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Draft A

Engineering Evaluation/ Cost Analysis for the 105-B Reactor Facility

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For External Review

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Engineering Evaluation/Cost Analysis for the 105-B Reactor Facility

April 2001

United States Department of Energy

P.O. Box 550, Richland, Washington 99352

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ACRONYMS

ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CWC	Central Waste Complex
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant difference
ETF	Effluent Treatment Facility
FR	*Federal Register*
FSB	fuel storage basin
HCP-EIS	Hanford Comprehensive Land-Use Plan Environmental Impact Statement
ISS	interim safe storage
LDR	land disposal restriction
NEPA	*National Environmental Policy Act of 1969*
NFPA	National Fire Protection Association
NPL	National Priorities List
PCB	polychlorinated biphenyl
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	Richland Operations Office
ROD	Record of Decision
S&M	surveillance and maintenance
TSCA	*Toxic Substances Control Act of 1976*
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WAC	*Washington Administrative Code*

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METRIC CONVERSION CHART

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

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	0.0836	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	millibecquerel	0.027	picocuries

1.0 INTRODUCTION

1.1 BACKGROUND

This document presents the results of an engineering evaluation/cost analysis (EE/CA) that was conducted to evaluate alternatives to address an interim removal action[1] at the 105-B Reactor building (subsequently referred to as the 105-B Facility[2]). The 105-B Facility is located in the 100-B/C Area of the Hanford Site in southeastern Washington State (Figure 1-1) and is operated by the U.S. Department of Energy (DOE), Richland Operations Office (RL). In November 1989, the 100 Area was one of four areas of the Hanford Site that were placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL) under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The 100 Area NPL includes the 100-B/C Area that is currently in various stages of the CERCLA remediation process. The EPA, Washington State Department of Ecology (Ecology), and DOE have determined that hazardous substances[3] in the historically significant 105-B Facility present a potential threat to human health and the environment to the extent that a removal action under CERCLA is warranted.

This EE/CA was prepared in accordance with CERCLA and Title 40, *Code of Federal Regulations* (CFR), Section 300.415. The purpose of the EE/CA is to evaluate and identify recommended non-time-critical removal action from a viable set of alternatives. This EE/CA also specifies actions designed to conform with the requirements of the DOE and the EPA joint policy, *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act* (DOE and EPA 1995), and the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998). After the public has commented on the alternatives presented in this EE/CA, DOE, EPA, and Ecology, referred to as the Tri-Parties, will evaluate public comments, respond to public comments, and select the preferred removal action to address the 105-B Facility. Their decisions will be documented in an Action Memorandum, which is a CERCLA decision document. EPA is the lead regulatory agency and will prepare the Action Memorandum, following public review.

The environmental impacts associated with the ultimate disposition of the Hanford Site reactors (including the B Reactor, but excluding the N Reactor) were previously evaluated under the authority of the *National Environmental Policy Act of 1969* (NEPA). This evaluation was

[1] "Remove" or "removal," as defined by Section 101(23) of CERCLA, refers to the cleanup or removal of released hazardous substances from the environment; actions if a threat of release of hazardous substances occur; actions to monitor, assess, and evaluate the release (or threat of release) of hazardous substances; the disposal of removed material; or other actions that may be necessary to prevent, minimize, or mitigate damage to public health or welfare or to the environment, which may otherwise result from a release or threat of release. If a planning period of at least 6 months exists before onsite actions must be initiated, the removal action is considered non-time-critical and an EE/CA is conducted.

[2] The term "Facility" is used in a generic way to encompass all the structures, buildings, tunnels, piping, ducting, etc., associated with the reactor building.

[3] "Hazardous substances" means those substances defined by Section 101(14) of CERCLA and include both radioactive and chemical substances.

documented in the Environmental Impact Statement (EIS) *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1992). The purpose of the EIS was to provide environmental information to assist DOE in selecting a decommissioning alternative for the eight surplus reactors at the Hanford Site. The EIS record of decision (ROD) (58 *Federal Register* [FR] 48509) documented the DOE's selection of safe storage of the reactors followed by deferred (approximately 70 to 75 years) one-piece removal of the reactor block and disposal at the Hanford Site's 200 West Area as the preferred decommissioning alternative. This EE/CA supports the EIS and ROD by providing alternatives that do not preclude actions necessary to comply with the EIS and ROD. In accordance with the Secretary of Energy's Policy Statement on NEPA (DOE 1994) and DOE Order 451.1A, NEPA values have been incorporated into this EE/CA. The policy statement and DOE Order allow integration of the NEPA values into CERCLA documents rather than requiring separate documentation.

This EE/CA describes the 105-B Facility, its historical significance, and interim action alternatives for cleanup and historic preservation. Additionally, site conditions and the sources and extent of contamination are presented to provide a framework for the discussion of removal action objectives and alternatives. Finally, each alternative is compared against a set of CERCLA criteria, and a recommended alternative is presented.

1.2 HISTORICAL SIGNIFICANCE OF THE 105-B FACILITY

Construction of the 105-B Facility began on June 7, 1943, by the U.S. Army Corps of Engineers as a part of the Manhattan Project effort to bring an end to World War II. In only 16 months (BHI 2000b), the reactor was fully constructed and operational. The first indications of radioactivity were observed on September 26, 1944, with the reactor achieving full power on February 4, 1945.

The 105-B Facility was the world's first full-scale production reactor. The reactor produced plutonium fuel for the world's first nuclear device, detonated at the Trinity test site in Alamogordo, New Mexico, on July 16, 1945. The facility also produced the plutonium fuel used in the atomic bomb, named "Fat Man," detonated at Nagasaki, Japan, on August 8, 1945, which hastened the end of World War II five days later.

In the absence of wartime pressures for plutonium and with continued problems with reactor graphite expansion, the B Reactor was shut down on March 16, 1946, and remained out of service until 1948. In June 1948, the 105-B Facility was restarted with a 10% increase in power rating. The facility continued to operate with increased power output and plutonium production until 1968. Between 1948 and 1968, the B Reactor power rating increased to 10 times its original design capacity. In addition to its legacy as a plutonium production reactor, the 105-B Facility produced tritium for the first hydrogen bomb tested at the Bikini Atoll Pacific Proving Grounds on October 31, 1952.

Final shutdown of the reactor occurred on February 12, 1968. In the 12 years following the initial shutdown order, the 105-B Facility was held in standby status, with a restart capability of 18 to 24 months duration. The reactor support facilities, including the 115-B Gas Purification

Building, 181-B River Pumphouse, 182-B Reservoir and Pumphouse, and the 184-B Powerhouse, were left in service to support the reactor in the 100-B/C Area, the C Reactor. The 105-B Facility was finally declared excess property in the early 1980s. In 1998, portions of the C Reactor were demolished and the reactor block was encapsulated in an interim safe storage enclosure awaiting final disposal of the reactor block. The pumphouses and other 100-B/C Area reactor support facilities have since been demolished, but the 105-B Facility has been preserved for its historical and interpretational value.

The historical significance of the 105-B Facility has entitled it to numerous declarations, including National Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers in 1976, and the Nuclear Historic Landmark Award. Because of its historical significance, the 105-B Facility has been listed in the National Register of Historic Properties and was designated a National Historic Civil Engineering Landmark in 1993. Since the late 1980s, guided tours have been led through portions of the 105-B Facility. Interpretive items and historical displays are exhibited in the facility along the current tour route.

