-9 and 7-67 to 7-70) (UNC 1978) BHI-00221 (p. 3-46) (BHI 1994b)
Fissionable Material	117-KW Exhaust Air Filter Building: Inlet tunnel; B cell; exhaust tunnel to 116-KW stack	Plutonium present as surface contamination, contamination within equipment, and as holdup in filter media.	The maximum smearable alpha contamination, 1,250 dpm/ 100 cm^2, was measured for the wall at the first turning vane in the inlet tunnel.	Smearable alpha contamination averaged approximately 100 dpm/100 cm^2.	UNI-946 (pp. 7-8 and 7-67) (UNC 1978) BHI-00221 (p. 3-46) (BHI 1994b)
Hazardous Material (e.g., toxic, carcinogenic)	117-KW Exhaust Air Filter Building	Asbestos insulation, friable if degraded or damaged.	Not quantified.	Building contains piping for service water, compressed air, and instrument lines.	WHC-SP-0331 Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Biohazard	117-KW Exhaust Air Filter Building	Insects, rodents, and snakes; animal feces.	Greater activity than in normally occupied facilities.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated. Access to facility can only be made via large steel roof hatches that must be removed with the aid of a crane.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Asphyxiant/ Confine Space	117-KW Exhaust Air Filter Building	Building is unventilated and has many confined spaces both above and below grade.	Not applicable.	Building is properly controlled as a "Confined Space," and building is not routinely entered.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Flammable/ Combustible Material	117-KW Exhaust Air Filter Building	Activated charcoal in filters.	Not quantified.	There are six banks of filters according to HW-74095 (GE 1963). Three of these have been removed according to UNI-946 (UNC 1978).	HW-74095, Vol. 3 (p. 132) (GE 1963) UNI-946 (pp. 7-53 to 7-55) (UNC 1978)

Table A-18. Summary of 117-KW Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Reactive Material	117-KW Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding reactive material.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Explosive Material	117-KW Exhaust Air Filter Building	Not applicable.	None.	Available references provide no information regarding explosive material. Based on description of historical operations it is anticipated that there are no explosive material hazards.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Electrical Energy	117-KW Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding electrical hazards. Building is energized.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b) Staff Interview
Thermal Energy	117-KW Exhaust Air Filter Building	Unknown.	Unknown.	Available references provide no information regarding thermal energy hazards.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
Kinetic Energy	117-KW Exhaust Air Filter Building	Structural components (e.g., large steel access covers).	Not applicable.	Removal of large steel access covers requires the aid of a crane, which implies a potential load drop. However, the building is not entered during routine S&M activities.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988) BHI-00221 (p. 3-46) (BHI 1994b)
	117-KW Exhaust Air Filter Building	Rotating equipment (i.e., axial vane fan).	One.	A single fan was available to provide ventilation for the building during maintenance. Available references provide no information regarding current status of equipment.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988)
	117-KW Exhaust Air Filter Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	117-KW Exhaust Air Filter Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	117-KW Exhaust Air Filter Building	Compressed air.	Typical of that found in industry.	Compressed air lines located within building. Available references provide no information regarding present condition of lines.	WHC-SP-0331, Rev. 0 (p. A-120) (WHC 1988)
Natural Phenomena	117-KW Exhaust Air Filter Building	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive and hazardous materials. The majority of the structure is below grade.	None
	117-KW Exhaust Air Filter Building	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive and hazardous materials.	None

Table A-18. Summary of 117-KW Exhaust Air Filter Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	117-KW Exhaust Air Filter Building	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with radioactive and hazardous materials.	None
	117-KW Exhaust Air Filter Building	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive and hazardous materials. Snowfall could result in structural members interacting with the radioactive and hazardous materials.	None
	117-KW Exhaust Air Filter Building	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive and hazardous materials.	None
	117-KW Exhaust Air Filter Building	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive and hazardous materials. The majority of the structure is below grade.	None

S&M = surveillance and maintenance

Table A-19. Summary of 118-KE-2 Horizontal Control Rod Storage Cave Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	118-KE-2 Horizontal Control Rod Storage Cave	Activated metal.	The south cave contains one HCR tip. The north cave is empty.	Both caves are locked. Since the cave was used for HCR tip storage, it is anticipated that the caves contain little or no surface contamination.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Direct Radiation	118-KE-2 Horizontal Control Rod Storage Cave	Activated metal in HCR tip.	One tip present in the south cave.	Radiation level at the cave entrance with the door open is 1 mR/hr.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Fissionable Material	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Since the cave was used for the storage of rod tips, it is anticipated that the caves do not contain fissionable material.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Hazardous Material (e.g., toxic, carcinogenic)	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Building only used for the temporary storage of radioactive HCR tips.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Biohazard	118-KE-2 Horizontal Control Rod Storage Cave	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Asphyxiant/ Confined Space	118-KE-2 Horizontal Control Rod Storage Cave	Unventilated structure.	Not applicable.	Building is posted as a confined space. Doors are locked.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988) Staff Interview
Flammable/ Combustible Material	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on historic use it is anticipated that it is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Reactive Material	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historic use it is anticipated that reactive material is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Explosive Material	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historic use it is anticipated that explosive material is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Electrical Energy	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Building does not have electrical service.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Thermal Energy	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding thermal energy. However, based on historic use it is anticipated that thermal energy is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)

Table A-19. Summary of 118-KE-2 Horizontal Control Rod Storage Cave Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	118-KE-2 Horizontal Control Rod Storage Cave	Structural components.	Not applicable.	Building is unoccupied during S&M activities.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
	118-KE-2 Horizontal Control Rod Storage Cave	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	118-KE-2 Horizontal Control Rod Storage Cave	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	118-KE-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding sources of high pressure. However, based on building description it is anticipated that high pressure is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-67) (WHC 1988)
Natural Phenomena	118-KE-2 Horizontal Control Rod Storage Cave	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive materials.	None
	118-KE-2 Horizontal Control Rod Storage Cave	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive materials.	None
	118-KE-2 Horizontal Control Rod Storage Cave	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	It is improbable that volcanic activity could produce sufficient ashfall to fail this structure.	None
	118-KE-2 Horizontal Control Rod Storage Cave	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive materials. It is improbable that sufficient snow could accumulate to fail this structure.	None
	118-KE-2 Horizontal Control Rod Storage Cave	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive materials. Caves are short structures covered by layers of earth fill and gravel.	None
	118-KE-2 Horizontal Control Rod Storage Cave	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive materials. Caves are short structures covered by layers of earth fill and gravel.	None

HCR = horizontal control rod

Table A-20. Summary of 118-KW-2 Horizontal Control Rod Storage Cave Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	118-KW-2 Horizontal Control Rod Storage Cave	Activated metal.	Contains four horizontal HCR tips.	Both caves are barricaded and locked. Not specific on location of rods. Since the cave was used for the storage of rod tips, it is anticipated that the caves contain little or no surface contamination.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Direct Radiation	118-KW-2 Horizontal Control Rod Storage Cave	Activated metal in HCR tips.	Four tips present in caves.	Radiation level at the cave entrance with the door open is 50 mR/hr.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Fissionable Material	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Since the cave was used for the storage of rod tips, it is anticipated that the caves do not contain fissionable material.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Hazardous Material (e.g., toxic, carcinogenic)	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Building used for the temporary storage of radioactive HCR tips.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Biohazard	118-KW-2 Horizontal Control Rod Storage Cave	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Asphyxiant/ Confined Space	118-KW-2 Horizontal Control Rod Storage Cave	Unventilated, below-grade structure.	Not applicable.	Building is posted as a confined space. Doors are locked.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988) Staff interview
Flammable/ Combustible Material	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. However, based on historic use it is anticipated that it is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Reactive Material	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding reactive material. However, based on historic use it is anticipated that reactive material is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Explosive Material	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding explosive material. However, based on historic use it is anticipated that explosive material is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Electrical Energy	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Facility does not have electrical service.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Thermal Energy	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding thermal energy sources. However, based on historic use it is anticipated that it is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)

Table A-20. Summary of 118-KW-2 Horizontal Control Rod Storage Cave Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	118-KW-2 Horizontal Control Rod Storage Cave	Structural components.	Not applicable.	Facility unoccupied during S&M activities.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
	118-KW-2 Horizontal Control Rod Storage Cave	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	118-KW-2 Horizontal Control Rod Storage Cave	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	118-KW-2 Horizontal Control Rod Storage Cave	Not applicable.	None.	Available references provide no information regarding sources of high pressure. However, based on building description it is anticipated that it is not a hazard.	WHC-SP-0331, Rev. 0 (p. D-69) (WHC 1988)
Natural Phenomena	118-KW-2 Horizontal Control Rod Storage Cave	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with radioactive materials.	None
	118-KW-2 Horizontal Control Rod Storage Cave	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with radioactive materials.	None
	118-KW-2 Horizontal Control Rod Storage Cave	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	It is improbable that volcanic activity could produce sufficient ashfall to fail this structure.	None
	118-KW-2 Horizontal Control Rod Storage Cave	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with radioactive materials. It is improbable that sufficient snow could accumulate to fail this structure.	None
	118-KW-2 Horizontal Control Rod Storage Cave	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with radioactive materials. Caves are short structures covered by layers of earth fill and gravel.	None
	118-KW-2 Horizontal Control Rod Storage Cave	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with radioactive materials. Caves are short structures covered by layers of earth fill and gravel.	None

HCR = horizontal control rod
S&M = surveillance and maintenance

Table A-21. Summary of 119-KW Exhaust Air Sample Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	119-KW Exhaust Air Sample Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	Staff interview, facility walkdown, WHC-EP-0231-4 (p. A-9) (WHC 1991)
Direct Radiation	119-KW Exhaust Air Sample Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	Staff interview, facility walkdown, WHC-EP-0231-4 (p. A-9) (WHC 1991)
Fissionable Material	119-KW Exhaust Air Sample Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	Staff interview, facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Hazardous Material (e.g., toxic, carcinogenic)	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding hazardous materials. Facility walkdown revealed that no hazardous materials are present.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Biohazard	119-KW Exhaust Air Sample Building	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Facility walkdown revealed the presence of spider webs, but nothing else regarding biohazards.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Asphyxiant/ Confined Space	119-KW Exhaust Air Sample Building	Not applicable.	None.	Based on description and historical use it is anticipated that there are no asphyxiants or confined spaces in the building. Facility walkdown indicated that there are no asphyxiants or confined spaces.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Flammable/ Combustible Material	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding flammable/combustible materials. Facility walkdown confirmed that there are no flammable/combustible materials in the building.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Reactive Material	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding reactive materials. Facility walkdown confirmed that there are no reactive materials in the building.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Explosive Material	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding explosive materials. Facility walkdown confirmed that there are no explosive materials in the building.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Electrical Energy	119-KW Exhaust Air Sample Building	Only that routinely encountered in industry.	Not quantified.	Building is energized.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)

Table A-21. Summary of 119-KW Exhaust Air Sample Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Thermal Energy	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding thermal energy hazards. Facility walkdown confirmed that there are no thermal energy hazards in the building.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Kinetic Energy	119-KW Exhaust Air Sample Building	Structural components.	Not applicable.	Facility occupied infrequently during S&M activities.	WHC-EP-0231-4 (p. A-9) (WHC 1991)
	119-KW Exhaust Air Sample Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	119-KW Exhaust Air Sample Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	119-KW Exhaust Air Sample Building	Not applicable.	None.	Available reference provides no information regarding sources of high pressure. Facility walkdown confirmed that there are no high-pressure hazards associated with the building.	Facility walkdown WHC-EP-0231-4 (p. A-9) (WHC 1991)
Natural Phenomena	119-KW Exhaust Air Sample Building	Not applicable.	Not applicable.	Since the building historically did not contain hazardous materials and is currently not in use, there is no potential for a natural phenomena event to interact with hazardous material.	None

RWP = radiological work permit

Table A-22. Summary of 150-KE Heat Recovery Station Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	150-KE Heat Recovery Station	Radioactive material is present in the ground underneath the metal structure.	Unknown.	Facility contained heat exchangers that were in the reactor effluent discharge flowpath. Heat exchangers have been removed, but electric pump and associated piping remain. Metal building (provided shelter for control systems) is located in a CA.	Staff interviews
Direct Radiation	150-KE Heat Recovery Station	Radioactive material located in ground below the metal structure portion of the facility.	Area on which the structure rests is posted as a CA.	The metal shack that housed the control systems is located in a contamination area. Operations inside the structure did not involve radioactive materials.	Staff interviews
Fissionable Material	150-KE Heat Recovery Station	Not applicable.	None.	Operations inside the structure did not involve radioactive materials.	Staff interviews
Hazardous Material (e.g., toxic, carcinogenic)	150-KE Heat Recovery Station	Not applicable.	None.	No hazardous material was noted to be present in the metal structure.	Staff interviews
Biohazard	150-KE Heat Recovery Station	Insects, rodents, and snakes; bird and animal feces.	Greater activity than observed at normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no asphyxiants and/or confined space hazards.	Staff interview
Flammable/ Combustible Material	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no flammable/combustible material hazards.	Staff interviews
Reactive Material	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no reactive material hazards.	Staff interviews
Explosive Material	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no explosive material hazards.	Staff interviews
Electrical Energy	150-KE Heat Recovery Station	Similar to that routinely encountered in industry.	Similar to that routinely encountered in industry.	Building is de-energized.	Staff interviews
Thermal Energy	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no thermal energy hazards.	Staff interviews

Table A-22. Summary of 150-KE Heat Recovery Station Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	150-KE Heat Recovery Station	Structural components.	Not applicable.	Facility occupied infrequently during S&M activities.	
	150-KE Heat Recovery Station	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	150-KE Heat Recovery Station	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	150-KE Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no high pressure hazards.	Staff interviews
Natural Phenomena	150-KE Heat Recovery Station	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Since the metal structure contains no known hazardous materials, it is improbable for an earthquake to interact with hazardous materials.	None
	150-KE Heat Recovery Station	Flooding of sufficient magnitude to result in intrusion of metal structure and remaining external components.	Not applicable.	The potential exists for floodwater to interact with radioactive materials present in the remaining heat exchanger system components.	None
	150-KE Heat Recovery Station	Volcanic activity produces sufficient ashfall to result in failure of structural members.	Not quantified.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for volcanic activity to interact with radioactive or hazardous materials.	None
	150-KE Heat Recovery Station	Precipitation infiltrates the metal structure and remaining external components. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the remaining external components and interact with radioactive materials. Since the metal structure contains no known radioactive or hazardous materials, it is improbable for snowfall to interact with radioactive or hazardous materials.	None
	150-KE Heat Recovery Station	Lightning strike on metal structure.	Not applicable.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for lightning to interact with radioactive or hazardous materials.	None
	150-KE Heat Recovery Station	High winds of sufficient magnitude to result in structural failure.	Not quantified.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for high winds to interact with radioactive or hazardous materials.	None

CA = contamination area
S&M = surveillance and maintenance

Table A-23. Summary of 150-KW Heat Recovery Station Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	150-KW Heat Recovery Station	Radioactive material is present in the ground underneath the metal structure.	Unknown.	Facility contained heat exchangers that were in the reactor effluent discharge flowpath. Heat exchangers have been removed, but electric pump and associated piping remain. Metal building (provided shelter for control systems) is located in a CA.	Staff interviews
Direct Radiation	150-KW Heat Recovery Station	Radioactive material located in ground below the metal structure portion of the facility.	Unknown.	The metal shack that housed the control systems is located in a CA. Operations inside the structure did not involve radioactive materials.	Staff interviews
Fissionable Material	150-KW Heat Recovery Station	Not applicable.	None.	Operations inside the structure did not involve radioactive materials.	Staff interviews
Hazardous Material (e.g., toxic, carcinogenic)	150-KW Heat Recovery Station	Not applicable.	None.	No hazardous material was noted to be present in the metal structure.	Staff interviews
Biohazard	150-KW Heat Recovery Station	Insects, rodents, and snakes; bird and animal feces.	Greater activity than observed at normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no asphyxiants and/or confined space hazards.	Staff interviews
Flammable/ Combustible Material	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no flammable/combustible material hazards.	Staff interviews
Reactive Material	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no reactive material hazards.	Staff interviews
Explosive Material	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no explosive material hazards.	Staff interviews
Electrical Energy	150-KW Heat Recovery Station	Similar to that routinely encountered in industry.	Similar to that routinely encountered in industry.	Building is de-energized.	Staff interviews
Thermal Energy	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no thermal energy hazards.	Staff interviews
Kinetic Energy	150-KW Heat Recovery Station	Structural components.	Not applicable.	Building occupied infrequently during S&M activities.	