In recognition of the need to preserve the physical legacy of the Manhattan Project, the DOE has declared in the *Record of Decision for the Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP-EIS) (DOE 1999) designated land use for the 105-B Facility as high-intensity recreation to support visitor-serving activities and facilities development.

Although the DOE has stated that the 105-B Facility will be preserved as a museum, the configuration of the museum has yet to be determined. Options, ranging from preservation of information to retention of the physical structure, could include one or more of the following:

- Recordation by photographs, drawings, models, and exhibits
- Written histories
- Preservation of some portions of the 105-B Facility for display on or near its present location
- Preservation of some portions of the 105-B Facility for display at a location other than the 105-B Facility
- Preservation of the complete 105-B Facility in place with guided public access.

A decision to preserve some or all portions of the 105-B Facility for public access could ultimately conflict with the decision to remove the reactor block in approximately 70 to 75 years as determined in the EIS (DOE 1992) and ROD (58 FR 48509). Should such an historical preservation decision be made, the ROD for reactor block disposition would need to be revisited. However, the scope of the removal actions in this EE/CA will not alter the current DOE EIS and ROD due to the limited duration of this removal action.

Future reviews by the DOE will be required to define the final configuration of the B Reactor Museum.

1.3 B REACTOR AND HANFORD SITE CLEANUP

While the DOE is currently taking actions to preserve the 105-B Facility as an historic property, efforts to clean up the 100 Areas of the Hanford Site are continuing. Removal actions for five reactors (the 105-C, 105-D, 105-DR, 105-H, and 105-F Facilities) have previously been determined through the issuance of Action Memoranda under CERCLA. This work scope supported Tri-Party Agreement Milestones M-93-17-T01, M-93-18-T01, and M-16-00 (Ecology et al. 1998).

As with the previous reactor facility EE/CAs, this EE/CA has been developed to analyze removal actions that may be performed at the 105-B Facility to protect human health and the environment. However, this EE/CA differs from the previous reactor facility EE/CAs because of the DOE's pending decision on the final configuration of the 105-B Facility that may include preservation of the facility structure. None of the previous reactor facility removal actions have included facilities under consideration for full or partial historical preservation of structures. Because of this, removal action alternatives cannot preclude use of any portion of the 105-B Facility for public access until a future determination is made regarding final configuration. Therefore, alternatives that would demolish the structure or alter its historically significant contents will not be analyzed in this EE/CA.

Long-term removal actions at the 105-B Facility are not proposed at this time. Instead, removal action alternatives are analyzed for a 10-year time period. It is anticipated that within this time frame, two important DOE determinations will be made to support the final removal action. First, it is expected that a decision as to the final configuration of the facility will occur within this time frame. Until such a decision is made, a final removal action cannot be defined without jeopardizing potential end-state uses of the facility. Second, because the 105-B Facility has exceeded its expected original design life, major structural upgrades are expected to be necessary for long-term use. Actions and associated costs for structural upgrades to allow sustained public access are not known at this time. This information will need to be gathered during this interim time period to adequately assess the feasibility and cost of sustained public use and risks to human health and the environment from remaining hazardous substances. The 10-year time period is also consistent with the DOE's Columbia River Corridor Initiative, the goal of which is to complete many cleanup and access decisions by the year 2012 and restore the river corridor.

For information purposes, the costs and activities for performing interim safe storage (ISS) of another reactor facility, the 105-D Facility, are included in Appendix A. ISS was previously chosen as the removal action for all five reactor facilities (the 105-C, 105-D, 105-DR, 105-H, and 105-F Facilities). Because this alternative would require demolition of much of the 105-B Facility, ISS has not been included as a viable alternative in this EE/CA. However, for information purposes, costs and activities identified in Appendix A for the 105-D Facility would be similar for the 105-B Facility under an ISS alternative.

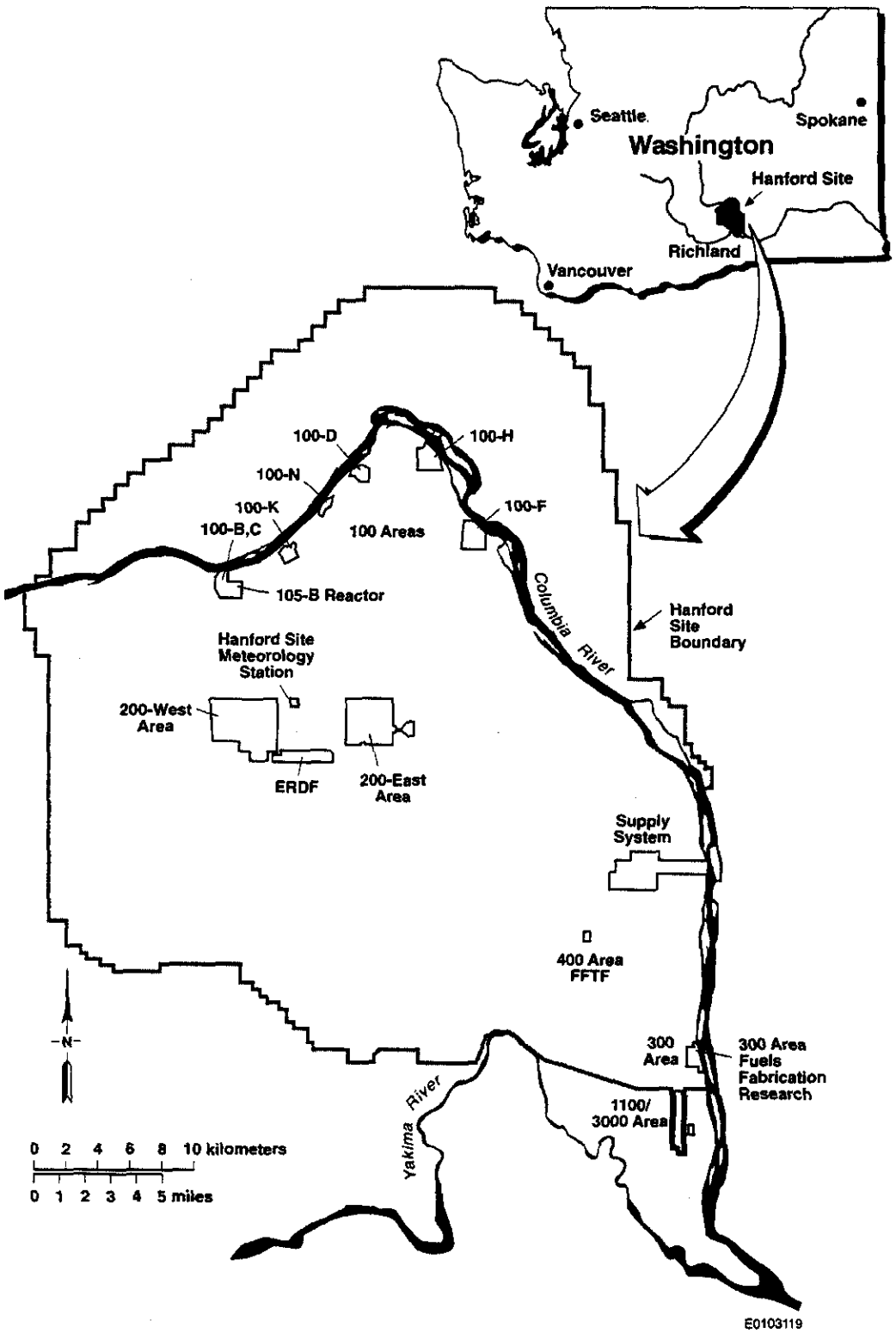
Previous work has been performed to define the hazards to the public, workers, and the environment within the 105-B Facility. The *105-B Reactor Facility Museum Phase I Feasibility Study Report* (Griffin et al. 1995) and the *Hanford B Reactor Building Hazard Assessment Report* (Griffin and Sharpe 1999) document these hazards, and have been used in preparing the hazard mitigation scope and costs reflected in this document.