Table A-23. Summary of 150-KW Heat Recovery Station Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	150-KW Heat Recovery Station	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	150-KW Heat Recovery Station	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	150-KW Heat Recovery Station	Not applicable.	None.	Based on information obtained by staff interview there are no high-pressure hazards.	Staff interviews
Natural Phenomena	150-KW Heat Recovery Station	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for an earthquake to interact with radioactive or hazardous materials.	None
	150-KW Heat Recovery Station	Flooding of sufficient magnitude to result in intrusion of metal structure and remaining external components.	Not applicable.	The potential exists for floodwater to interact with radioactive materials present in the remaining heat exchanger system components.	None
	150-KW Heat Recovery Station	Volcanic activity produces sufficient ashfall to result in failure of structural members.	Not quantified.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for volcanic activity to interact with radioactive or hazardous materials.	None
	150-KW Heat Recovery Station	Precipitation infiltrates the metal structure and remaining external components. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the remaining external components and interact with radioactive materials. Since the metal structure contains no known radioactive or hazardous materials, it is improbable for snowfall to interact with radioactive or hazardous materials.	None
	150-KW Heat Recovery Station	Lightning strike on metal structure.	Not applicable.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for lightning to interact with radioactive or hazardous materials.	None
	150-KW Heat Recovery Station	High winds of sufficient magnitude to result in structural failure.	Not quantified.	Since the metal structure contains no known radioactive or hazardous materials, it is improbable for high winds to interact with radioactive or hazardous materials.	None

CA = contamination area
S&M = surveillance and maintenance

Table A-24. Summary of 165-KW Power Control Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	165-KW Power Control Building	Not applicable.	None.	Documentation indicates no radiation levels above background.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
Direct Radiation	165-KW Power Control Building	Not applicable.	None.	Documentation indicates no radiation levels above background.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
Fissionable Material	165-KW Power Control Building	Not applicable.	None.	Documentation indicates no radiation levels above background.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993)
Hazardous Material (e.g., toxic, carcinogenic)	165-KW Power Control Building: HVAC room; outside and west of 165-KW	Asbestos insulation, friable if degraded or damaged.	Not quantified.	Documentation indicates that the boiler room is free of asbestos hazards. Status of the asbestos abatement program for the rest of the building is unknown. Friable asbestos was found in HVAC room.	WHC-SD-DD-TI-044 (WHC 1989) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
	165-KW Power Control Building	Mercury switches in manometer, thermostats, and thermometers.	Two switches; one manometer.	Switches are at the middle of the south wall of the control room, and the manometer is in the center of the boiler room.	WHC-EP-0619 (p. C1-256) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
	165-KW Power Control Building	Ethylene glycol in pipe traps.	Residual quantity.	Underground glycol tanks are noted (status unknown).	BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
	165-KW Power Control Building: Tunnel entry area, basement	Sodium hypochlorite.	Two 5-gal buckets.	None.	
Biohazard	165-KW Power Control Building	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
Asphyxiant/ Confined Space	165-KW Power Control Building: Tunnels to 105 Building	Chlorine.	Not quantified.	Chlorine odor noted in basement area near chlorinator.	WHC-EP-0619 (p. C1-252) (WHC 1993)

Table A-24. Summary of 165-KW Power Control Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	165-KW Power Control Building	Oil leaking from piping and equipment.	Small quantities		WHC-EP-0619 (p. C1-252) (WHC 1993)
Reactive Material	165-KW Power Control Building	Unknown.	Unknown.	Available references provide no information regarding reactive material.	
Explosive Material	165-KW Power Control Building: Battery room in basement underneath electrical room	Hydrogen gas resulting from use of batteries.	50+ batteries are indicated as being in use.	The batteries are used to support switchgear operations for K Basin, which is excluded from S&M activities.	WHC-EP-0619 (p. C1-257) (WHC 1993)
Electrical Energy	165-KW Power Control Building	Isolated electrical hazards resulting from insufficient control and maintenance.	Not quantified.	Electrical system in good condition except for isolated problems. Reference indicates several electrical shock hazards (e.g., exposed energized conductors, deteriorating insulation).	WHC-EP-0619 (p. C1-253) (WHC 1993)
Thermal Energy	165-KW Power Control Building	Unknown.	Unknown.	Available references provide no information regarding thermal energy sources.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)
Kinetic Energy	165-KW Power Control Building	Structural components.	Not applicable.	Facility occupied infrequently by S&M personnel during S&M activities. K Basin personnel access the switchgear portion of the building on a daily basis.	WHC-SP-0331, Rev. 0 (p. A-123) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993)
	165-KW Power Control Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	165-KW Power Control Building	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	165-KW Power Control Building	Not applicable.	None.	Available references provide no information regarding high-pressure sources. However, based on historic use and building description, it is anticipated that there are no high-pressure hazards.	WHC-SP-0331, Rev. 0 (p. A-124) (WHC 1988) WHC-EP-0619 (p. C1-251) (WHC 1993) BHI-00081, Rev. 0 (p. 3-12) (BHI 1994c)

Table A-24. Summary of 165-KW Power Control Building Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	165-KW Power Control Building	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with hazardous materials.	None
	165-KW Power Control Building	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with hazardous materials.	None
	165-KW Power Control Building	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with hazardous materials.	None
	165-KW Power Control Building	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with hazardous materials. Snowfall could result in structural members interacting with the hazardous materials.	None
	165-KW Power Control Building	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with hazardous materials.	None
	165-KW Power Control Building	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with hazardous materials.	None

HVAC = heating, ventilation, and air conditioning
S&M = surveillance and maintenance

Table A-25. Summary of 166-KE Oil Storage Facility Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	166-KE Oil Storage Facility	Not applicable.	None.	Provided inactive waste material storage and stored oil for the 165-KE boilers from 1955 to 1971. Stored Bunker C fuel oil for the 100-N Area from 1981 to 1985.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Direct Radiation	166-KE Oil Storage Facility	Not applicable.	None.	Vault is uncontaminated.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Fissionable Material	166-KE Oil Storage Facility	Not applicable.	None.	Vault is uncontaminated.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Hazardous Material (e.g., toxic, carcinogenic)	166-KE Oil Storage Facility	Unknown.	Unknown.	Available references provide no information regarding hazardous materials other than to indicate that it was once used for inactive waste material storage.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Biohazard	166-KE Oil Storage Facility	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	166-KE Oil Storage Facility	Not applicable.	None.	Not entered during routine S&M activities.	Access requirements listing for BHI buildings
Flammable/ Combustible Material	166-KE Oil Storage Facility	Oil.	Residual quantity.	Residual quantities are presumed because the documentation appears to indicate that the vault is no longer used. Staff interview indicated that approximately 2,000 gal (1-ft-deep pool) of residual oil remains.	WHC-SP-0331, Rev. 1 (p. C-45) (WHC 1994)
Reactive Material	166-KE Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historic operations it is anticipated that reactive materials are not a hazard.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Explosive Material	166-KE Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historic operations it is anticipated that explosive material are not a hazard.	WHC-SP-0331, Rev.1 (p. C-45) (WHC 1994)
Electrical Energy	166-KE Oil Storage Facility	Similar to that routinely encountered in industry.	Similar to that routinely encountered in industry.	Documentation does not indicate whether the building is energized or not.	WHC-SP-0331, Rev. 1 (p. C-45) (WHC 1994)
Thermal Energy	166-KE Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding thermal energy sources. Based on building description it is anticipated that thermal energy is not a hazard.	WHC-SP-0331, Rev. 1 (p. C-45) (WHC 1994)

Table A-25. Summary of 166-KE Oil Storage Facility Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	166-KE Oil Storage Facility	Structural components.	Not applicable.	No entry is permitted to the building during normal S&M activities.	Access requirements documents for BHI buildings
	166-KE Oil Storage Facility	Pumps.	Unknown.	Documentation indicates that there was a pump room associated with the facility. Current status of pump room unknown.	WHC-SP-0331, Rev. 1 (p. C-45) (WHC 1994)
	166-KE Oil Storage Facility	Aircraft crash.	Not applicable.	Probability of event is extremely low	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	166-KE Oil Storage Facility	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	166-KE Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding high pressure. Based on historic operations and building description, it is anticipated that high pressure is not a hazard.	WHC-SP-0331, Rev. 1 (p. C-45) (WHC 1994)
Natural Phenomena	166-KE Oil Storage Facility	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with hazardous materials. The majority of the facility (i.e., concrete storage bunkers) is below grade.	None
	166-KE Oil Storage Facility	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with hazardous materials.	None
	166-KE Oil Storage Facility	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with hazardous materials. Below-grade concrete storage bunkers would not be impacted by ashfall.	None
	166-KE Oil Storage Facility	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with hazardous materials. Snowfall could result in structural members interacting with the, hazardous materials. Below-grade concrete storage bunkers would not be impacted by snowfall.	None
	166-KE Oil Storage Facility	Lightning strike on structure.	Not applicable.	Lightning could strike the above-ground portion of the facility and interact with hazardous materials.	None
	166-KE Oil Storage Facility	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could impact above-ground portion of the facility, resulting in structural members interacting with hazardous materials. Concrete storage bunkers unaffected by high winds.	None

S&M = surveillance and maintenance

Table A-26. Summary of 166-KW Oil Storage Facility Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	166-KW Oil Storage Facility	Not applicable.	None.	Used for oil storage. Documentation indicates that it is uncontaminated.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Direct Radiation	166-KW Oil Storage Facility	Not applicable.	None.	Reference indicates that it is uncontaminated.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Fissionable Material	166-KW Oil Storage Facility	Not applicable.	None.	Reference indicates that it is uncontaminated.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Hazardous Material (e.g., toxic, carcinogenic)	166-KW Oil Storage Facility	Unknown.	Unknown.	Available references provide no information regarding hazardous materials.	
Biohazard	166-KW Oil Storage Facility	Insects, rodents, and snakes; bird and animal feces.	Greater activity than observed in normally occupied buildings.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Space	166-KW Oil Storage Facility	Facility is unventilated, below-grade structure with confined spaces.	Not quantified.	No entry is permitted during routine S&M activities.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Flammable/ Combustible Material	166-KW Oil Storage Facility	Remnant oil heel in concrete storage bunkers.	7,600 L	The bunkers have been drained and retired, but a 7,600 L oil heel remains.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Reactive Material	166-KW Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding reactive materials. Based upon description of historical building operations, it is anticipated that this is not a hazard.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Explosive Material	166-KW Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding explosive materials. Based upon description of historical building operations, it is anticipated that this is not a hazard.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Electrical Energy	166-KW Oil Storage Facility	Similar to that routinely encountered in industry.	Similar to that routinely encountered in industry.	Most recent documentation indicates that the building is energized.	WHC-SP-0331, Rev.1 (p. A-151) (WHC 1994)
Thermal Energy	166-KW Oil Storage Facility	Pumps.	Unknown.	Available references do not indicate that the pumps have been removed.	WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Kinetic Energy	166-KW Oil Storage Facility	Structural components.	Not applicable.	Facility occupied infrequently during S&M activities.	WHC-SP-0331, Rev. 1 (p. A-152) (WHC 1994)
	166-KW Oil Storage Facility	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	166-KW Oil Storage Facility	Vehicle crash.	Not applicable.	Probability of event is low.	

Table A-26. Summary of 166-KW Oil Storage Facility Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	166-KW Oil Storage Facility	Not applicable.	None.	Available references provide no information regarding potential high-pressure hazards. However, based on the historical use of the building and its current status, it is anticipated that there are no high-pressure hazards.	WHC-SP-0331, Rev. 1 (pp. A-151 to A-153) (WHC 1994) WHC-SP-0331, Rev. 0 (p. E-57) (WHC 1988)
Natural Phenomena	166-KW Oil Storage Facility	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with hazardous materials. The majority of the facility (i.e., concrete storage bunkers) is below grade.	None
	166-KW Oil Storage Facility	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with hazardous materials.	None
	166-KW Oil Storage Facility	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with hazardous materials. Storage bunkers would not be impacted by ashfall.	None
	166-KW Oil Storage Facility	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with hazardous materials. Snowfall could result in structural members interacting with the hazardous materials. Below-grade concrete storage bunkers would not be impacted by snowfall.	None
	166-KW Oil Storage Facility	Lightning strike on structure.	Not applicable.	Lightning could strike the above-ground portion of the facility and interact with hazardous materials.	None
	166-KW Oil Storage Facility	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could cause above ground structural members to interact with hazardous materials. Storage bunkers unaffected by high winds.	None

S&M = surveillance and maintenance

Table A-27. Summary of 1720-K Administrative Office Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	1720-K Administrative Office Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988) Access requirements document
Direct Radiation	1720-K Administrative Office Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988) Access requirements document
Fissionable Material	1720-K Administrative Office Building	Not applicable.	None.	The building is uncontaminated. Access to the building is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988) Access requirements document
Hazardous Material (e.g., toxic, carcinogenic)	1720-K Administrative Office Building	Asbestos insulation, friable if degraded or damaged.	Unknown.	Staff interview indicated that the building has no known asbestos hazards.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988) Staff interview
Biohazard	1720-K Administrative Office Building	Insects, rodents, and snakes; bird and animal feces.	Greater activity anticipated than in normally occupied facilities.	Because of limited activity in and around the building, increased insect, rodent, and snake activity is expected. Animal feces are considered a health hazard and may be contaminated.	Historical knowledge
Asphyxiant/ Confined Space	1720-K Administrative Office Building	Not applicable.	None.	Building was used as an office space and does not contain any asphyxiants or confined spaces.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Flammable/ Combustible Material	1720-K Administrative Office Building	Wood furniture, paper.	Not quantified.	The hazard is no greater than that routinely encountered in industry.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Reactive Material	1720-K Administrative Office Building	Not applicable.	None.	Building was used as an office space and does not contain any reactive materials.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Explosive Material	1720-K Administrative Office Building	Not applicable.	None.	Building was used as an office space and does not contain any explosive materials.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Electrical Energy	1720-K Administrative Office Building	None outside that routinely encountered in industry.	None outside that routinely encountered in industry.		WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Thermal Energy	1720-K Administrative Office Building	None outside that routinely encountered in industry.	None outside that routinely encountered in industry.		WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988)
Kinetic Energy	1720-K Administrative Office Building	Structural components.	Not quantified.	Staff interview indicated that the building is not currently occupied.	WHC-SP-0331, Rev. 0 (p. A-91) (WHC 1988) Staff interview
	1720-K Administrative Office Building	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	1720-K Administrative Office Building	Vehicle crash.	Not applicable.	Probability of event is low.	

Table A-27. Summary of 1720-K Administrative Office Building Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	1720-K Administrative Office Building	Not applicable.	None.	Building was used as an office space and does not contain any high-pressure hazards.	Facility walkdown and staff interviews
Natural Phenomena	1720-K Administrative Office Building	Not applicable.	Not applicable.	Since the building contains insignificant amounts of hazardous materials, no radioactive materials, and is currently not in use, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

RWP = radiological work permit

Table A-28. Summary of 182-K Emergency Water Reservoir Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	No radiation levels detected above background. Access requirements document indicates that entry is not governed by a RWP.	BHI-00221 (p. 3-34) (BHI 1994b) Access requirements document
Direct Radiation	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	No radiation levels detected above background. Access requirements document indicates that entry is not governed by a RWP.	BHI-00221 (p. 3-34) (BHI 1994b) Access requirements document
Fissionable Material	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	No radiation levels detected above background. Access requirements document indicates that entry is not governed by a RWP.	BHI-00221 (p. 3-34) (BHI 1994b) Access requirements document
Hazardous Material (e.g., toxic, carcinogenic)	182-K Emergency Water Reservoir Pumphouse	Mercury in thermometers on piping.	Not quantified.	The amount of mercury is small and the mercury is contained.	BHI-00221 (p. 3-34) (BHI 1994b)
	182-K Emergency Water Reservoir Pumphouse: Middle portion of north wall; north end of building	Lead sheet.	One sheet in each location. No indication of size/mass of sheets.	Quantity of lead appears to be negligible. Lead oxidation rates due to exposure to air has been greater than anticipated. Oxidation results in lead being more readily dispersible.	WHC-EP-0619 (p. C1-183) (WHC 1993)
	182-K Emergency Water Reservoir Pumphouse: Throughout building	Ethylene glycol liquid.	Residual quantity in pipes.	None.	WHC-EP-0619 (p. C1-187) (WHC 1993)
Biohazard	182-K Emergency Water Reservoir Pumphouse	Insects, rodents, snakes; bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	BHI-00221 (p. 3-34) (BHI 1994b)
Asphyxiant/ Confined Space	182-K Emergency Water Reservoir Pumphouse	Unventilated, confined spaces.	Not quantified.	Confined spaces are not identified. Clearwell under building is a potential confined space.	WHC-EP-0619 (p. C1-182) (WHC 1993)
Flammable/ Combustible Material	182-K Emergency Water Reservoir Pumphouse	Oil in pumps.	Unknown.	Improper storage of flammable substances indicated.	BHI-00221 (p. 3-34) (BHI 1994b)

Table A-28. Summary of 182-K Emergency Water Reservoir Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Flammable/ Combustible Material	182-K Emergency Water Reservoir Pumphouse: Southwest corner of building over pipe tunnel	Lube oil in tank.	Sight glass indicates that the tank is almost full. Staff interview indicated that 250 to 300 gal of lube oil is contained within the tank.	Staff interview indicated that the oil is still present.	WHC-EP-0619 (p. C1-186) (WHC 1993) Staff interview
	182-K Emergency Water Reservoir Pumphouse: Out building on north side	Oil in underground storage tanks. Oil was pumped out and tanks were removed according to knowledgeable staff.	Possibility of spills in excess of 2,000 gal. Spill is no longer a concern based on information obtained from staff interview.	A staff interview indicated that the diesel oil storage tanks were pumped out and removed from this location subsequent to the publication of WHC-EP-0619 (WHC 1993).	WHC-EP-0619 (p. C1-186) (WHC 1993) Staff interview
Reactive Material	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historical use it is anticipated that reactive materials are not a hazard.	BHI-00221 (p. 3-34) (BHI 1994b)
Explosive Material	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historical use it is anticipated that explosive materials are not a hazard.	BHI-00221 (p. 3-34) (BHI 1994b)
Electrical Energy	182-K Emergency Water Reservoir Pumphouse	None outside that routinely encountered in industry.	None outside that routinely encountered in industry.	Reference indicates that there were no findings associated with the electrical system.	BHI-00221 (p. 3-34) (BHI 1994b)
Thermal Energy	182-K Emergency Water Reservoir Pumphouse	Diesel pumps.	Two.	Building is no longer in use.	BHI-00221 (p. 3-34) (BHI 1994b)
Kinetic Energy	182-K Emergency Water Reservoir Pumphouse	Structural components.	Not applicable.	Building is occupied infrequently during S&M activities.	
	182-K Emergency Water Reservoir Pumphouse	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	182-K Emergency Water Reservoir Pumphouse	Vehicle crash.	Not applicable.	Probability of event is low.	

Table A-28. Summary of 182-K Emergency Water Reservoir Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	182-K Emergency Water Reservoir Pumphouse	Not applicable.	None.	Available references provide no information regarding high-pressure sources. Based on historical use and current status, it is anticipated that high pressure is not a hazard.	BHI-00221 (p. 3-34) (BHI 1994b)
Natural Phenomena	182-K Emergency Water Reservoir Pumphouse	Earthquake of sufficient magnitude to result in structural failure.	Not applicable.	Earthquake could result in structural members interacting with hazardous materials.	None
	182-K Emergency Water Reservoir Pumphouse	Flooding of sufficient magnitude to result in structural intrusion.	Not applicable.	Flooding could result in water interacting with hazardous materials.	None
	182-K Emergency Water Reservoir Pumphouse	Volcanic activity produces sufficient ashfall to result in failure of roof.	Not quantified.	Ashfall could result in structural members interacting with hazardous materials.	None
	182-K Emergency Water Reservoir Pumphouse	Precipitation infiltrates structure. Precipitation in the form of snow results in failure of structural members.	Not quantified.	Precipitation could infiltrate the structure and interact with hazardous materials. Snowfall could result in structural members interacting with the hazardous materials.	None
	182-K Emergency Water Reservoir Pumphouse	Lightning strike on structure.	Not applicable.	Lightning could strike the structure and interact with hazardous materials.	None
	182-K Emergency Water Reservoir Pumphouse	High winds of sufficient magnitude to result in structural failure.	Not quantified.	High winds could result in structural members interacting with hazardous materials.	None

RWP = radiological work permit

Table A-29. Summary of 183-K Pipe Tunnels Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	183-K Pipe Tunnels	Not applicable.	None.	The structure is uncontaminated.	Staff interviews
Direct Radiation	183-K Pipe Tunnels	Not applicable.	None.	The structure is uncontaminated.	Staff interviews
Fissionable Material	183-K Pipe Tunnels	Not applicable.	None.	The structure is uncontaminated.	Staff interviews
Hazardous Material (e.g., toxic, carcinogenic)	183-K Pipe Tunnels	Asbestos insulation, friable if degraded or damaged.	Unknown.	Status of asbestos abatement program unknown for this structure.	Staff interviews
Biohazard	183-K Pipe Tunnels	Insects, rodents, snakes.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected as a result of limited human activity.	
Asphyxiant/ Confined Space	183-K Pipe Tunnels	Structure is entirely below grade and is unventilated.	Not quantified.	Status of posting for confined spaces is unknown.	Staff interviews
Flammable/ Combustible Material	183-K Pipe Tunnels	Not applicable.	None.	Available references provide no information regarding flammable/combustible material. Based on historic operation, it is anticipated that there are no such materials present.	Staff interviews
Reactive Material	183-K Pipe Tunnels	Not applicable.	None.	Available references provide no information regarding reactive material. Based on historic operation, it is anticipated that there are no such materials present.	Staff interviews
Explosive Material	183-K Pipe Tunnels	Not applicable.	None.	Available references provide no information regarding explosive material. Based on historic operation, it is anticipated that there are no such materials present.	Staff interviews
Electrical Energy	183-K Pipe Tunnels	None outside that routinely encountered in industry.	None outside that routinely encountered in industry.	Electrical power is provided for lighting circuits.	Staff interviews
Thermal Energy	183-K Pipe Tunnels	Not applicable.	None.	Available references provide no information regarding thermal energy sources. Based on historical operation, it is anticipated that there are none present.	Staff interviews
Kinetic Energy	183-K Pipe Tunnels	Structural components.	Not applicable.	Structure is occupied infrequently during S&M activities.	
	183-K Pipe Tunnels	Aircraft crash.	Not applicable.	Probability of event is extremely low.	
	183-K Pipe Tunnels	Vehicle crash.	Not applicable.	Structure is entirely below grade.	Staff interviews

Table A-29. Summary of 183-K Pipe Tunnels Hazard Identification. (2 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
High Pressure	183-K Pipe Tunnels	Not applicable.	Not applicable.	Available references provide no information regarding sources of high pressure. Based on historical operation, it is anticipated that there are none present.	Staff interviews
Natural Phenomena	183-K Pipe Tunnels	Not applicable.	Not applicable.	Since the tunnels do not contain any radioactive material, did not historically contain hazardous materials, and current use does not involve hazardous materials, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

S&M = surveillance and maintenance

Table A-30. Summary of 183-KW Filter Plant Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	183-KW Filter Plant	Not applicable.	None.	Documentation indicates no radioactive material used or stored. Access requirements document indicates that entry is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-126) (WHC 1988) WHC-EP-0619 (p. C1-261) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)
Direct Radiation	183-KW Filter Plant	Unknown.	Unknown.	Documentation provides somewhat conflicting information. Generally indicates no radioactive material used or stored, but BHI-00081 (p. 3-33), indicates the presence of a radiation zone.	WHC-SP-0331, Rev. 0 (p. A-126) (WHC 1988) WHC-EP-0619 (p. C1-261) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)
Fissionable Material	183-KW Filter Plant	Not applicable.	None.	Documentation indicates no radioactive material used or stored. Access requirements document indicates that entry is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-126) (WHC 1988) WHC-EP-0619 (p. C1-261) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)
Hazardous Material (e.g., toxic, carcinogenic)	183-KW Filter Plant: Multiple potential locations inside building; adjacent to southeast corner of building	Friable asbestos on piping located adjacent to southeast corner of building. Asbestos insulation, friable if degraded or damaged.	Not quantified.	No evidence of an asbestos abatement program.	WHC-SP-0331, Rev. 0 (p. A-126) (WHC 1988) WHC-EP-0619 (p. C1-263) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)
	183-KW Filter Plant: East wall of basement	Mercury switch.	One switch.	The amount of mercury is small and it is contained.	WHC-EP-0619 (p. C1-264) (WHC 1993)
	183-KW Filter Plant	Solvents in containers on ground.	Unknown.	Specific identity, quantity, and location of solvents is unknown. Staff interview indicated that the residual chemicals have been removed from the building.	BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c) Staff interview
	183-KW Filter Plant: Southwest corner roof area	Chemical tank of unknown content.	Unknown.	Reference indicates that tank shows evidence of leaking. Staff interview indicated that the residual chemicals have been removed from the building.	WHC-EP-0619 (p. C1-264) (WHC 1993) Staff interview
	183-KW Filter Plant	Powder substance.	Unknown.	Documentation indicates that a powder substance of unknown type is stored in the building. Staff interview indicated that all of the residual chemicals have been removed from the building.	BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c) Staff interview
	183-KW Filter Plant Adjacent to bauxite silo outside building	30-gal garbage can with unknown material.	Unknown.	Staff interview indicated that all of the residual chemicals have been removed from the building.	BHI-00081, Rev.0 (p. 3-13) (BHI 1994c) WHC-EP-0619 (p. C1-265) (WHC 1993) Staff interview

Table A-30. Summary of 183-KW Filter Plant Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Hazardous Material (e.g., toxic, carcinogenic)	183-KW Filter Plant	Sodium dichromate.	Residual quantity in pumping equipment.	Staff interview indicated that all of the residual chemicals have been removed from the building.	BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c) Staff interview
	183-KW Filter Plant Brine pit adjacent to SE corner of building	Solid remnant.	Residual quantity.		WHC-EP-0619 (p. C1-265) (WHC 1993)
Biohazard	183-KW Filter Plant	Insects, rodents, and snakes; bird and animal feces.	Greater activity than in normally occupied facilities.	Increased rodent, insect, and snake activity expected due to limited human activity. Animal feces are considered a health hazard and may be contaminated.	BHI-00081, Rev.0 (p. 3-13) (BHI 1994c) WHC-EP-0619 (p. C1-265) (WHC 1993)
Asphyxiant/ Confined Space	183-KW Filter Plant	Not applicable.	None.	References indicate that the building does not contain any asphyxiants and does not have any confined spaces.	WHC-EP-0619 (p. 3-54) (WHC 1993) BHI-00081 (p. 3-13) (BHI 1994c)
Flammable/ Combustible Material	183-KW Filter Plant	Oil leaking from equipment.	Small quantities.	The quantity of material noted does not represent a significant hazard.	WHC-EP-0619 (p. C1-268) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)
Reactive Material	183-KW Filter Plant	Not applicable.	None.	Available references provide no information regarding reactive materials. A staff interview revealed that the residual chemicals have been removed.	Staff interview WHC-EP-0619 (p. 3-54) (WHC 1993)
Explosive Material	183-KW Filter Plant	Not applicable.	None.	Available references provide no information regarding explosive materials. A staff interview revealed that the residual chemicals have been removed.	Staff interview WHC-EP-0619 (p. 3-54) (WHC 1993)
Electrical Energy	183-KW Filter Plant	Isolated electrical hazards resulting from insufficient control and maintenance.	Not quantified.	Equipment out of service yet energized; exposed conductors. A staff interview indicated that the switchgear was updated for the lighting circuits only in 1997.	WHC-EP-0619 (p. C1-253) (WHC 1993) Staff interview
Thermal Energy	183-KW Filter Plant	Unknown.	Unknown.	None.	
Kinetic Energy	183-KW Filter Plant	Structural components.	Not applicable.	Facility occupied infrequently during S&M activities.	WHC-EP-0619 (p. C1-261) (WHC 1993)
	183-KW Filter Plant	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	183-KW Filter Plant	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	183-KW Filter Plant	Not applicable.	None.	Available references provided no information regarding sources of high pressure. However, based on description of building and its operation, it is anticipated that there are no high-pressure hazards.	WHC-SP-0331, Rev. 0 (p. A-127) (WHC 1988) WHC-EP-0619 (p. C1-261) (WHC 1993) BHI-00081, Rev. 0 (p. 3-13) (BHI 1994c)

Table A-30. Summary of 183-KW Filter Plant Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Natural Phenomena	183-KW Filter Plant	Not applicable.	Not applicable.	Since there is no radioactive material and the residual chemicals have been removed from the facility, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

RWP = radiological work permit
S&M = surveillance and maintenance

Table A-31. Summary of 181-KW River Pumphouse Hazard Identification.