1.4 SUPPLEMENTAL INFORMATION TO SUPPORT SUSTAINED USE OF THE 105-B FACILITY AS AN HISTORICAL PROPERTY

In addition to identifying and analyzing interim removal actions for the 105-B Facility, supplemental information has been provided in this EE/CA to help support future decisions on the final configuration of the 105-B Facility as an historical property. This information is included in Appendix B, Tables B-1 and B-2, and details actions and costs for mitigating hazards in all internal and external areas of the 105-B Facility to enable full public access for a 75-year period (coinciding with the timing for disposition of the reactor core as specified in the EIS ROD [58 FR 48509]).

Included in the actions identified in Appendix B is the performance of a complete structural evaluation of the 105-B Facility that must be performed before decisions regarding the long-term configuration are made. The DOE expects to conduct a more detailed analysis of required building upgrades and structural suitability prior to any major construction necessary for long-term use of the facility as a public museum.

Figure 1-1. Hanford Site Map.



2.0 SITE CHARACTERIZATION

2.1 BACKGROUND AND SITE DESCRIPTION

2.1.1 General Description of the 100-B/C Area of the Hanford Site

The 105-B Facility is located in the 100-B/C Area of the Hanford Site (Figure 1-1) along the southern shore of the Columbia River in southeastern Washington State. The 100-B/C Area contains two inactive reactors: the B Reactor and the C Reactor. The C Reactor has undergone a removal action for ISS and now exists in a safe storage enclosure under the long-term surveillance and maintenance (S&M) program. The B Reactor is currently managed under the S&M program to ensure continued protection of the public and the environment during the safe storage period until decommissioning is initiated, as documented in the EIS (DOE 1992) and ROD (58 FR 48509). Support facilities for the B and C Reactors, with the exception of the 181-B River Pumphouse and the 182-B Reservoir and Pumphouse, have been demolished.

Groundbreaking for the 105-B Facility began in March 1943 (Gerber 1993) by the U.S. Army Corps of Engineers as a part of the Manhattan Project. The reactor operated from 1944 to 1946 and was taken out of service from 1946 until 1948. In June 1948, the 105-B Facility was restarted and continued to be operational until 1968. Final shutdown of the reactor occurred on February 12, 1968. The 105-B Facility was a water-cooled, graphite-moderated, plutonium production reactor.

On November 3, 1989, the EPA placed the 100 Areas on the NPL because of soil and groundwater contamination resulting from the past operation of the reactors and their support facilities. The 100 Areas include many liquid and solid waste disposal sites used to support past reactor operations. To organize remediation efforts under CERCLA, these sites were subdivided into operable units consisting of waste sites that were related geographically to the reactor areas. The 100-B/C Area contains two source operable units (100-BC-1 and 100-BC-2) and one groundwater operable unit (100-BC-5).

2.1.1.1 Land-Use Access. Public access to the Hanford Site, including the 100-B/C Area, is currently restricted except for occasional guided tours of the 105-B Facility. Present land use in the 100 Areas consists of facilities support, waste management, and soil and groundwater remediation activities. The Columbia River, adjacent to the 100 Areas, is accessible to the public for recreational use (e.g., boating and sport fishing). Proposed alternatives for future land use were described in the HCP-EIS (DOE 1999). The ROD for that EIS identifies land use in the 100 Areas as conservation/preservation for the foreseeable future (64 FR 61615). The HCP-EIS designated land use for the 105-B Facility is high-intensity recreation to support visitor-service activities and facilities development.

On June 9, 2000, 792 km^2 (306 mi^2) of land surrounding a 82-km (51-mi)-long stretch of the Columbia River, known as the Hanford Reach, was designated a National Monument by Presidential Proclamation under the *American Antiquities Act of 1906* (16 U.S.C. 431, et seq.).

The 100 Areas of the Hanford Site, including the 100-B/C Area, are included in the Hanford Reach National Monument, pending cleanup and hazard mitigation.

2.1.1.2 Flora and Fauna. The ecological setting of the Hanford Site is described in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Neitzel 2000). The upland habitats affected by the actions described in this document are rabbitbrush/cheatgrass communities and highly disturbed industrialized areas covered with rocky soils and sparse weedy vegetation dominated by cheatgrass and Russian thistle.

Before initiating work specified in the Action Memorandum, project-specific ecological resource reviews will be conducted to determine the presence or absence of species or habitats of concern. If ecological resources of concern are identified, mitigation actions will be prescribed to reduce or prevent injury. If injury to habitat or species of concern (as identified in the *Hanford Site Biological Resources Management Plan* [DOE-RL 1996]) is unavoidable, compensatory mitigation for that habitat or species will be evaluated.

Currently there are no threatened or endangered plants (50 CFR 17) listed by the Federal government on the Hanford Site. However, nine species of plants listed as threatened or endangered by Washington State are found on the Hanford Site (Neitzel 2000). Washington State has also listed mature sagebrush habitat as "priority habitat" because of the decline of these areas due to agricultural development.

Four animal species listed by the Federal government as threatened or endangered are associated with the Hanford Site. The threatened/endangered species include the bald eagle (threatened), the peregrine falcon (endangered), the steelhead trout (endangered), and the spring-run Chinook salmon (endangered). Consultation with the appropriate U.S. Department of Interior agency is required under the *Endangered Species Act of 1973* to establish mitigation actions to prevent impact. This consultation for the bald eagle and the peregrine falcon is documented in the *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington* (DOE-RL 1994). A similar plan, the *Threatened and Endangered Species Management Plan, Salmon and Steelhead* (DOE-RL 2000b), has been developed for steelhead trout and Chinook salmon that defines pre-approved mitigation actions and determines when further consultation is required.

Under Washington State listings for threatened and endangered species, there are four additional animal species: the American white pelican, the ferruginous hawk, the Sandhill crane, and the western sage grouse. These species are not likely to be impacted by activities described in this EE/CA. However, if any of these species are identified in a project-specific ecological review, mitigation actions will be implemented to prevent impacts.

2.1.1.3 Cultural Resources. The area along the Columbia River contains cultural resources, including prehistoric and historic sites, Native American artifacts, and sites of religious significance (Neitzel 2000). Archaeological sites and traditional-use areas have been located adjacent to the 100-B/C Area. However, the likelihood of encountering archaeological remains or traditional-use areas within or adjacent to the 105-B Facility footprint is remote because of the extensive disturbance that occurred during construction.

All of the buildings and structures in the 100-B/C Area were built during the Manhattan Project and Cold War eras.

The 105-B Facility is the only Manhattan Project building listed on the National Register of Historic Places. Consequently, it is a contributing property within the Hanford Site Manhattan Project and Cold War Era Historic District. The facility has also been declared a National Historic Mechanical Engineering Landmark, a National Civil Engineering Landmark, and awarded the Nuclear Historic Landmark Award.