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	181-KW River Pumphouse	Not applicable.	None.	Building operation did not involve radioactive materials.	HW-74095, Vol 3 (p. 25) (GE 1963)
Direct Radiation	181-KW River Pumphouse	Not applicable.	None.	Building operation did not involve radioactive materials.	HW-74095, Vol 3 (p. 25) (GE 1963)
Fissionable Material	181-KW River Pumphouse	Not applicable.	None.	Building operation did not involve radioactive materials.	HW-74095, Vol 3 (p. 25) (GE 1963)
Hazardous Material (e.g., toxic, carcinogenic)	181-KW River Pumphouse:	Not applicable.	None.	Staff interview indicated that there are no hazardous materials.	Staff interview
Biohazard	181-KW River Pumphouse	Rodents, insects, snakes; bird and animal feces.	Greater activity than observed at normally occupied facilities.	Potential increased rodent, insect, and snake activity due to limited human activity. Animal feces are considered a health hazard and may be radioactively contaminated.	WHC-EP-0619 (WHC 1993)
Asphyxiant/ Confined Spaces	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any confined spaces.	Staff interview
Flammable/ Combustible Material	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any flammable/combustible material.	Staff interview
Reactive Material	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any reactive materials.	Staff interview
Explosive Material	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any explosive materials.	Staff interview
Electrical Energy	181-KW River Pumphouse	Not applicable	None.	The facility is de-energized according to knowledgeable staff.	Staff interview
Thermal Energy	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any thermal energy hazards.	Staff interview
Kinetic Energy	181-KW River Pumphouse	Structural components.	Not applicable.	Facility occupied only infrequently during S&M activities.	Staff interview
	181-KW River Pumphouse	Aircraft crash.	Not applicable.	Probability of such an event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	181-KW River Pumphouse	Vehicle impact.	Not applicable.	Probability of such an event is low.	None
High Pressure	181-KW River Pumphouse	Not applicable.	None.	The facility does not contain any high-pressure hazards.	Staff interview
Natural Phenomena	181-KW River Pumphouse	Not applicable.	Not applicable.	There is no potential for a natural phenomena event to interact with radioactive or hazardous materials.	Staff interview

Table A-32. Summary of 190-KW Process Water Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Radioactive Material	190-KW Process Water Pumphouse	Not applicable.	None.	Documentation indicates no radiation levels above background. Access requirements document indicates that entry is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-129) (WHC 1988) WHC-EP-0619 (p. C1-271) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c)
Direct Radiation	190-KW Process Water Pumphouse	Not applicable.	None.	Documentation indicates no radiation levels above background. Access requirements document indicates that entry is not governed by a RWP.	WHC-SP-0331, Rev. 0 (p. A-129) (WHC 1988) WHC-EP-0619 (p. C1-271) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c)
Fissionable Material	190-KW Process Water Pumphouse	Not applicable.	None.	Documentation indicates no radiation levels above background.	WHC-SP-0331, Rev. 0 (p. A-129) (WHC 1988) WHC-EP-0619 (p. C1-271) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c)
Hazardous Material (e.g., toxic, carcinogenic)	190-KW Process Water Pumphouse	Asbestos insulation, friable if degraded or damaged.	Not quantified.	95% of facility insulation in good condition with isolated instances of degradation. No evidence of an asbestos abatement program.	WHC-EP-0619 (p. C1-271) (WHC 1993)
	190-KW Process Water Pumphouse: Equipment near center of building	Mercury switches.	Residual quantity.	Mercury present in small quantity in a form that is not readily dispersible.	WHC-EP-0619 (p. C1-274) (WHC 1993)
	190-KW Process Water Pumphouse	Solvents in containers.	None.	Specific identity, quantity, and location of solvents is unknown. Staff interview indicated that the residual chemicals have been removed from the building.	BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c) Staff interview
	190-KW Process Water Pumphouse: Pipe traps; pipelines throughout building	Ethylene glycol.	Residual.	None.	WHC-EP-0619 (p. C1-271) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c)
	190-KW Process Water Pumphouse	Assorted chemicals (e.g., adsorbents, Portland cement, soda-ash).	None.	Documentation indicates large quantity of 5-gal buckets full of a variety of products, many of which are unknown. Staff interview indicated that the residual chemicals have been removed from the building.	WHC-EP-0619 (pp. C1-274, 275) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c) Staff interview
	190-KW Process Water Pumphouse	Aerosol cans, paint, etc.	None.	Miscellaneous materials stored in building. Staff interview indicated that the residual chemicals have been removed from the building.	BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c) WHC-EP-0619 (pp. C1-274, 275) (WHC 1993)

Table A-32. Summary of 190-KW Process Water Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Biohazard	190-KW Process Water Pumphouse	Insects, rodents, and snakes; bird and animal feces.	Greater than that in routinely occupied facilities.	Increased activity expected because the majority of the facility is not routinely occupied. Animal feces are considered a health hazard and may be contaminated.	BHI-00081, Rev.0 (p. 3-14) (BHI 1994c) WHC-EP-0619 (p. C1-278) (WHC 1993)
Asphyxiant/ Confined Space	190-KW Process Water Pumphouse	Unventilated, below-grade areas.	Not quantified.	Confined spaces are not identified.	WHC-EP-0619 (p. C1-272) (WHC 1993)
Flammable/ Combustible Material	190-KW Process Water Pumphouse: Valve pit	Oil leaking from valve actuators.	Small quantities.	Quantity is a negligible hazard.	WHC-EP-0619 (p. C1-278) (WHC 1993)
	190-KW Process Water Pumphouse: Underground oil storage tank west of building	Oil residue or heels.	Unknown.	None.	WHC-EP-0619 (p. C1-278) (WHC 1993)
	190-KW Process Water Pumphouse	Gasoline in approved container, but not stored in proper cabinet.	Unknown.	Staff interview indicated that the residual materials have been removed from the building.	WHC-EP-0619 (p. C1-275) (WHC 1993) BHI-00081 Rev 0 (p. 3-14) (BHI 1994c) Staff interview
	190-KW Process Water Pumphouse	Miscellaneous combustibles in containers.	None.	Staff interview indicated that the residual materials have been removed from the building.	WHC-EP-0619 (p. C1-275) (WHC 1993) BHI-00081 Rev 0 (p. 3-14) (BHI 1994c) Staff interview
Reactive Material	190-KW Process Water Pumphouse	Not applicable.	None.	Available references provide no specific information regarding reactive materials potentially stored in the building. Staff interview indicated that the residual chemicals have been removed from the building.	Staff interview
Explosive Material	190-KW Process Water Pumphouse	Hydrogen gas in ethylene glycol lines.	Unknown.	None.	BHI-00081 Rev 0 (p. 3-14) (BHI 1994c)
Electrical Energy	190-KW Process Water Pumphouse	None other than what is routinely encountered in industry.	None other than what is routinely encountered in industry.	WHC-EP-0619 (WHC 1993) indicates that there are several potential electrical shock hazards (e.g., broken and frayed insulation on conductors).	WHC-EP-0619 (pp. C1-272, 273) (WHC 1993)
Thermal Energy	190-KW Process Water Pumphouse	Unknown.	Unknown.	Available references indicate that many pieces of equipment are out of service yet energized. Some of this equipment may present a thermal energy hazard.	WHC-EP-0619 (pp. C1-272, 273) (WHC 1993)

Table A-32. Summary of 190-KW Process Water Pumphouse Hazard Identification. (3 Pages)

Hazard Type	Location	Form	Quantity	Remarks	References
Kinetic Energy	190-KW Process Water Pumphouse	Structural components.	Not applicable.	Building is infrequently occupied during S&M activities. WHC-EP-0619 (WHC 1993) indicates that it is constantly occupied because it is used as a warehouse in support of K Basin operations. Staff interview indicated that the south bay is used by K Basin as a warehouse.	WHC-EP-0619 (p. C1-274) (WHC 1993) Staff interview
	190-KW Process Water Pumphouse	Aircraft crash.	Not applicable.	Probability of event is extremely low.	WHC-SD-CP-SAR-021, Rev. 1 (WHC 1996)
	190-KW Process Water Pumphouse	Vehicle crash.	Not applicable.	Probability of event is low.	
High Pressure	190-KW Process Water Pumphouse	Not applicable.	None.	Available references provide no specific information on potential high-pressure hazards. However, based on description of facility and operation, it is anticipated that there are no hazards associated with high pressure.	WHC-SP-0331, Rev. 0 (p. A-129) (WHC 1988) WHC-EP-0619 (p. C1-261) (WHC 1993) BHI-00081, Rev. 0 (p. 3-14) (BHI 1994c)
Natural Phenomena	190-KW Process Water Pumphouse	Not applicable.	Not applicable.	Since there is no known radioactive material and the residual chemicals have been removed from the facility, there is no potential for a natural phenomena event to interact with radioactive or hazardous material.	None

RWP = radiological work permit
S&M = surveillance and maintenance

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-B Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-B Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high wind forces or wind-generated missiles is unknown. High wind can result in potential damage to above-ground portion of structure and the release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or Snow Loading	105-B Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of Electrical Power	105-B Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in the release of hazardous materials because the reactor is not actively ventilated. Possible causes: loss of electrical feed to the facility, component or system failure, human error.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.
5	Aircraft Impact	105-B Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 105-B Reactor Building is qualitatively assessed as being of such a low probability that further consideration is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-1	E	No (improbable). Refer to Section 4.2.1.2 of the ASA for discussion.

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
6	Vehicle Impact	105-B Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/incapacitation	Building structure, reactor block structure, shield walls.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-B Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	D	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
8	Water Intrusion	105-B Reactor Building: Module 1	Radioactive material, toxic material	Water intrusion into module 1 (i.e., general ancillary areas outside shield walls, excluding the FSB) of the reactor building results in a spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) states that the doors are deteriorated and that there are openings around the exterior doors. Possible causes: degradation of roof, run-on flooding, internal flooding.	Building structure.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
9	Water Intrusion	105-B Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
10	Water Intrusion	105-B Reactor Building: FSB and transfer pit	Radioactive material, toxic material	Water intrusion into the FSB and transfer pit of the reactor building results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
11	Water Intrusion	105-B Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event). Refer to Section 4.2.1.1 of the ASA for discussion.
12	Fire	105-B Reactor Building: Module 2 reactor block	Radioactive material, toxic material	This is not a credible event. There is no direct ignition source and a lack of exposed surface area (lamination of Masonite and steel that is bound by an external and internal structure). The graphite will not ignite per DOE/EIS-0119 (DOE 1989).	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.
13	Fire	105-B Reactor Building: Module 1	Radioactive material, toxic material	Fire in module 1 lofts radioactive/toxic materials present as surface contamination. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program.	III-3	D	No (bounded by fire in FSB/transfer pits). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
14	Fire	105-B Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 lofts radioactive/toxic materials present as surface contamination and/or waste. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program	III-2	D	No (bounded by fire in FSB/transfer pits). Refer to Section 4.2.1.3 of the ASA for discussion.
15	Fire	105-B Reactor Building: FSB and transfer pit	Radioactive material, toxic material	Fire in the FSB and transfer pit lofts radioactive/toxic materials present as surface contamination and/or waste. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program	III-2	D	Yes. Refer to Section 4.2.1.3 of the ASA for discussion.
16	Lightning	105-B Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on the reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program.	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for a detailed discussion.
17	Criticality	105-B Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is significantly less than the subcritical activity threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100B-CE-N0007 (BHI 1997b).	Reactor block structure, shield walls.	None.	I	E	No (improbable). Refer to Section 4.2.1.4 of the ASA for discussion.

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
18	Container Spill	105-B Reactor Building	Toxic material	Spill of hazardous material within the building results in a release of hazardous material to the environment. Possible causes: degradation of container, human error, container pressurization.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
19	Container Explosion	105-B Reactor Building	Toxic material, flammable material	Container venting and/or explosion results in a release of hazardous material to the environment. Possible causes: inadvertent chemical reaction, gradual container pressurization.	Building structure.	ERC facility surveillance procedure, ERC Emergency Management Program.	III-3	D	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
20	Spread of External Surface Contaminants	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequences).
21	Flammable Gas Explosion	105-B Reactor Building	Flammable material	Hydrogen generated during recharging of batteries ignites. Possible causes: overcharging of batteries results in excess offgassing.	Building structure.	ERC Emergency Management Program	II	D	No (this accident results in personal injury, does not result in significant environmental release).
22	Facility Worker Exposure to External Radiation	105-B Reactor Building	Direct radiation	Facility worker resides in radiation or high radiation area for extended period of time. Possible causes: human error in surveying and/or posting of radiation or high radiation areas, radiation survey instrument failure.	Shielding, physical access control of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[2]	D	No.

Table A-33. Summary of 105-B Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
23	Facility Worker Uptake of Radioactive Material	105-B Reactor Building	Radioactive material	Facility worker enters airborne radioactive material area or works in surface contamination area without proper protection equipment. Possible causes: human error in surveying and/or posting of surface contamination and/or airborne radioactive material areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
24	Facility Worker Exposure to Toxic Materials	105-B Reactor Building	Hazardous materials	Breach of piping/ equipment results in spread of residual quantities of toxic materials. Possible causes: degradation of equipment, personnel error.	None.	ERC HASP, site-specific HASP, ERC work control procedure	II[b]	D	No.

[a] The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b] Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible, and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-34. Summary of 105-C Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-C Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-C Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces or wind-generated missiles is unknown. High wind can result in potential damage to above-ground portion of structure and the release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or Snow Loading	105-C Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of Electrical Power	105-C Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in the release of hazardous materials because the reactor is not actively ventilated. Possible causes: loss of electrical feed to the facility, component or system failure, human error.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.
5	Aircraft Impact	105-C Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 105-C Reactor Building is qualitatively assessed as being of such a low probability that further consideration is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-1	E	No (improbable). Refer to Section 4.2.1.2 of the ASA for discussion.

Table A-34. Summary of 105-C Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
6	Vehicle Impact	105-C Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/incapacitation.	Building structure, reactor block structure, shield walls.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-C Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	D	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
8	Water Intrusion	105-C Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
9	Water Intrusion	105-C Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event). Refer to Section 4.2.1.1 of the ASA for discussion.
10	Fire	105-C Reactor Building: Module 2 reactor block	Radioactive material, toxic material	This is not a credible event. There is no direct ignition source and a lack of exposed surface area (lamination of Masonite and steel that is bound by an external and internal structure). The graphite will not ignite per DOE/EIS-0119 (DOE 1989).	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-34. Summary of 105-C Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
11	Fire	105-B Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 lofts radioactive/ toxic materials present as surface contamination and/or waste. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program	III-2	D	No (bounded by fire in FSB/transfer pits). Refer to Section 4.2.1.3 of the ASA for discussion.
12	Lightning	105-C Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on the reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program.	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for a detailed discussion.
13	Criticality	105-C Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is significantly less than the subcritical activity threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100B-CE-N0007 (BHI 1997b).	Reactor block structure, shield walls.	None.	I	E	No (improbable). Refer to Section 4.2.1.4 of the ASA for discussion.
14	Spread of External Surface Contaminants	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequences).
15	Facility Worker Exposure to External Radiation	105-C Reactor Building	Direct radiation	Facility worker resides in radiation or high radiation area for extended period of time. Possible causes: human error in surveying and/or posting of radiation or high radiation areas, radiation survey instrument failure.	Shielding, physical access control of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[b]	D	No.

Table A-34. Summary of 105-C Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
16	Facility Worker Uptake of Radioactive Material	105-C Reactor Building	Radioactive material	Facility worker enters airborne radioactive material area or works in surface contamination area without proper protection equipment. Possible causes: human error in surveying and/or posting of surface contamination and/or airborne radioactive material areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
17	Facility Worker Exposure to Toxic Materials	105-C Reactor Building	Hazardous materials	Breach of piping/ equipment results in spread of residual quantities of toxic materials. Possible causes: degradation of equipment, personnel error.	None.	ERC HASP, site-specific HASP, ERC work control procedure	II[b]	D	No.

[a] The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b] Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible, and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-35. Summary of 105-DR Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-DR Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-DR Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces or wind-generated missiles is unknown. High wind can result in potential damage to above-ground portion of structure and the release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or Snow Loading	105-DR Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of Electrical Power	105-DR Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in the release of hazardous materials because the reactor is not actively ventilated. Possible causes: loss of electrical feed to the facility, component or system failure, human error.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.
5	Aircraft Impact	105-DR Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting 105-DR Reactor Building is qualitatively assessed as being of such a low probability that further consideration is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-1	E	No (improbable). Refer to Section 4.2.1.2 of the ASA for discussion.

Table A-35. Summary of 105-DR Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
6	Vehicle Impact	105-DR Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/incapacitation	Building structure, reactor block structure, shield walls.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-DR Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	D	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
8	Water Intrusion	105-DR Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
9	Water Intrusion	105-DR Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event). Refer to Section 4.2.1.1 of the ASA for discussion.
10	Fire	105-DR Reactor Building: Module 2 reactor block	Radioactive material, toxic material	This is not a credible event. There is no direct ignition source and a lack of exposed surface area (lamination of Masonite and steel that is bound by an external and internal structure). The graphite will not ignite per DOE/EIS-0119 (DOE 1989).	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-35. Summary of 105-DR Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
11	Fire	105-DR Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 lofts radioactive/toxic materials present as surface contamination and/or waste. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program	III-2	D	No (bounded by fire in FSB/transfer pits). Refer to Section 4.2.1.3 of the ASA for discussion.
12	Lightning	105-DR Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on the reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program.	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for a detailed discussion.
13	Criticality	105-DR Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is significantly less than the subcritical activity threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100D-CE-N0004, Rev. 5 (BHI-2001a).	Reactor block structure, shield walls.	None.	I	E	No (improbable). Refer to Section 4.2.1.4 of the ASA for discussion.
14	Spread of External Surface Contaminants	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequences).
15	Facility Worker Exposure to External Radiation	105-DR Reactor Building	Direct radiation	Facility worker resides in radiation or high radiation area for extended period of time. Possible causes: human error in surveying and/or posting of radiation or high radiation areas, radiation survey instrument failure.	Shielding, physical access control of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[b]	D	No.

Table A-35. Summary of 105-DR Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
16	Facility Worker Uptake of Radioactive Material	105-DR Reactor Building	Radioactive material	Facility worker enters airborne radioactive material area or works in surface contamination area without proper protection equipment. Possible causes: human error in surveying and/or posting of surface contamination and/or airborne radioactive material areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
17	Facility Worker Exposure to Toxic Materials	105-DR Reactor Building	Hazardous materials	Breach of piping/ equipment results in spread of residual quantities of toxic materials. Possible causes: degradation of equipment, personnel error.	None.	ERC HASP, site specific HASP, ERC work control procedure	II[b]	D	No.

[a] The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b] Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible, and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-36. Summary of 105-F Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-F Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-F Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces or wind-generated missiles is unknown. High wind can result in potential damage to above-ground portion of structure and the release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or Snow Loading	105-F Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of Electrical Power	105-F Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in the release of hazardous materials because the reactor is not actively ventilated. Possible causes: loss of electrical feed to the facility, component or system failure, human error.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.
5	Aircraft Impact	105-F Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 105-F Reactor Building is qualitatively assessed as being of such a low probability that further consideration is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-1	E	No (improbable). Refer to Section 4.2.1.2 of the ASA for discussion.

Table A-36. Summary of 105-F Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
6	Vehicle Impact	105-F Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/incapacitation	Building structure, reactor block structure, shield walls.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-F Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	D	No (low consequences). Refer to Section 4.2.1.1 of the ASA for discussion.
8	Water Intrusion	105-F Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in a spread of hazardous materials within the building and to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, shield walls.	ERC work control procedure, ERC facility surveillance procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
9	Water Intrusion	105-F Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event). Refer to Section 4.2.1.1 of the ASA for discussion.
10	Fire	105-F Reactor Building: Module 2 reactor block	Radioactive material, toxic material	This is not a credible event. There is no direct ignition source and a lack of exposed surface area (lamination of Masonite and steel that is bound by an external and internal structure). The graphite will not ignite per DOE/EIS-0119 (DOE 1989).	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-36. Summary of 105-F Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
11	Fire	105-F Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 lofts radioactive/toxic materials present as surface contamination and/or waste. Possible causes: electrical service, mechanical sparks near flammable materials, adverse chemical reactions.	Building structure.	ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting), ERC Emergency Management Program	III-2	D	No (bounded by fire in FSB/transfer pits). Refer to Section 4.2.1.3 of the ASA for discussion.
12	Lightning	105-F Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on the reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for a detailed discussion.
13	Criticality	105-F Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is significantly less than the subcritical activity threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100F-CE-N0002, Rev. 7 (BHI 2003).	Reactor block structure, shield walls.	None	I	E	No (improbable). Refer to Section 4.2.1.4 of the ASA for discussion.
14	Spread of External Surface Contaminants	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequences).
15	Facility Worker Exposure to External Radiation	105-F Reactor Building	Direct radiation	Facility worker resides in radiation or high radiation area for extended period of time. Possible causes: human error in surveying and/or posting of radiation or high radiation areas, radiation survey instrument failure.	Shielding, physical access control of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[b]	D	No.

Table A-36. Summary of 105-F Reactor Building Hazard Evaluation. (4 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
16	Facility Worker Uptake of Radioactive Material	105-F Reactor Building	Radioactive material	Facility worker enters airborne radioactive material area or works in surface contamination area without proper protection equipment. Possible causes: human error in surveying and/or posting of surface contamination and/or airborne radioactive material areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
17	Facility Worker Exposure to Toxic Materials	105-F Reactor Building	Hazardous materials	Breach of piping/ equipment results in spread of residual quantities of toxic materials. Possible causes: degradation of equipment, personnel error.	None.	ERC HASP, site specific HASP, ERC work control procedure	II[b]	D	No.

[a] The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b] Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible, and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-KE Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-KE Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces or wind-generated missiles is unknown. High wind can potentially result in damage to above-ground portion of structure, loss of confinement and the release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or snow loading	105-KE Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of electrical power	105-KE Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in a loss of confinement because the building is not actively ventilated. Thus, a release of hazardous materials to the environment is not a credible event. Possible causes: loss of electrical feed to the building, system/component failure within the building.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (improbable). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
5	Aircraft Impact	105-KE Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 105-KE Reactor Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-I	E	No (improbable). Refer to Section 4.2.1.2 of the ASA for discussion.
6	Vehicle Impact	105-KE Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure, shield walls, reactor block structure.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequences). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-KE Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in a spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	D	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
8	Water Intrusion	105-KE Reactor Building: Module 1	Radioactive material, toxic material	Water intrusion into module 1 (i.e., general ancillary areas outside shield walls) of the reactor building results in spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, internal flooding, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
9	Water Intrusion	105-KE Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, internal flooding, run-on flooding.	Building structure, shield walls.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
10	Water Intrusion	105-KE Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this event is improbable). Refer to Section 4.2.1.1 of the ASA for discussion.

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
11	Fire	105-KE Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Fire involving reactor block lofts radioactive/toxic material present as activation products, resulting in a release of hazardous materials to the environment. Possible causes: inadvertent introduction of combustible material and ignition source in proximity to reactor block.	Reactor block structure, building structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (not a credible event). Refer to Section 4.2.1.3 of the ASA for discussion.
12	Fire	105-KE Reactor Building: Module 1	Radioactive material, toxic material	Fire in module 1 area lofts radioactive/ toxic materials present as surface contamination. Possible causes: ignition of combustible materials. Possible ignition source is an electrical short.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting)	III-3	D	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
13	Fire	105-KE Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 area lofts radioactive/toxic materials present as surface contamination and/or waste. Possible causes: ignition of combustible materials. Possible ignition source is an electrical short.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting)	III-2	D	No (bounded by seismic). Refer to Section 4.2.1.3 of the ASA for discussion.
14	Lightning	105-KE Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for discussion.

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
15	Criticality	105-KE Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is less than the subcritical threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100K-CE-N0001 (BHI 1997c).	Reactor block structure (e.g., fissionabl e material dispersed, biological shield).	None.	I	E	No (not a credible event). Refer to Section 4.2.1.4 of the ASA for discussion.
16	Container Spill	105-KE Reactor Building	Toxic material	Spill of hazardous material within the building results in a release of hazardous material to the environment. Possible causes: container degradation, container pressurization, human error.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
17	Container Explosion	105-KE Reactor Building	Toxic material, flammable/ combustible material	Container venting and/or explosion results in a release of hazardous material to the environment. Possible causes: inadvertent chemical reaction, container pressurization.	Building structure.	ERC facility surveillance procedure, ERC Emergency Management Program	III-3	D	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
18	Spread of External Surface Contamination	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequence).
19	Facility Worker Exposure to External Radiation	105-KE Reactor Building	Direct radiation	Facility worker resides in a radiation or high radiation area for an excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Shielding, physical access control of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[b]	C	No.

Table A-37. Summary of 105-KE Reactor Building Hazard Evaluation. (6 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
20	Facility Worker Uptake of Radioactive Material	105-KE Reactor Building	Radioactive material	Facility worker works in a surface contamination area without proper personal protective equipment. Possible causes: human error in surveying and/or posting of surface contamination areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
21	Facility Worker Exposure to Toxic Materials	105-KE Reactor Building	Hazardous materials	Breach of process piping/ equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, personnel error.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	II[b]	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b]Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-38. Summary of 105-KW Reactor Building and Water Tunnel Hazard Evaluation. (5 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	105-KW Reactor Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/ equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	Yes. Refer to Section 4.2.1.1 of the ASA for discussion.
2	High Wind	105-KW Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. High wind can potentially result in damage to above-ground portion of structure and a release of hazardous materials to the environment.	Building structure, reactor block structure, shield walls. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
3	Ash and/or snow loading	105-KW Reactor Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure would result in impacts to hazardous materials and a release to the environment.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by seismic). Refer to Section 4.2.1.1 of the ASA for discussion.
4	Loss of Electrical Power	105-KW Reactor Building	Radioactive material, toxic material	The loss of electrical power would not result in a loss of confinement because the reactor building is not actively ventilated. Thus, a release of hazardous materials to the environment is not a credible event. Possible causes: loss of electrical feed to the building, system/ component failure within the building.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event). Refer to Section 4.2.1.3 of the ASA for discussion.
5	Aircraft Impact	105-KW Reactor Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 105-KW Reactor Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	Building structure, reactor block structure, shield walls.	ERC Emergency Management Program	III-1	E	No (not a credible event). Refer to Section 4.2.1.2 of the ASA for discussion.

Table A-38. Summary of 105-KW Reactor Building and Water Tunnel Hazard Evaluation. (5 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
6	Vehicle Impact	105-KW Reactor Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the reactor building, compromising containment and releasing hazardous materials to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure, shield walls, reactor block structure.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (low consequences). Refer to Section 4.2.1.2 of the ASA for discussion.
7	Water Intrusion	105-KW Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Water intrusion into the reactor block results in spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, internal flooding, run-on flooding.	Building structure, reactor block structure, shield walls.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	D	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
8	Water Intrusion	105-KW Reactor Building: Module 1	Radioactive material, toxic material	Water intrusion into module 1 (i.e., general ancillary areas outside shield walls) of the reactor building results in spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, internal flooding, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.

Table A-38. Summary of 105-KW Reactor Building and Water Tunnel Hazard Evaluation. (5 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
9	Water Intrusion	105-KW Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Water intrusion into module 2 (i.e., areas within shield walls excluding reactor block) of the reactor building results in spread of hazardous materials within the building and to the environment. WHC-EP-0619 (WHC 1993) indicates that there are no obvious pathways for a release of contaminated water from the building to the environment. Possible causes: degradation of roof, internal flooding, run-on flooding.	Building structure, shield walls.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.1 of the ASA for discussion.
10	Water Intrusion	105-KW Reactor Building: All areas	Radioactive material, toxic material	Water inundates all areas of the building as a result of catastrophic flooding, releasing hazardous materials to the environment. Possible causes: 50% failure of the Grand Coulee Dam.	Building structure, reactor block structure.	ERC Emergency Management Program	III-2	E	No (this event is improbable). Refer to Section 4.2.1.1 of the ASA for discussion.
11	Fire	105-KW Reactor Building: Module 2 reactor block	Radioactive material, toxic material	Fire involving reactor block lofts radioactive/toxic material present as activation products, resulting in a release of hazardous materials to the environment. Possible causes: Inadvertent introduction of combustible material and ignition source in proximity to reactor block.	Reactor block structure.	ERC Emergency Management Program, ERC facility surveillance procedure	II	E	No (not a credible event). Refer to Section 4.2.1.3 of the ASA for discussion.
12	Fire	105-KW Reactor Building: Module 1	Radioactive material, toxic material	Fire in module 1 area lofts radioactive/toxic materials present as surface contamination, resulting in a release of hazardous material to the environment. Possible causes: ignition of combustible materials. Possible ignition source is an electrical short.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting)	III-3	D	No (bounded by seismic). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-38. Summary of 105-KW Reactor Building and Water Tunnel Hazard Evaluation. (5 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
13	Fire	105-KW Reactor Building: Module 2 excluding reactor block	Radioactive material, toxic material	Fire in module 2 area lofts radioactive/toxic materials present as surface contamination and/or waste, resulting in a release to the environment. Possible causes: inadvertent introduction of combustible materials. Possible ignition source is an electrical short.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting)	III-2	D	No (bounded by seismic). Refer to Section 4.2.1.3 of the ASA for discussion.
14	Lightning	105-KW Reactor Building: All areas	Radioactive material, toxic material	Lightning strike on reactor building results in the release of hazardous materials to the environment.	Building structure, reactor block structure.	ERC Emergency Management Program	III-3	D	No (bounded by the seismic event). Refer to Section 4.2.1.1 of the ASA for discussion.
15	Criticality	105-KW Reactor Building	Radioactive material, direct radiation	This is not a credible event because the quantity of fissionable material in the reactor building is less than the subcritical threshold limits for criticality given in BHI-DE-01, EDPI-4.35-01. This calculation is documented in 0100K-CE-N0002. (BHI 1997d)	Reactor block structure (e.g., fissionable material dispersed, biological shield).	None.	I	E	No (not a credible event). Refer to Section 4.2.1.4 of the ASA for discussion.
16	Container Spill	105-KW Reactor Building	Toxic material	Spill of hazardous material within the building results in a release of toxic material to the building interior and potentially to the environment. Possible causes: degradation of container, human error.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.
17	Container Explosion	105-KW Reactor Building	Toxic material, flammable/ combustible material	Container venting and/or explosion results in a release of hazardous material to the environment. Possible causes: inadvertent chemical reaction, container pressurization.	Building structure.	ERC facility surveillance procedure, ERC Emergency Management Program	III-3	D	No (low consequence). Refer to Section 4.2.1.3 of the ASA for discussion.