Under the provision for "Protection of Historic and Cultural Properties" (36 CFR 800), cumulative impacts of decommissioning the 105-B Facility must be mitigated. The EIS for the *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1992) states "Actions to preserve this historic resource may include extensive recordation by photographs, drawings, models, exhibits, and written histories, and may also include preservation of some portions of the B Reactor for display on or near its present location or at some other selected location." Requirements under *The Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings* (USDI 1992) state that a proposed action affecting National Register listed properties such as the 105-B Facility must comply with a number of standards. Standards for rehabilitation include the following:

- Avoidance of changes to the defining characteristics of the building and its environment
- Preservation of the historic character of the property and prohibition of removal of historic materials
- Prohibition of the addition of conjectural features or architectural elements from other buildings
- Preservation of property features that show change over time
- Preservation of craftsmanship and historic materials
- Repair or in-kind replacement of deteriorated historic features
- Prevention of destruction of historic materials related to new construction
- Maintenance of the essential form and integrity of the historic property.

Under the *National Historic Preservation Act of 1966* (16 U.S.C. 470), the DOE is required to consult with the Washington State Historic Preservation Office and the Advisory Council on Historic Preservation regarding actions that may affect National Register properties.

2.2 FACILITY DESCRIPTION

The 105-B Facility has been deactivated. Deactivation of this facility has included de-energization of nonessential electrical sources and equipment, preservation of tools and equipment, routine housekeeping, radiological surveys, and application of fixatives to many contaminated surfaces. The facility has not been fully decontaminated. Previous work has been performed to define the hazards to the public, workers, and the environment within the 105-B Facility. The *105-B Reactor Facility Museum Phase I Feasibility Study Report* (Griffin et al. 1995) and the *Hanford B Reactor Building Hazard Assessment Report* (Griffin and Sharpe 1999) document the current status of these hazards within the facility. Information regarding hazardous substances in the facility is based primarily on S&M survey data, knowledge of construction materials, historical operations, and process knowledge of the facility and of analogous facilities in the 100 Areas. Information on the nature and extent of contamination is provided in Section 2.3. Primary references for the facility information are *Pre-Existing Conditions Survey of Hanford Site Facilities to be Managed by Bechtel Hanford, Inc.* (BHI 1994), *Summary of 100-B/C Reactor Operations and Resultant Wastes, Hanford Site* (Gerber 1993), *Risk Management Study for the Retired Hanford Site Facilities* (WHC 1993), and *Hanford Surplus Facilities Hazards Identification Document* (BHI 1997). Additional information was obtained from the work experience with the 105-C, 105-D, 105-DR, 105-H, and 105-F interim safe storage and cleanup activities.

2.2.1 105-B Facility

The 105-B Facility (Figures 2-1 and 2-2) contains a reactor block, a control room, a spent fuel discharge area, a fuel storage basin (FSB), fans and ducts for ventilation and recirculating inert gas systems, water cooling systems, support offices, shops, and laboratories. The reactor facility is a steel reinforced concrete and concrete block structure. Within the reactor facility, massive reinforced concrete walls (0.9 to 1.5 m [3 to 5 ft] thick) extend upward to the height of the reactor block to provide shielding, with the upper sections constructed of concrete block. Asbestos, radiological, and hazardous material contamination exists in the building.

Roof construction of the 105-B Facility is composed of pre-cast concrete roof tile, except over the discharge area enclosure (the rear face) and the inner horizontal rod room. Over those areas, the roof is composed of 1.8-m (6-ft)-thick reinforced concrete (Gerber 1993). The original pre-cast concrete tiles remain in place. Repairs have been made to individual pre-cast roof panels that were showing signs of excessive deflection and corrosion (WHC 1994). The 105-B Facility underwent interim roof repair in fiscal year 2001. Total roof replacement is discussed in the *105-B Reactor Museum Feasibility Assessment (Phase II)* (BHI 2000a) and will be contingent upon the determination of the final configuration of the overall reactor structure.

The following subsections provide a brief description of some of the areas or rooms contained within the 105-B Facility that are of significance to this EE/CA.

Reactor Block. The reactor block consists of the following: a 1.8-m (6-ft)-thick concrete foundation; a steel baseplate 3.8 cm (1.5 in.) thick; a cast iron bottom shield 0.25 m (10 in.) thick; a cubical stack of graphite blocks 11 m (36 ft) wide, 11 m (36 ft) tall, and 8.5 m (28 ft)

front to rear; cast iron thermal shield walls and cover approximately 0.25 m (10 in.) thick surrounding the graphite; steel and masonite biological shield walls and cover about 1.2 m (4 ft) thick; welded gas-tight seams and seals; and 2,004 aluminum process tubes, running from the front face to the rear face of the reactor block, to hold the uranium fuel and carry the cooling water. The reactor block is located in the center of the 105-B Building and is bordered on the west by the front-face work area (room 110) and to the east by the FSB/transfer area (room 410).

Front-Face Work Area. The front-face work area (room 110) is a 204-m^2 (2,200-ft^2) concrete room west of the charging face of the reactor block. The work area is sufficiently large enough that the 12-m (40-ft)-long aluminum process tubes could be inserted or removed from the reactor block for maintenance purposes. Several spots of fixed radioactive contamination exist on the floor of the front-face work area. The contamination has been painted over, and locations are clearly marked on the work area floor. The front-face work area is part of the present B Reactor tour route and contains a number of museum displays and interpretational items.

Valve Pit. Adjacent to the work area (to the west) is the valve pit. The valve pit is surrounded at grade with a grated metal walkway. Below grade, the valve pit houses the main connections, piping, and control valves for the process water lines that came from the 190-B Process Pump House (now demolished) and ran to the reactor block. The walkway elevated above the valve pit offers access to the supply fan and exhaust fan rooms (rooms 311 through 315), as well as the flow lab/machine maintenance room (room 231a).

Supply Fan/Exhaust Fan Rooms. The supply fan room (room 315) is located to the south of the valve pit. The supply fan room contains the main blowers, heaters, and air filters for the entire 105-B Facility inactive heating and ventilation systems. There are two dual-drive supply fans and four exhaust fans. The exhaust fans, numbered 9 through 12, are isolated from the supply system in separate concrete cubicles (rooms 311, 312, 313, and 314). A concrete duct connected the fan room to the 61-m (200-ft)-tall reactor stack (116-B) via the 117-B filter building, which has been demolished.

Flow Lab/Machine Maintenance Room. The flow lab/machine maintenance room (room 231a) is located west of the valve pit and north of the supply fan room (room 315). This room is also sometimes referred to as the flow lab/machine maintenance room. The room is empty and can be upgraded to provide an egress to the exterior west side of the building.

Office/Storage Room. The office/storage room (room 228a) is located on the west side of the 105-B Facility, adjacent to the entrance door to the hallway 227a and 227b corridor no. 5. The room currently serves as a lunchroom and meeting area for S&M personnel.

Electrical Equipment Room. The electrical equipment room (room 223) is located north of the front-face work area (room 110). The electrical equipment room contains inactive instrumentation for reactor operations.

Accumulator Room. The accumulator room (room 222) is located north of the electrical equipment room (room 223) and west of the control room (room 220). The accumulator room contains inactive equipment associated with the accumulator tanks housed within. A doorway on

the south side of the room leads to the electrical equipment room (room 223). Concrete stairs with wooden railings lead from the ground level of the accumulator room to a walkway and entrance to the outer rod room on the second level.