Table A-38. Summary of 105-KW Reactor Building and Water Tunnel Hazard Evaluation. (5 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
18	Spread of External Surface Contamination	All outdoor surface contamination	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequence).
19	Facility Worker Exposure to External Radiation	105-KW Reactor Building	Direct radiation	Facility worker resides in a radiation or high radiation area for excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Shielding, physical access control (e.g., barricades, locked doors) of high radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	II[b]	C	No.
20	Facility Worker Uptake of Radioactive Material	105-KW Reactor Building	Radioactive material	Facility worker works in a surface contamination area without proper personal protective equipment. Possible causes: human error in surveying and/or posting of surface contamination areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
21	Facility Worker Exposure to Toxic Materials	105-KW Reactor Building	Hazardous materials	Breach of process piping/equipment results in a spread of residual quantities of process chemicals.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	II[b]	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b]Based on historical information, an exposure resulting in a consequence ranking of II is judged to be essentially incredible. However, exposures are possible and a consequence ranking of II is more applicable than III based on their respective definitions (i.e., "severe" versus "unplanned release").

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FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-39. Summary of 115-KE Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	115-KE Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/ equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	No (bounded by reactor buildings).
2	High Wind	115-KE Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. Potential damage to above-ground structure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
3	Ash and/or Snow Loading	115-KE Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
4	Loss of Electricity	115-KE Building	Radioactive material, toxic material	Loss of electricity would not result in a loss of confinement because the building does not have forced ventilation. Therefore, a release of hazardous material to the environment is not a credible event.	None.	ERC facility surveillance procedure	IV	E	No (not a credible event).
5	Aircraft Impact	115-KE Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 115-KE Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	None.	ERC Emergency Management Program	III-1	E	No (not a credible event).
6	Vehicle Impact	115-KE Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the building resulting in a loss of confinement and a release of hazardous material to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure (reinforced concrete walls).	ERC facility access control procedure, ERC work control procedure	III-3	C	No (bounded by reactor buildings).

Table A-39. Summary of 115-KE Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
7	Water Intrusion	115-KE Building	Radioactive material, toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (bounded by reactor buildings).
8	Water Intrusion	115-KE Building	Radioactive material, toxic material	Majority of building is submerged in flood water, resulting in the release of hazardous materials to the environment. Possible cause: catastrophic flooding due to a 50% failure of the Grand Coulee Dam.	Building structure.	ERC Emergency Management Program	III-2	E	No (This is an improbable event).
9	Fire	115-KE Building	Radioactive material, toxic material	Fire in building suspends radioactive/toxic materials present as surface contamination, resulting in a release of hazardous material to the environment. Possible causes: inadvertent introduction of flammable/ combustible material. Potential ignition source is electrical short.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (i.e., welding, cutting).	III-2	D	No (bounded by reactor buildings).
10	Lightning	115-KE Building	Radioactive material, toxic material	Lightning strike on the building results in the release of hazardous materials to the environment.	Building structure.	ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
11	Spread o External Surface Contamination	115-KE Building	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequence).

Table A-39. Summary of 115-KE Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
12	Facility Worker Exposure to External radiation	115-KE Building	Direct radiation	S&M personnel reside in radiation area for excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Physical access control of radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	IV	D	No.
13	Facility Worker Uptake of Radioactive Material	115-KE Building	Radioactive material	S&M personnel work in a surface contamination area without proper personal protective equipment. Possible causes: human error regarding surveying and/or posting of surface contamination areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
14	Facility Worker Exposure to Toxic Materials	115-KE Building	Toxic material	Breach of process piping/equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, personnel error.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	IV	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

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SSC = system, structure, and component
UBC = Uniform Building Code

Table A-40. Summary of 115-KW Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	115-KW Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	No (bounded by reactor buildings).
2	High Wind	115-KW Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. Potential damage to above-ground structure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
3	Ash and/or snow loading	115-KW Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
4	Loss of Electricity	115-KW Building	Radioactive material, toxic material	Loss of electricity would not result in a loss of confinement because the building does not have forced ventilation. Therefore, a release of hazardous material to the environment is not a credible event.	None.	ERC facility surveillance procedure	IV	E	No (not a credible event).
5	Aircraft Impact	115-KW Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 115-KW Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	None.	ERC Emergency Management Program	III-1	E	No (not a credible event).
6	Vehicle Impact	115-KW Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the building, resulting in a loss of confinement and a release of hazardous material to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure (reinforced concrete walls).	ERC facility access control procedure, ERC work control procedure	III-3	C	No (bounded by reactor buildings).

Table A-40. Summary of 115-KW Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
7	Water Intrusion	115-KW Building	Radioactive material, toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of roof, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (bounded by reactor buildings).
8	Water Intrusion	115-KW Building	Radioactive material, toxic material	Majority of building is submerged in flood water, resulting in the release of hazardous materials to the environment. Possible cause: catastrophic flooding due to a 50% failure of the Grand Coulee Dam.	Building structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event).
9	Fire	115-KW Building	Radioactive material, toxic material	Fire in building suspends radioactive/toxic materials present as surface contamination, resulting in a release of hazardous material to the environment. Possible causes: inadvertent introduction of flammable/ combustible material. Potential ignition source is electrical short.	None.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (i.e., welding, cutting)	III-2	D	No (bounded by reactor buildings).
10	Lightning	115-KW Building	Radioactive material, toxic material	Lightning strike on the building results in the release of hazardous materials to the environment.	Building structure.	ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
11	Spread of External Surface Contamination	115-KW Building	Radioactive material	Surface contamination is spread from designated areas. Possible causes: high winds, biological agents (birds, rodents, etc.).	None.	ERC Radiological Control Program requirements (e.g., routine surveys, posting of radiological areas)	III-3	C	No (low consequence).
12	Facility Worker Exposure to External Radiation	115-KW Building	Direct radiation	S&M personnel reside in radiation area for excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Physical access control of radiation areas.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure	IV	D	No.

Table A-40. Summary of 115-KW Gas Recirculation Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
13	Facility Worker Uptake of Radioactive Material	115-KW Building	Radioactive material	S&M personnel work in a surface/airborne contamination area without proper personal protective equipment. Possible causes: human error in surveying/posting of surface contamination areas.	None.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure	IV	D	No.
14	Facility Worker Exposure to Toxic Materials	115-KW Building	Toxic material	Breach of process piping/equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, personnel error.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	IV	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

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Table A-41. Summary of 117-KE Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	117-KE Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/ equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	No (bounded by reactor buildings).
2	High Wind	117-KE Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. Potential damage to above-ground portion of structure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
3	Ash and/or Snow Loading	117-KE Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
4	Loss of Electrical Power	117-KE Building	Radioactive material, toxic material	Loss of electrical power would not result in a loss of confinement because the building is not actively ventilated. Thus a release of hazardous material is not a credible event.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event).
5	Aircraft Impact	117-KE Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 117-KE Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	None.	ERC Emergency Management Program	III-1	E	No (not a credible event).
6	Vehicle Impact	117-KE Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the building resulting in a loss of confinement and a release of hazardous material to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure (i.e., building almost entirely below grade with earthen berm around walls).	ERC facility access control procedure, ERC work control procedure	III-3	C	No (bounded by reactor buildings).

Table A-41. Summary of 117-KE Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
7	Water Intrusion	117-KE Building	Radioactive material, toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of roof/ walls of building, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (bounded by reactor buildings).
8	Water Intrusion	117-KE Building	Radioactive material, toxic material	Majority of building is submerged in flood water, resulting in the release of hazardous materials to the environment. Possible cause: catastrophic flooding due to a 50% failure of the Grand Coulee Dam.	Building structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event).
9	Fire	117-KE Building	Radioactive material, toxic material	Fire in building suspends radioactive/toxic materials present as surface contamination resulting in a release to the environment. Possible causes: potential ignition source is electrical short. Interior surfaces of building coated with polyvinyl sealant.	None.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (i.e., welding, cutting)	III-2	D	No (bounded by reactor buildings).
10	Lightning	117-KE Building	Radioactive material, toxic material	Lightning strike on the building results in the release of hazardous materials to the environment.	Building structure.	ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
11	Facility Worker Exposure to External Radiation	117-KE Building	Direct radiation	S&M personnel reside in radiation area for excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Physical access control of the building.	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure, ERC facility access control procedure (building not entered for routine S&M activities)	IV	D	No.

Table A-41. Summary of 117-KE Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
12	Facility Worker Uptake of Radioactive Material	117-KE Building	Radioactive material	S&M personnel work in a surface contamination area without proper personal protective equipment. Possible causes: human error is surveying and/or posting of surface contamination areas.	Physical access control of the building.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC work control procedure, ERC facility access control procedure (not entered for routine S&M activities)	IV	D	No.
13	Facility Worker Exposure to Toxic Materials	117-KE Building	Toxic material	Breach of process piping/ equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, human error.	Physical access control of the building.	ERC facility surveillance procedure, ERC facility access control procedure (not routinely entered for S&M activities), ERC work control procedure	IV	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

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Table A-42. Summary of 117-KW Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	117-KW Building	Radioactive material, toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/ equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-2[a]	C	No (bounded by reactor buildings).
2	High Wind	117-KW Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. Potential damage to above-ground portion of structure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
3	Ash and/or snow loading	117-KW Building	Radioactive material, toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
4	Loss of electrical power	117-KW Building	Radioactive material, toxic material	Loss of electrical power would not result in the release of hazardous material to the environment because the building is not actively ventilated.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event).
5	Aircraft impact	117-KW Building	Radioactive material, toxic material, kinetic energy	The likelihood of an aircraft impacting the 117-KW Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	None.	ERC Emergency Management Program	III-1	E	No (not a credible event).
6	Vehicle impact	117-KW Building	Radioactive material, toxic material, kinetic energy	Vehicle impacts the building resulting in a loss of confinement and a release of hazardous material to the environment. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure (i.e., building almost entirely below grade with earthen berm around walls).	ERC facility access control procedure, ERC work control procedure	III-3	C	No (bounded by reactor buildings).

Table A-42. Summary of 117-KW Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
7	Water Intrusion	117-KW Building	Radioactive material, toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of roof and/or walls of building, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (bounded by reactor buildings).
8	Water Intrusion	117-KW Building	Radioactive material, toxic material	Majority of building is submerged in flood water, resulting in the release of hazardous materials to the environment. Possible cause: catastrophic flooding due to a 50% failure of the Grand Coulee Dam.	Building structure.	ERC Emergency Management Program	III-2	E	No (this is an improbable event).
9	Fire	117-KW Building	Radioactive material, toxic material	Fire within building suspends radioactive/toxic materials present as surface contamination resulting in a release of hazardous material to the environment. Possible causes: potential ignition source is electrical short. Interior surfaces of building coated with polyvinyl sealant.	Building structure.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (i.e., welding and cutting).	III-2	D	No (bounded by reactor buildings).
10	Lightning	117-KW Building	Radioactive material, toxic material	Lightning strike on the building results in the release of hazardous materials to the environment.	Building structure.	ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
11	Facility Worker Exposure to External Radiation	117-KW Building	Radioactive material	S&M personnel reside in radiation area for excessive period of time. Possible causes: human error in surveying and/or posting of radiation areas; radiation survey instrument failure.	Physical access control of the building. (Note: Access to building must be made through large steel hatches that must be removed with the aid of a crane.)	ERC Radiological Control Program, ERC RWP procedure, ERC work control procedure, ERC facility access control procedure (building not routinely entered for S&M activities)	IV	D	No.

Table A-42. Summary of 117-KW Exhaust Air Filter Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
12	Facility Worker Uptake of Radioactive Material	117-KW Building	Radioactive material	S&M personnel work in a surface contamination area without proper personal protective equipment. Possible causes: human error in surveying and/or posting of surface contamination areas.	Physical access control of the building.	ERC Radiological Control Program, ERC RWP procedure, ERC airborne radioactive material monitoring and evaluation procedure, ERC facility access control procedure (not routinely entered for S&M activities)	IV	D	No.
13	Facility Worker Exposure to Toxic Materials	117-KW Building	Toxic material	Breach of process piping/equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, human error.	Physical access control of the building.	ERC facility surveillance procedure, ERC facility access control procedure(not routinely entered for S&M activities), ERC work control procedure	IV	D	No.

[a]The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-43. Summary of 165-KW Power Control Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	165-KW Building	Toxic material, kinetic energy	Structural damage results in a loss of confinement. Shock/vibration and movement of structure/ equipment suspends hazardous materials resulting in an uncontrolled release to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	C	No (bounded by reactor buildings).
2	High Wind	165-KW Building	Toxic material, kinetic energy	Capability of structure to resist high-wind forces unknown. Potential damage to above-ground portion of structure and release of hazardous material to the environment.	Building structure. Assume structure met UBC at time of construction.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
3	Ash and/or Snow Loading	165-KW Building	Toxic material, kinetic energy	Capability of structure to resist ash and/or snow loading unknown. Potential roof failure and release of hazardous material to the environment.	Building structure.	ERC Emergency Management Program, ERC work control procedure	III-3[a]	D	No (bounded by reactor buildings).
4	Loss of Electrical Power	165-KW Building	Toxic material	The building is not actively ventilated. Loss of electrical power would not result in the release of hazardous material to the environment.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event).
5	Aircraft Impact	165-KW Building	Toxic material, kinetic energy	The likelihood of an aircraft impacting the 165-KW Building is qualitatively assessed to be of such a low probability that further evaluation is not required.	None.	ERC Emergency Management Program	III-2	E	No (not a credible event).
6	Vehicle Impact	165-KW Building	Toxic material, kinetic energy	Vehicle impacts the building, potentially compromising the structural integrity. Possible causes: mechanical failure, operator error/ incapacitation.	Building structure.	ERC facility access control procedure, ERC work control procedure	III-3	C	No (bounded by reactor buildings).

Table A-43. Summary of 165-KW Power Control Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
7	Water Intrusion	165-KW Building	Toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of roof of building, run-on flooding.	Building structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	C	No (bounded by reactor buildings).
8	Water Intrusion	165-KW Building	Radioactive material, toxic material	Majority of building is submerged in flood water, resulting in the release of hazardous materials to the environment. Possible cause: catastrophic flooding due to a 50% failure of the Grand Coulee Dam.	Building structure.	ERC Emergency Management Program	III-2	E	No (This is an improbable event).
9	Fire	165-KW Building	Toxic material	Fire within building suspends toxic material present in bulk containers resulting in a release to the environment. Possible causes: inadvertent introduction of combustibles; failure to remove combustibles. Potential ignition source is electrical short.	None.	ERC Emergency Management Program, ERC facility surveillance procedure, restriction on open flame activities (e.g., welding and cutting)	III-3	D	No (bounded by reactor buildings).
10	Lightning	165-KW Building	Radioactive material, toxic material	Lightning strike on the building results in the release of hazardous materials to the environment.	Building structure.	ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
11	Liquid Spill to Ground	165-KW Building	Toxic material	Spill of residual hazardous material to the ground from storage vessel. Possible causes: corrosion.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	III-3	C	No (low consequences).