Control Room and Offices. To the north of and opposite the reactor block, and separated by a 0.9-m (3-ft)-thick concrete wall, is the 60-m^2 (650-ft^2) main control room (room 220). The control room housed instrumentation and mechanisms for controlling the reactor and maintaining its operational safety envelope. The room was air conditioned and lined with acoustic material. Adjacent to the control room and separated by a glass partition are two control room offices, office 219a and office 219b/c. The control room and offices are part of the current B Reactor tour route.

Fuel Storage Basin/Basin Viewing Room. The FSB/transfer area (room 410) is located east of the rear face, separated from the reactor block by a 1.5-m (5-ft)-thick concrete wall. The FSB served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. The FSB consisted of a fuel element pickup area, storage area, and transfer area covered with redwood planking. The FSB is approximately 6 m (20 ft) deep. The redwood planking and the transfer area are visible from the basin viewing room (room 414).

2.2.2 Other Impacted Sites and Facilities

Three wooden sheds are present on the exterior of the 105-B Facility. The sheds are currently empty and are not used for storage of materials.

In an effort to promote the structural integrity of the 105-B Facility, the 100-B/C pipeline remedial action project and the regulatory agencies have agreed that no ground will be disturbed within a 7.6-m (25-ft) buffer around the reactor facility. The only waste site within the 7.6-m (25-ft) buffer is the 120-B-1 Battery Acid Sump, which will not undergo remediation at this time. The site of the former 132-B-4 Filter Building is located near the 7.6-m (25-ft) buffer, but is not contained within it. To maintain the buffer, some process piping will be left in place, cut, blocked, and contained along with the tunnels from the reactor to the 132-B-4 site. No waste sites or other facilities are anticipated to be impacted by activities described in this EE/CA.

2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

Portions of the 105-B Facility are contaminated with chemical and radiological hazardous substances. To identify the hazardous substances in the facility, several sources of information were used, including results of S&M activities, characterization data, historical operations information, process knowledge, and knowledge of construction material. The primary hazardous substances of concern are radioactive materials. All known quantities of concentrated hazardous chemicals were removed from the facility during deactivation, although some residual quantities of hazardous chemicals may remain in the process lines, tanks, and drains.

In addition, the 105-B Facility is expected to contain one or more of the hazardous materials known to be present in most Hanford Site facilities, including the following:

- Polychlorinated biphenyls (PCBs) in oils and light ballasts
- Lead paint
- Lead shielding
- Mercury switches, gauges, and thermometers
- Mercury or sodium vapor lights
- Used oil from motors and pumps
- Friable and nonfriable forms of asbestos
- Sodium dichromate from water treatment chemicals
- Cadmium from oxidation of reactor control rods.

A summary of the suspected contamination for the 105-B Facility is provided in Table 2-1. Key radionuclide contaminants are transuranics, including plutonium-239 and americium-241, mixed fission products such as strontium-90 and cesium-137, and activation products such as carbon-14 and cobalt-60. Contaminants are most likely to be contacted as adherent films and residues encrusted in or on deactivated process equipment, piping, and ventilation system ductwork. In addition, the FSB and associated transfer pit contains radioactive residues and sediments emitting gamma radiation that, if unshielded, results in a direct exposure dose of 0.12 mrem/hr at the viewing window in the FSB viewing room on the proposed tour route.

2.4 RISK EVALUATION AND SITE CONDITIONS THAT JUSTIFY REMOVAL ACTION

The reactor facility addressed in this EE/CA is known to be contaminated with radioactive and nonradioactive hazardous substances. Radionuclides are known to present a carcinogenic risk. The risk associated with this contamination would exceed acceptable limits for general workers occupying the facility full time or for a tour guide conducting visitors along the proposed tour route.

Radiological areas in the 105-B Facility include surface contamination in all below-grade areas, on the top of the reactor block, in the outer rod room, and in the work rooms adjacent to the reactor. The inner rod room is cited as an airborne radioactivity area because of carbon-14 from the reactor core. Below-grade portions of the FSB, sample rooms, and ball recovery system could also be sources of unacceptable levels of radiation dose or high levels of hazardous waste contamination. The levels of risk associated with the radioactive contaminants in these portions of the facility have been quantified in terms of anticipated exposures to workers and members of the public.

The 105-B Facility is located within the 100-B/C Area radiologically controlled area. In a radiogically controlled area, worker exposure is less than 100 mrem/yr and only general employee radiological training (but no monitoring) is required to access the area. Current S&M activities at the 105-B Facility result in a dose to workers of less than 100 mrem/yr because they

do not require a worker to occupy the facility full time. A security fence encloses the 105-B Facility. Entrance into fenced areas requires approval from the site superintendent and additional site-specific training. If a worker were to occupy some portions of the building full time (i.e., 40 hr/wk, 50 wk/yr) he/she could receive an external exposure dose exceeding 100 mrem/yr. Although this level of exposure would be within allowable exposure levels for radiological workers, workers would have to receive specific radiological worker training and monitoring to occupy those portions of the building full time in its present condition. This level of exposure would not be acceptable for general workers.

In recent years, guided public tours have been conducted on a tour route through a controlled portion of the building, which has been deemed safe for supervised public entry. Public access is restricted to the front-face work area, control room, and control room offices on the current tour route. Entry requirements are imposed because hazardous substances have been detected outside of the existing tour route during facility walkdowns and radiological surveys.

Until decommissioning as described by the ROD (58 FR 48509) is initiated, DOE must continue to conduct routine maintenance, surveillance, and radiological monitoring activities to ensure protection of the public and the environment during the safe-storage period. Without allowing public tours, continued S&M for safe storage of the reactor facility would present no measurable risk to the public or the environment.

A tour guide escorting visitors on the proposed expanded tour route including the FSB viewing room would be expected to receive an average annual dose above background of 20 mrem/yr, which is above the guideline limit of 15 mrem/yr for general exposure. This is based on the assumption that a tour guide would be on tour for 2,000 hr/yr and the average dose rate on the proposed tour route is 0.01 mrem/hr above background. The dose of 20 mrem/yr corresponds to a risk of 1.7×10^{-4} at the isotopic distribution of the radioactive materials to which the guide is expected to be exposed. Visitors to the 105-B Facility would be expected to receive a much lower dose and a much lower associated risk because they would spend less time in the facility. A visitor spending 8 hours annually inside the 105-B Facility is predicted to receive a dose of 0.08 mrem/yr above background, which corresponds to a risk of 7×10^{-7}. The acceptable risk range for radionuclide exposure is 10^{-4} to 10^{-6}, based on EPA policy statements.

The primary pathway of concern for radionuclides is direct exposure. Inhalation and ingestion pathways are also of concern with the disturbance of piping, equipment, and building materials potentially containing radionuclides or hazardous substances, such as asbestos piping insulation or mercury switches. Current S&M activities have reduced the potential for release of radioactive and hazardous substances. However, exposure of personnel providing S&M for these buildings/facilities and of intruding wildlife (e.g., rodents, insects, snakes, and birds) may occur. There is also potential for the spread of contamination due to contact with and subsequent transfer by wildlife.

The reactor building continues to age and deteriorate. Without intervention, the threat of potential release of hazardous substances increases, and it becomes more difficult to confine these hazardous substances from the environment. The S&M activities required to confine the hazardous substances over the long term would be expected to increase the risk of potential exposure to personnel as additional activities become necessary to prevent the spread of contamination.

Figure 2-1. South Side of the 105-B Facility, Facing the Columbia River.

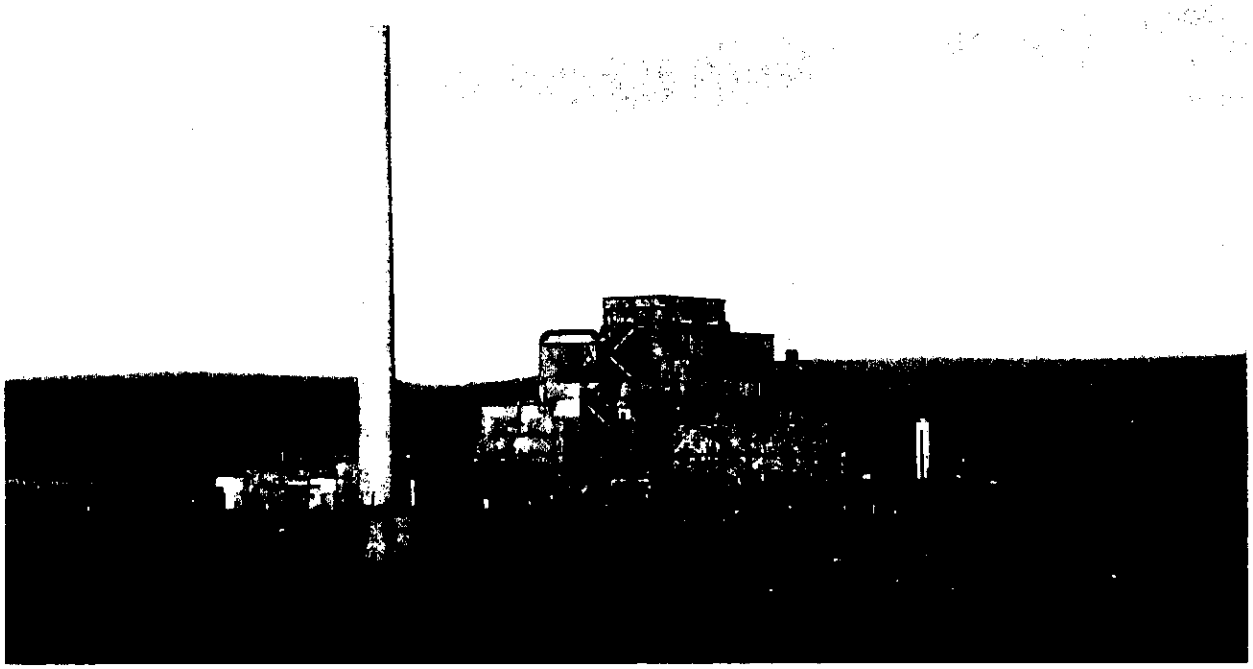


Figure 2-2. Schematic Drawing of the Ground Floor of the 105-B Facility.

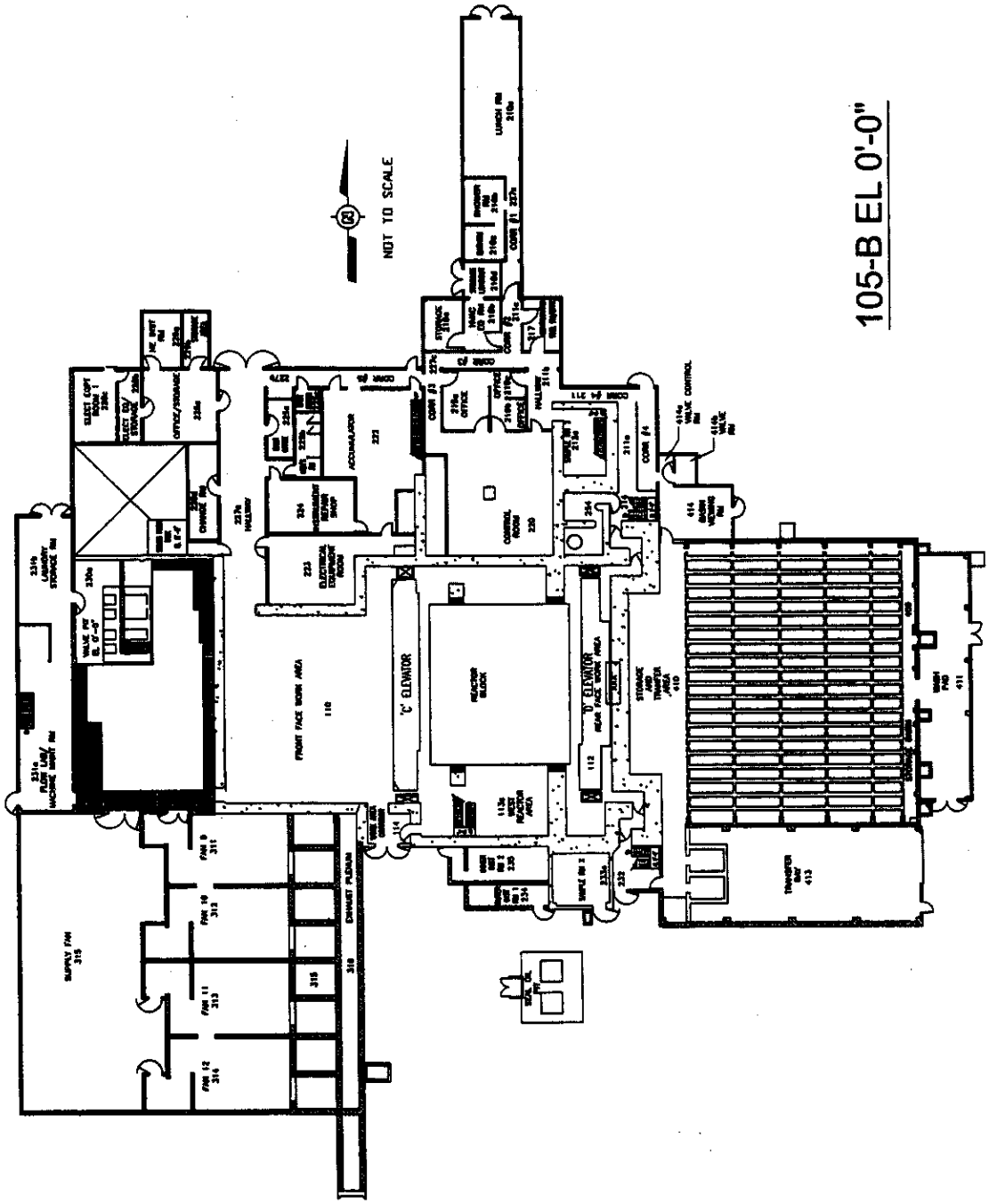


Table 2-1. Suspected Contaminants in the 105-B Facility.

Facility	Hazardous Substance
105-B Facility	• Radioactive contaminants (e.g., Sr-90, Cs-137, C-14, Co-60, Pu-239, Am-241) • Lead (shielding, oxides, switches, and drains) • Mercury (gauges, switches, and drains) • PCBs (light ballasts and gear oil) • Heavy metals (cadmium, chromium) • Asbestos (pipe lagging, insulation, and transite) • Oils/greases

3.0 REMOVAL ACTION OBJECTIVES

The primary purpose of this EE/CA is to evaluate the interim action removal alternatives for the 105-B Facility. The removal alternative would be conducted in a manner that is protective of human health and the environment. The principal threats to be addressed are radioactive and/or nonradioactive hazardous substances contained in and around the 105-B Facility. Uncontaminated structures (or portions of structures) associated with the facilities within this scope would be removed or otherwise addressed to facilitate implementation of the selected removal action.