Table A-43. Summary of 165-KW Power Control Building Hazard Evaluation. (3 Pages)

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
12	Container Spill	165-KW Building	Toxic material	Spill of hazardous material within the building results in a release to the environment. No pathways to the environment were noted in the vicinity of the containers. Possible causes: container degradation, human error.	Building structure.	ERC facility surveillance procedure, ERC work control procedure	IV	C	No (low consequences).
13	Container Explosion	165-KW Building	Toxic material, flammable/ combustible material	Container venting and/or explosion results in a release of hazardous material to the environment. Possible causes: inadvertent chemical reaction.	Building structure.	ERC facility surveillance procedure, ERC Emergency Management Program	III-3	D	No (low consequences).
14	Flammable Gas Explosion	165-KW Building: Battery room in basement	Flammable/ combustible material	Hydrogen generated as a result of recharging batteries in battery room is ignited and produces a deflagration. Possible causes: overcharging of batteries results in excess hydrogen generation. Possible ignition sources include electrical short.	Building structure.	ERC Emergency Management Program	III-3 [b]	D	No (low consequences).
15	Facility Worker Exposure to Toxic Material	165-KW Building	Toxic material	Facility worker exposed to toxic material as a result of a container spill or breach. Possible causes: container degradation, human error.	None.	ERC Project HASP, site-specific HASP, ERC work control procedure	IV	D	No.

[b] The consequence rankings of these events are based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

[b] The consequence ranking of this event is based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being directly impacted by the explosion are considered to be a standard industrial hazard.

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-44. Summary of 166-KE Oil Storage Facility Hazard Evaluation.

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	166-KE Oil Storage Facility	Toxic material	Structural damage results in a loss of confinement and an uncontrolled release to the environment.	Vault structure.	ERC Emergency Management Program, ERC work control procedure	IV	D	No (low consequence).
2	Loss of electrical power	166-KE Oil Storage Facility	Toxic material	Loss of electrical power would not result in the release of hazardous material. Not a credible event because the building is not actively ventilated.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event).
3	Water Intrusion	166-KE Oil Storage Facility	Toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of vault structure.	Vault structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	D	No (bounded by reactor buildings).
4	Fire	166-KE Oil Storage Facility	Toxic material	Fire within storage vaults releases toxic material to the environment. Possible causes: inadvertent introduction of combustibles and ignition source into storage vaults.	None.	ERC facility access control procedure (entry is not permitted during routine S&M activities) ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
5	Facility Worker Exposure to Toxic Material	166-KE Oil Storage Facility	Toxic material	Breach of process piping/equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, human error.	None.	ERC facility access control procedure (entry is not permitted during routine S&M activities) ERC work control procedure, ERC facility surveillance procedure	IV	D	No.

[a]The consequence ranking of the seismic event is based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
SSC = system, structure, and component
UBC = Uniform Building Code

Table A-45. Summary of 166-KW Oil Storage Facility Hazard Evaluation.

Item	Summary				Prevention and Mitigation		Event Ranking		Detailed Hazards Eval.
	Potential Event	Location	Hazard Type	Event and Possible Causes	SSCs	Administrative	C	L	
1	Seismic Event	166-KW Oil Storage Facility	Toxic material	Structural damage results in a loss of confinement and an uncontrolled release to the environment.	Vault structure.	ERC Emergency Management Program, ERC work control procedure	IV[a]	D	No (low consequence).
2	Loss of electrical power	166-KW Oil Storage Facility	Toxic material	Loss of electrical power would not result in the release of hazardous material. Not a credible event because the building is not actively ventilated.	None.	ERC facility surveillance procedure, ERC work control procedure	IV	E	No (not a credible event).
3	Water Intrusion	166-KW Oil Storage Facility	Toxic material	Water intrusion into the building results in the release of hazardous material to the environment. Possible causes: degradation of vault structure.	Vault structure.	ERC facility surveillance procedure, ERC work control procedure, ERC waste management procedure	III-3	D	No (bounded by reactor buildings).
4	Fire	166-KW Oil Storage Facility	Toxic material	Fire within storage vaults releases toxic material to the environment. Possible causes: inadvertent introduction of combustibles and ignition source into storage vaults.	None.	ERC Facility Access Control procedure (entry is not permitted during routine S&M activities) ERC Emergency Management Program	III-3	D	No (bounded by reactor buildings).
5	Facility Worker Exposure to Toxic Material	166-KW Oil Storage Facility	Toxic material	Breach of process piping/equipment results in a spread of residual quantities of process chemicals. Possible causes: degradation of equipment, human error.	None.	ERC facility access control procedure (entry is not permitted during routine S&M activities). ERC Emergency Management Program, ERC facility surveillance procedure.	IV	D	No.

[a]The consequence ranking of the seismic event is based only on the potential exposure of individuals to radioactive/toxic materials released during the event. Consequences to facility workers as a result of being struck by falling structural members are considered to be a standard industrial hazard.

ASA = auditable safety analysis
ERC = Environmental Restoration Contractor
FSB = fuel storage basin
HASP = health and safety plan
RWP = radiological work permit
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APPENDIX B

FINAL HAZARD CLASSIFICATION

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APPENDIX B

FINAL HAZARD CLASSIFICATION

B.1 INTRODUCTION

Preliminary hazard classification (PHC) analyses have been performed for the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors. The PHCs were determined by comparing the radionuclide inventories present in defined segments (e.g., module 1 and reactor block) to the threshold quantities in DOE-STD-1027-92 (DOE 1992). The PHC results are summarized in Table B-1.

Table B-1. Results of Preliminary Hazard Classification Analyses for the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors.

Facility	PHC	Basis	Reference
105-B	Nuclear Category 3	Reactor block and fuel storage basin inventory	BHI-01085, Table 6, p. 16 (BHI 1997b)
105-C	Nuclear Category 3	Reactor block inventory	BHI-00831, Table 6, p. 11 (BHI 1996d)
105-DR	Nuclear Category 3	Reactor block inventory	BHI-01083, Table 5, p. 16 (BHI 1997c)
105-F	Nuclear Category 3	Reactor block inventory	BHI-01082, Table 6, p. 16 (BHI 1997d)
105-KE[a]	Nuclear Category 3	Reactor block inventory	BHI-01080, Table 5, p. 13 (BHI 1997e)
105-KW[a]	Nuclear Category 3	Reactor block inventory	BHI-01079, Table 5, p. 13 (BHI 1997f)

[a]The 105-KE and 105-KW fuel storage basins are not included in the scope of this analysis.

In accordance with DOE-STD-1027-92, final hazard classification (FHC) analyses are performed considering the quantity, form, location, and dispersibility of the radionuclide inventory and its interaction with available energy sources (DOE 1992). Three scenarios (i.e., a fuel storage basin [FSB] fire for 105-B and a seismic event for 105-C and 105-KE) were selected for analysis based on the hazard identification and preliminary hazards analysis performed for the above-identified surplus reactors and their associated ancillary facilities. Analysis of these scenarios forms the basis for the FHC determination. The analysis was performed in accordance with guidance presented in BHI-DE-01, *Design Engineering Procedures Manual*, EDPI-4.37-01.

B.2 FUEL STORAGE BASIN FIRE

B.2.1 Background

The 105-B, 105-C, 105-DR, and 105-F Reactor Buildings house an FSB (the 105-KE and 105-KW FSBs are not included in the scope of this analysis). The basins served as collection, storage, and transfer facilities for fuel elements discharged from the reactors. The basins consist of a fuel element pickup chute, storage area, and transfer area (see Figure 2-7). The storage area portion of the basins measures approximately 72 ft by 94 ft by 20 ft deep (UNC 1986).

In preparation for decommissioning, various efforts were made to clean and stabilize the basin. As described in UNI-3958 (UNC 1986), the 105-B Reactor FSB contained an estimated 1 to 2 in. of sediment composed of iron oxides and silt. The water was removed from the basin, and approximately 600 ft^3 of sediment was collected and placed in the transfer pits (UNC 1986). The mass of the sediment is estimated to be 50,000 kg (UNC 1987). Containment covers were placed over the sediment (UNC 1986). Individuals involved in the project reported that before installation of these plywood covers, a layer of sand 1 to 3 ft thick was placed over the sediment to provide shielding. Following removal of the water and sediment, the walls and floor of the basin were vacuumed to remove dust and loose particles. An asphalt emulsion was then applied as a surface fixative (UNC 1986).

The water was removed from the 105-C Reactor FSB, and the contaminated sludge was pumped into the transfer area pits. The pits were covered with plywood covers. A high-pressure water system was used to wash the basin walls. Next, the contamination was fixed by applying coats of an asphalt-based emulsion. Estimates predicted that the 105-C transfer area contained approximately 50,000 kg of contaminated sludge (UNC 1987). The water and sludge remained in the pits until 1997. Activities associated with the Interim Safe Storage (ISS) Project removed the plywood covers from the pits to expose the top surface of the sludge. For as low as reasonably achievable (ALARA) and cost reasons, the project decided that the sediment should remain in the pits and should be removed as two large monoliths (BHI 1998a). As a result, grout caps were set in place and covered with sand for protection. The above-grade FSB and metals examination facility (MEF) facilities were demolished and removed. Again, safety, cost and ALARA forced the demolition of the FSB and MEF walls 15 ft below ground level. The monolithes were trimmed to this level, and then backfilled. Thus, all walls were demolished to a minimum of 15 ft below grade (BHI 1998a).

The 105-DR FSB area was located on the east side of the 105-DR Building and served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. The FSB area consisted of the fuel element discharge pickup area, located adjacent to the reactor rear face; the fuel storage area, which was the basin proper; the fuel transfer area, including the fuel transfer pits; the viewing area; and the wash pad area used to decontaminate fuel handling equipment. The storage area dimensions were approximately 22.6 m by 23.8 m by 6.1 m (74 ft by 78 ft by 20 ft) deep. The total area of the FSB was approximately 651 m^2 (7,000 ft^2). The FSB, including the fuel transfer pits, was drained and cleared of debris, and fixative has been applied to portions of the contaminated surfaces (UNC 1986). The asphalt emulsion fixative was applied on the bottom 2.44 m (8 ft) of the FSB walls. The top 15 ft of the walls were removed from the 105-DR FSB, and the remaining structure was filled with soil during ISS activities.

The 105-F FSB area was located on the south side of the 105-F Building and served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. The FSB area consisted of the fuel element discharge pickup area, which was located adjacent to the reactor rear face; the fuel storage area, which was the basin proper; the fuel transfer area, which included the fuel transfer pits; and the wash pad area used to decontaminate fuel handling equipment. The storage basin was approximately 22 by 25 by 6.1 m (72 by 82 by 20 ft) deep. The total area of the FSB was approximately 744.2 m^2 (8,000 ft^2). The transfer bay was located west of the FSB and served as a railcar cask loading area to transfer fuel from the FSB. The transfer bay also had a 3X ball washer located in the southwest corner. All the concrete structure of the 105-F FSB including the concrete floor and 2 ft of the soil beneath the floor was removed during the ISS activities. The soil sampling results met the closure criteria.

The radionuclide inventories of the 105-B FSB are presented in Table B-2. The values in Table B-2 are taken from UNC-3714 (UNC 1987). The values for the 105-B Reactor were determined by multiplying 50,000 kg of sediment by measured radionuclide concentrations. The inventories in the 105-C, 105-DR, and 105-F FSBs have been removed to the extent necessary to meet closure criteria. Therefore, there is no inventory identified for the 105-C, 105-DR, and 105-F FSBs in this ASA.

Table B-2. Fuel Storage Basin Inventory (Curies as of March 1, 1985).

Isotope	105-B Reactor
Ni-59	0.5
Co-60	11
Ni-63	60
Sr-90	14
Cs-137	16
Eu-152	1.4
Eu-154	4.2
U-238	0.009
Pu-239	1.6
Am-241	0.5
Pu-238	0.075

Source: UNC (1987).

B.2.2 Scenario

A fire was postulated to occur involving the 105-B Reactor FSB.

The above-grade portion of the 105-B Reactor FSB structure is constructed of concrete block walls and a precast concrete panel roof 10 to 40 ft high. The below-grade portion is constructed of reinforced concrete (DOE 1989).

Although the basin is constructed of noncombustible materials, wood planking is present and the asphalt fixative used on the basin walls and floor is combustible. Originally, the wood planking and asphalt fixative were fire-resistant; however, it is assumed that the ability of these materials to resist burning has been degraded due to the age of the treatment chemicals. It is postulated that the wood planking ignites, burns, and falls into the basin, thus providing sufficient energy to burn the asphalt fixative and disperse the underlying contamination.

The fire could spread and involve the transfer pit plywood covers; however, no significant release of radioactive material from the sediments is postulated. Suspension of material in the transfer pits would occur via aerodynamic entrainment, which is a surface phenomenon. Because the sediments are covered with 1 to 3 ft of sand, the sediments would not be impacted by the fire. The sensitivity of the analysis to this assumption is addressed in Section B.2.3.

It is assumed that the fire does not spread to other portions of the 105-B Reactor Building based on the facility materials of construction and relatively low combustible loading. DOE/EIS-0119D, *Draft Environmental Impact Statement; Decommissioning of Eight Surplus Reactors at the Hanford Site, Richland Washington* (DOE 1989) concluded that there were no credible sources for the energy needed to heat the graphite blocks of the reactor to the temperatures required to sustain combustion. The Masonite component of the biological shield is also combustible; however, it is layered between sheets of steel (Figure 2-6) and does not pose a significant fire hazard. Additionally, the radionuclide inventory in the biological shield (90% of which is in the steel) is very small, (i.e., the biological shield cobalt-60, nickel-63, and nickel-59 may be treated as essentially zero) (UNC 1987).

B.2.3 Source Term

For the purposes of this FHC determination, "source term" is defined as the amount of respirable radioactive material released to the air and available for transport to downwind receptors. Given the scenario described in Section B2.1, the radioactive material on the walls and floor of the basin and that present in the sediments are potentially available for release.

Calculation 0100-CA-N0002 (BHI 1996a, sheet 5) conservatively estimated the inventory on the 105-C Reactor FSB walls (before ISS activities) and floor to be equivalent to 20% of the sediment inventory, based on measured dose rates and assuming the same isotopic composition as the sediment. Although specifically derived for the 105-C Reactor FSB, this estimate is judged applicable to the 105-B Reactor FSB because the missions and usage of both basins were the same, and identical cleanup and stabilization processes were used.

Note that the measured dose rates at the 105-B Reactor FSB (i.e., a maximum of 4 mrem [BHI 1997a]) are less than those that were at the 105-C Reactor FSB before ISS activities (i.e., an average of 35 mrem [BHI 1996b]), suggesting that the application of the 20% value is not only applicable, but conservative.