Based on the potential hazards identified in Sections 2.3 and 2.4, the specific removal action objectives are as follows:

- Reduce or eliminate the potential for exposure to hazardous substances above levels that are protective of the workers, public, and the environment
- Reduce or eliminate the potential for a future release of contaminants
- Protect workers from the hazards posed by the continuing deterioration and aging of the 105-B Facility
- Prevent potentially adverse impacts to cultural/natural resources and threatened or endangered species
- Safely manage the wastes generated by the removal action
- Take no action that will preclude use of any and all portions of the 105-B Facility for historical interpretation until a decision is made by DOE as to the final configuration of the B Reactor
- Take no action that will preclude the eventual final disposition of the B Reactor block pursuant to the EIS and ROD for this action
- Coordinate with the Remedial Action and Waste Disposal Project to address waste sites that will be integrated with the final disposition of the 105-B Facility.

4.0 DISCUSSION OF REMOVAL ACTION ALTERNATIVES

The removal action alternatives for the 105-B Facility must be protective of human health and the environment and meet the remedial action objectives for the 10-year interim action. The principal threats to be addressed in the selection of a removal action alternative are radioactive and/or nonradioactive hazardous substances contained in and around the 105-B Facility and its contaminated surfaces.

Based on the above considerations, the following three removal action alternatives were identified:

- Alternative One: No Action
- Alternative Two: Surveillance and Maintenance
- Alternative Three: Hazards Mitigation for Public Access.

Common Requirements for Waste Management. Alternatives Two and Three would each generate small quantities of waste that require disposal at an appropriate disposal site. Waste management would be a common element for these alternatives.

Each alternative would evaluate opportunities for waste minimization and pollution prevention. Contaminated waste for which no reuse, recycle, or decontamination option is identified would be assigned an appropriate waste designation (e.g., solid, asbestos, PCB, radioactive, dangerous, or mixed). Most of the contaminated waste generated during implementation of these alternatives would be disposed at the Environmental Restoration Disposal Facility (ERDF) in the Hanford Site's 200 West Area. Based on previous EE/CAs addressing other reactor facilities in the 100-DR, 100-H, 100-B/C, and 100-F Areas (such as the 100-DR and 100-F Area EE/CA [DOE-RL 1998a]), the ERDF would be the preferred waste disposal option because it is an engineered facility that provides a high degree of protection to human health and the environment and is more cost effective than disposing waste at other disposal sites. Construction and operation of the ERDF were authorized via a separate CERCLA ROD (EPA 1995) and explanation of significant difference (ESD) (Ecology et al. 1996). The ERDF is a highly engineered structure designed to meet *Resource Conservation and Recovery Act of 1976* (RCRA) minimum technological requirements for landfills, including standards for a double liner, a leachate collection system, leak detection, and a final cover.

The *U.S. DOE Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington, Explanation of Significant Differences (ESD)* (Ecology et al. 1996) modified the ERDF ROD (EPA 1995) to clarify the eligibility of waste generated during cleanup of the Hanford Site. The ESD makes any low-level waste, mixed waste, and hazardous/dangerous waste generated as a result of CERCLA or RCRA cleanup actions (e.g., decontamination and decommissioning [D&D] wastes, RCRA past-practice wastes, and investigation-derived waste) eligible for ERDF disposal, provided that the waste meets ERDF waste acceptance criteria and that appropriate CERCLA decision documents are in place.

The waste generated during the removal action proposed in this EE/CA would fall within the definition of waste eligible for disposal at the ERDF established in the ERDF ROD and subsequent ESD. Waste may require treatment to meet ERDF waste acceptance criteria. The type of treatment is anticipated to consist of solidification/stabilization techniques such as macroencapsulation or grouting. If more complex treatment is required, the method and location would be subject to approval by the Tri-Parties on a case-by-case basis. Waste volumes that would be generated for disposal at the ERDF are not expected to significantly impact capacity limitations at the ERDF. The waste volumes in this document have been taken into account for ERDF planning purposes. Further discussions of the construction and operation of the ERDF are not within the scope of this EE/CA.

While most of the waste generated during the removal action would likely meet the ERDF waste acceptance criteria, some waste may not meet these criteria or may not be able to be treated to meet them. Specifically, this would include low-level radioactive and nonradioactive liquid wastes and transuranic wastes that may be encountered or generated during the removal action. Transuranic wastes would be sent to the Hanford Site's Central Waste Complex (CWC) for storage pending eventual offsite disposal. Collected liquids containing levels of radioactive and/or nonradioactive hazardous substances meeting waste acceptance standards would be sent to the Hanford Site's Effluent Treatment Facility (ETF) and treated to satisfy applicable or relevant and appropriate requirements (ARARs) for discharge. Clean water (e.g., nonradioactive and nondangerous) could be used for dust suppression.

The ETF, the CWC, the ERDF, and the 100 Area NPL site are considered to be a single site for the purposes of disposal of waste from the removal action proposed in this EE/CA. There is no requirement to obtain a permit to dispose of CERCLA wastes at these facilities.[4] The ETF and CWC facilities have been permitted for management of non-CERCLA wastes. In these situations, any permit conditions would need to be complied with for the management of CERCLA wastes as well. It is expected that the waste generated during removal actions proposed in this EE/CA can be disposed on site. However, if any waste is encountered that must be sent offsite, EPA would make a determination in accordance with 40 CFR 300.440 as to the acceptability of the proposed disposal site for receiving CERCLA removal action waste. Uncontaminated material will be disposed at a Subtitle D landfill, and recycling will be considered, as appropriate.

[4] CERCLA Section 104(d)(4) states that, where two or more noncontiguous facilities are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health or welfare or the environment, the President may, at his discretion, treat these facilities as one for the purpose of this section. The preamble to the National Oil and Hazardous Substances Pollution Contingency Plan clarifies the stated EPA interpretation that when noncontiguous facilities are reasonably close to one another, and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. Therefore, the 100 Area NPL site and the ERDF, ETF, Low-Level Burial Ground, and CWC are considered to be a single site for response purposes under this removal action. It should be noted that the scope of work covered in this removal action is for those facilities and waste contaminated with hazardous substances. Materials encountered during implementation of the selected removal action that are not contaminated with hazardous substances will be dispositioned by DOE.

Common Requirement for End States. Alternatives Two and Three would each result in an interim end state that would not preclude either of the following at the conclusion of the interim action:

- Long-term historical preservation of the 105-B Facility structure and contents
- Disposal of the B Reactor block to the 200 Area Plateau.

As stated in the Reactor Disposition EIS ROD (58 FR 48509), the final proposed action for disposal of the reactor block would include the transport of the reactor block, intact, on a tractor transporter, from its present location in the 100 Areas to the 200 West Area of the Hanford Site for disposal. As stated in Section 1.2, any conflicts between a decision for sustained historical preservation of the structure and the EIS ROD would need to be resolved prior to such a decision.