At the time the asphalt fixative was applied, the activity remaining in the basin was bound to the concrete walls. For the purposes of this analysis, it is assumed that the activity is present as a layer of chemically nonreactive powder. This is judged to be a conservative assumption as it is anticipated that some fraction of the activity has migrated into the walls and would not be impacted by the fire. DOE-HDBK-3010-94 (DOE 1994) specifies a bounding airborne release fraction (ARF) of 6 x 10^{-3} and a respirable fraction (RF) of 1 x 10^{-2} for nonreactive compounds subjected to thermal stress. Table B-3 presents (1) the radionuclide inventory of the 105-B Reactor sediment decayed to March 1, 1998; (2) the basin inventory (equivalent to 20% of the sediment inventory); and (3) the FSB fire source term (calculated by multiplying the basin inventory by the ARF/RF of 6 x 10^{-5}). The inventories of the daughter products were not included to simplify the presentation of the calculations. A sensitivity study was performed and determined that the daughter products account for less than 1% of the total dose.

The scenario in Section B2.1 assumes that there is no significant contribution to the source term from the transfer pit sediments because they are covered with sand. To evaluate the sensitivity of the analysis to this assumption, it is postulated that burning of the plywood pit covers impacts the first 0.5 in. (i.e., approximately 1 cm) of the sand layer. Given that the two pits each measure 6.3 ft by 9 ft, the volume of sand impacted is equal to 4.8 ft^3. Based on 105-C Reactor experience, it is suspected that the sand has become contaminated over time due to the migration of moisture in the sediments. Assuming that the concentration of radionuclides in the sand is the same as the underlying sediments, a volume of 4.8 ft^3 represents 0.8% of the total radionuclide inventory. Given identical airborne release mechanisms, this quantity is judged to be insignificant relative to the 20% assumed to be present on the FSB walls and floors.

Table B-3. 105-B Reactor Fuel Storage Basin Fire Source Term.

Isotope	1998 Sediment Inventory (Ci)[a]	Basin Wall/Floor Inventory (Ci)	Source Term (Ci)
Ni-59	5.00E-01	1.00E-01	6.00E-06
Co-60	1.99E+00	3.98E-01	2.39E-05
Ni-63	5.48E+01	1.10E+01	6.58E-04
Sr-90	1.02E+01	2.04E+00	1.22E-04
Cs-137	1.19E+01	2.38E+00	1.43E-04
Eu-152	7.08E-01	1.42E-01	8.50E-06
Eu-154	1.45E+00	2.90E-01	1.74E-05
U-238	9.00E-03	1.80E-03	1.08E-07
Pu-238	6.77E-02	1.35E-02	8.12E-07
Pu-239	1.60E+00	3.20E-01	1.92E-05
Am-241	4.90E-01	9.80E-02	5.88E-06

[a]From BHI (1998b), Attachment 1.

B.2.4 Consequences

The radiological consequence at a distance of 30 m resulting from a 105-B Reactor FSB fire is a committed effective dose equivalent (CEDE) of 1.9 rem. Approximately 97% of this dose results from two isotopes (i.e., 1.2 rem from plutonium-239 and 0.59 mrem from americium-241).

The doses calculated are not intended to be predictive of the actual dose consequences if such an event were to occur and are only meant to serve as a bounding case. Actual consequences from such an event would be much smaller. Conservative assumptions made in the dose calculation include a bounding ARF/RF and assume a ground-level, point-source release at adverse atmospheric dispersion conditions based on 100-N Area joint frequency meteorological data. The 30-m receptor location is based on DOE-STD-1027-92 (DOE 1992), which uses a dose of 10 rem at 30 m to define Hazard Category 3 threshold quantities. The calculation is documented in Calculation 0100X-CA-0001 (BHI 1998b), Attachment 1.

For information purposes, the dose was also calculated at a distance of 100 m and at the near shoreline of the Columbia River (a distance of 820 m). The CEDEs are 0.24 rem and 1.4×10^{-3} rem, respectively.

B.3 SEISMIC EVENT

B.3.1 Background

A seismic event could result in structural failure of the reactor buildings. Within the buildings, the largest inventories of radioactive material are located in the FSBs and the reactor blocks.

It is assumed that the collapse of walls and roof panels into the 105-B Reactor FSB would result in insignificant releases of radioactive material. This assumption is based on the relative nondispersability of the material at risk. Specifically, the 105-B Reactor inventory on the basin walls and floor is fixed in place by an asphalt emulsion; and the sediments are located in two 6.3- by 9- by 25-ft-deep pits (UNC 1986), layered with sand, and covered by plywood. No airborne releases are anticipated from such an event.

The inventory of radioactive material associated with the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor blocks is also relatively well protected from forces related to structural failure of the reactor buildings. The reactor blocks are massive structures consisting of a graphite moderator stack, a thermal shield, and a biological shield. The 105-B, 105-C, 105-DR, and 105-F graphite stacks measure 28 ft by 36 ft by 36 ft. The 105-KE and 105-KW graphite stacks are larger, measuring 33.5 ft by 41 ft by 41 ft. The thermal shields, which surround the graphite stacks, are 8 to 10 in. thick and are made of cast iron. The biological shields surround the thermal shields. At the 105-B, 105-C, 105-DR, and 105-F Reactors, the biological shields are 52 in. thick and are made of alternating laminated layers of steel and

Masonite®. At the 105-KE and 105-KW Reactors, the biological shields vary in thickness from 45 to 83 in. and are made of heavy aggregate concrete (UNC 1987).

DOE/EIS-0119D (DOE 1989) analyzed the accidental drop of a reactor block during transport for disposal. The accident postulates that the reactor block, weighing approximately 8,000,000 kg, is dropped from a height of 14.5 ft with the result that 1% of the graphite stack is crushed into a powder. It is assumed that the release of radioactive material from the reactor block drop accident conservatively bounds the release that would occur given the seismic-induced structural failure of a reactor building. This assumption has been previously applied to the 105-C Reactor seismic event analyses (BHI 1996d).

B.3.2 Scenario

A seismic event is postulated to occur resulting in structural failure of the 105-KE Reactor Building and the 105-C Reactor Building. The 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactor Buildings all have equivalent inventories of transuranics (e.g., plutonium-239 and americium-241), which are the primary dose contributors (Table B-4). The 105-KE Reactor was selected for analysis because its graphite stack contains the largest quantities of hydrogen-3 and chlorine-36, two of the primary remaining contributors to the dose. Additionally, the 105-C Reactor was selected for analysis because its graphite stack contains the largest quantity of cobalt-60 and, in this case, the cobalt is assumed to be dispersible.

Table B-4. Estimated Radionuclide Inventory in Reactor Graphite (Curies as of March 1, 1985[a]). (2 Pages)

Isotope	105-B Reactor	105-C Reactor	105-DR Reactor	105-F Reactor	105-KE Reactor	105-KW Reactor
H-3	8,300	8900	4900	2790	30,000	27,000
C-14	4,500	4500	3200	3690	7,000	6,700
Co-60	100	10410	30	951	5	5
Ni-63	180	878	95	804	11	15
Ni-59	1	7.1	1	8.1	--	--
Cl-36	42	85	26	33	54	52
Pu-239	1	1	1	1	1	1
Am-241	0.3	0.3	0.3	0.3	0.3	0.3
Sr-90	10	10.2	10	7.5	10	10
Nb-94	0.3	0.32	0.3	0.3	1.1	1.1
Cs-137	30	30	30	22.2	30	30
Ba-133	32	--	10	11	1	1

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Table B-4. Estimated Radionuclide Inventory in Reactor Graphite (Curies as of March 1, 1985[a]). (2 Pages)

Isotope	105-B Reactor	105-C Reactor	105-DR Reactor	105-F Reactor	105-KE Reactor	105-KW Reactor
Eu-152	40	41.7	40	20.9	40	40
Eu-154	20	21.3	20	7.3	20	20
Ca-41	190	18	90	142	1	5

[a]105-F Reactor inventory is decayed to March 1, 1998.

The impact of the buildings collapsing onto the reactor blocks is assumed to breach the biological and thermal shields and crush 1% of the graphite (approximately 10 m^3 for the 105-B, 105-C, 105-DR, and 105-F Reactors, or 16 m^3 for 105-KE and 105-KW Reactors) into a fine powder. In addition to crushing a portion of the graphite, it is assumed that the impact similarly dislodges and turns to powder 1% of the scale built up within the reactor process tubes.

B.3.3 Source Term

Consistent with the analysis documented in DOE/EIS-0119D (DOE 1989), it is assumed that 1% of the graphite powder and powdered process tube scale is resuspended by wind action over an 8-hour period.

The inventory of radionuclides in the graphite stack and process tube scale is not uniformly distributed. The outer edges of the reactor block were exposed to a lower neutron flux and, consequently, contain a lower inventory relative to the center. Consistent with DOE 1989, a "10-to-1 peak-to-average ratio" is applied. The source term is therefore 1.0×10^{-5} (1% crushed to powder by 1% resuspended by 10%) of the graphite stack and process tube scale inventory.

Table B-5 presents (1) the 105-KE Reactor graphite stack inventory decayed to March 1, 1998; (2) the 105-KE Reactor process tube inventory decayed to March 1, 1998; and (3) the seismic event source term (calculated by multiplying the sum of the graphite stack and process tube inventory by 1.0×10^{-5}).

Table B-5. 105-KE Reactor Seismic Event Source Term. (2 Pages)

Isotope	1998 Graphite Stack Inventory* (Ci)	1998 Process Tube Scale Inventory* (Ci)	Source Term (Ci)
H-3	1.45E+04	00E+00	1.45E-01
C-14	6.99E+03	00E+00	6.99E-02
Cl-36	5.40E+01	00E+00	5.40E-04
Ca-41	1.00E+00	00E+00	1.00E-05
Ni-59	00E+00	1.30E+01	1.30E-04

Table B-5. 105-KE Reactor Seismic Event Source Term. (2 Pages)

Isotope	1998 Graphite Stack Inventory* (Ci)	1998 Process Tube Scale Inventory* (Ci)	Source Term (Ci)
Co-60	9.06E-01	3.44E+01	3.53E-04
Ni-63	1.01E+01	1.55E+03	1.56E-02
Sr-90	7.32E+00	2.20E-01	7.54E-05
Mo-93	00E+00	1.99E-01	1.99E-06
Zr-93	00E+00	1.10E+01	1.10E-04
Tc-93	00E+00	3.00E-02	3.00E-07
Nb-94	1.10E+00	6.00E-01	1.70E-05
Cs-137	2.23E+01	00E+00	2.23E-04
Eu-152	2.02E+01	1.10E+00	2.13E-04
Eu-154	6.93E+00	5.54E-01	7.48E-05
Ba-133	4.30E-01	00E+00	4.30E-06
Am-241	2.94E-01	00E+00	2.94E-06
Pu-239	1.00E+00	00E+00	1.00E-05

Source: BHI (1998b), Attachment 1.

Table B-6 presents the 105-C Reactor graphite stack inventory decayed to October 1, 1996, and the seismic source term (calculated by multiplying the inventory by 1.0×10^{-5}). The accident scenario postulates damage to the thermal and biological shields. It is assumed that this damage does not significantly contribute to the source term. The thermal shield does contain a large inventory of cobalt-60 (i.e., 8,690 Ci); however, it is integral to the cast iron metal matrix of the shield and, thus, is not readily dispersible. DOE-HDBK-3010-94 (DOE 1994), which documents this analysis, states that no significant airborne release is postulated for metals undergoing impaction stresses. The biological shields, although massive in size, contain very little radioactive material.

Table B-6. 105-C Reactor Seismic Event Source Term. (2 Pages)

Isotope	Activity (Ci) as of October 1, 1996	Source Term (Ci)
H-3	4.63E+03	4.6E-02
C-14	4.49E+03	4.5E-02
Cl-36	8.50E+01	8.5E-04
Ca-41	1.80E+01	1.8E-04
Ni-59	7.10E+00	7.1E-05
Co-60	2.26E+03	2.3E-02
Ni-63	8.10E+03	8.1E-03

Table B-6. 105-C Reactor Seismic Event Source Term. (2 Pages)

Isotope	Activity (Ci) as of October 1, 1996	Source Term (Ci)
Sr-90	7.74E+00	7.7E-05
Mo-93	3.99E+00	4.0E-07
Zr-93	0	0
Tc-99	2.00E-03	2.0E-08
Nb-94	3.20E-01	3.0E-06
Ag-108M	2.82E-02	0
Cs-137	2.30E+01	2.3E-04
Eu-152	2.30E+01	2.3E-04
Eu-154	8.35E+00	8.4E-05
Ba-133	0	0
Am-241	2.94E-01	4.2E-06
Pu-239	1.00E+00	1.0E-05

Source: BHI (1996d).

B.3.4 Consequences

The radiological consequence at a distance of 30 m, resulting from the seismic-induced failure of the 105-KE Reactor Building, is a CEDE of 1.7 rem. Approximately 97% of this dose results from four isotopes (i.e., 0.98 rem from plutonium-239, 0.30 mrem from americium-241, 0.18 mrem from hydrogen-3, and 0.21 mrem chlorine-36).

Calculated in Appendix C of BHI (1996c), the radiological consequence at a distance of 30 m resulting from the seismic-induced failure of the 105-C Reactor Building is a CEDE of 1.6 rem. Approximately 99% of this dose results from three isotopes (i.e., 0.68 rem from cobalt-60, 0.65 rem from plutonium-239, and 0.27 rem from americium-241).

The doses calculated are not intended to be predictive of the actual dose consequences if such an event were to occur, but are only meant to serve as a bounding case. Actual consequences from such an event would be much smaller. Conservative assumptions made in the dose calculation include assuming a ground-level, point source release at adverse atmospheric dispersion conditions based on 100-N Area joint frequency meteorological data. The 30-m receptor location is based on DOE-STD-1027-92 (DOE 1992), which uses a dose of 10 rem at 30 m to define Hazard Category 3 threshold quantities. The calculation is documented in BHI (1998b) (Attachment 1, sheet 1).

For information purposes, the dose from the 105-KE Reactor Building seismic event was also calculated at a distance of 100 m and at the near shoreline of the Columbia River (a distance of 590 m). The CEDEs are 0.22 rem and 4.6 x 10^{-3} rem, respectively.

B.4 CONCLUSIONS

Three accidents, a FSB fire for 105-B and a seismic event for 105-C and 105-KE, have been analyzed for the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors. These accidents are judged to bound other potential accidents at the reactor buildings, as well as their associated ancillary facilities.

The radiological consequences of the analyzed accidents are less than the 10 rem at a distance of 30 m used by DOE-STD-1027-92 (DOE 1992) to define Category 3 threshold quantities. Therefore, the FHC of the 105-B, 105-C, 105-DR, 105-F, 105-KE, and 105-KW Reactors and associated ancillary facilities is Radiological.

The degree of conservatism in the FSB inventory estimate, as provided in UNC-3714 (UNC 1987), is unknown. For the FSB fire scenarios, the inventory would need to be a factor of 5 greater to achieve a consequence in excess of 10 rem.

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