4.1 ALTERNATIVE ONE – NO ACTION

With Alternative One, no activities would be performed, and current S&M activities would be discontinued. However, Hanford Site institutional controls (e.g., fencing, posted signs) would be maintained to help minimize personnel, worker, and public entry to the facilities and warn of hazards. No other specific controls would be established for the facility covered by this EE/CA. Because the facility would not be decontaminated, and no action would be taken to prevent the facility from deteriorating, there would be an increased threat and likelihood that a release would occur, potentially exposing the workers, public, or the environment to hazardous substances.

4.2 ALTERNATIVE TWO – SURVEILLANCE AND MAINTENANCE

Alternative Two would consist of S&M of the 105-B Facility for the purposes of maintaining minimum safe conditions of the facility. This alternative would include no public access of the facility during the interim removal action. The S&M measures would include routine radiological and hazard monitoring of the facility and safety inspections, as required. The S&M activities would be adjusted based on the specific condition of the facility. Activities would be balanced to reduce hazards to workers while reducing the potential for releases of contaminants. Major repairs such as reroofing and shoring structural components would be necessary. These major repairs would be required to ensure the integrity of the facility, which is necessary to contain contaminants within the structure. It is anticipated that a new roof would be required for the reactor once during the 10-year interim action. Roofs typically have a 20-year service life and based on the present age of the roof cover, 3 to 5 years would be the maximum remaining life of the current cover. Other major repairs would be performed on an as-needed basis.

In general, as facilities age and deteriorate, S&M must become more aggressive over time, and worker safety is a critical factor. These activities would require a higher level of worker protection and associated increases in cost with time. Without an increasingly aggressive S&M program, the threats associated with unplanned releases within the structure as well as to the environment and injury to workers would increase. Conversely, an aggressive S&M program

would require workers to enter the facility more often, and workers may be required to perform more invasive procedures to maintain the facility, which would increase the potential for exposure to workers. Additionally, personal protection requirements to maintain the more aggressive program continually increase, which would add to the cost. Because this interim action is for a 10-year period, the level of S&M activities required is expected to initially remain fairly constant, but may need to be increased slightly in the later years of the action.

A variety of waste streams would be generated in the performance of S&M that would be stored, characterized, packaged, and disposed. Waste that meets the ERDF waste acceptance criteria would be disposed at the ERDF, and other wastes would be managed to comply with identified ARARs as described in Section 4.0.

4.2.1 Cost Estimates for Alternative Two

Costs were estimated in present-day dollars (fiscal year 2001) and summarized for the 10-year period (Table 4-1). The costs to implement this alternative include a one-time-only cost for the 105-B roof replacement with polyurethane foam and associated waste disposal at the ERDF facility, and annual costs for routine S&M for a 10-year period.

4.3 ALTERNATIVE THREE – HAZARDS MITIGATION FOR PUBLIC ACCESS

4.3.1 General Description of Alternative Three

Alternative Three would expand public access to portions of the 105-B Facility while maintaining S&M for the remainder of the facility. The front-face work area (room 110), control room (room 220), control room offices (rooms 219a, 219b, and 219c), and associated hallways are currently accessible to the public during guided tours. Alternative Three would release additional portions of the facility for public access, including the office/storage room (room 228a), the at-grade portion of the valve pit, the supply fan room (room 315), the flow lab/ maintenance room (room 231a), the accumulator room (room 222), the electrical equipment room (room 223), the FSB viewing room (room 414), and their associated access hallways and corridors. These portions of the facility were selected based on their historical interpretation value and the feasibility of mitigating and releasing them for managed public access. Each of the rooms is more completely described in Section 2.2.1. Figure 4-1 illustrates the current and proposed access and viewing areas, which are as follows.

- Front-face work area (room 110) and hallway 227a
- Control room (room 220)
- Accumulator room (room 222)
- Electrical equipment room (room 223)
- Supply fan room (room 315)
- Basin viewing room (room 414), corridor no. 4, and hallway 211
- Offices 219a, 219b, and 219c
- Office/storage room (room 228a)

- Corridors 227a, 227b, and 227c
- Valve pit
- Valve pit (4.6 m [15 ft] below grade)[5]
- Flow lab/machine maintenance room (room 231a).

Alternative Three would consist of three major tasks to mitigate hazardous substances and support public access:

- Providing upgrades to facility infrastructures to ensure that risks to the public and workers from remaining hazardous substances are minimized

- Removing, decontaminating, containing, or encapsulating hazardous substances in publicly accessible areas of the 105-B Facility

- Performing routine S&M activities in all areas of the 105-B Facility to protect workers and the public and prevent releases of hazardous substances to the environment during the 10-year interim action.

These tasks are further described in the following subsections. It should be noted that some of these tasks are not strictly required by CERCLA in order to mitigate hazardous substances, such as provisions for safe walking surfaces; however, they are provided for completeness and to ensure that the alternative results in its desired end state. These tasks are not considered to significantly add to the cost of the alternative or to the difficulty of implementing the alternative.

4.3.2 Infrastructure Upgrades to the 105-B Facility

4.3.2.1 Electrical. Electrical upgrades would consist of deactivating the existing electrical system in the facility and establishing a new electrical service and distribution system. This would involve installation of a new 400-amp 208/120-volt, three-phase, four-wire panelboard to provide power for lighting, fans, receptacles, and heaters. Four breaker upgrades would also be added. Demolition of the existing fixtures or systems would not occur, as they would be isolated from the new system.

4.3.2.2 Ventilation. The 105-B Facility ventilation system is currently inoperable. Ventilation fans would need to be installed through the walls of the structure into the work area, except in the control room. These fans would discharge to the outdoors through the exterior walls. The fans would be sized to provide ventilation for occupants and for radon mitigation. In the control room, a new system would need to be designed and installed to control the elevated radon levels that currently exist. In addition, existing ventilation ducts that have in the past provided pathways for water leakage would need to be blanked off.

4.3.2.3 Fire-Suppression System. Fire-suppression system upgrades would be required and would consist of installing five additional fire extinguishers and a new fire alarm and detection

[5] Although no access will be permitted to below-grade portions of the valve pit, the area is visible from the walkway at grade and will require hazard mitigation to prevent potential releases of hazardous substances.

system. Detection devices would be provided along public access routes as well as in locations where early detection of fires in remote areas would be necessary. Also, the wall separating the tool/storage room from the rest of the facility would be upgraded to at least a 1-hour fire-resistance rating in accordance with Section 8-3.2 of the National Fire Protection Association's *Life Safety Code*® (NFPA 101®) (NFPA 2000). An additional exit door from the valve pit area to the flow lab/machine maintenance room would be installed, and the door to the outside from the flow lab/machine maintenance room would be made accessible. Emergency lights and exit signs would be required throughout the facility

4.3.2.4 Structural Analyses and Upgrades. The 105-B Facility is an aging structure that has exceeded its original intended design life. Because of this, minor structural upgrades would be implemented during the 10-year interim remedy. Inside the facility, netting would be installed overhead in the front face of the reactor to mitigate hazards from old structures that could create a falling hazard for the public. In addition, during the 10-year interim remedy, a more complete structural analysis would be performed to determine actions necessary for longer term use of the facility for public access.

4.3.2.5 Exterior Hazards. Various activities would be required to ensure protection of the public, workers, and the environment from hazards outside the 105-B Facility. These activities include the following:

- Removal of loose paint that may contain lead
- Removal of miscellaneous pipes and conduits that are not architectural-defining elements
- Cleaning abandoned transformers
- Restoration of wooden structures, doors, handrails, and stairwells
- Repair and reconstruction of the security fence around the facility
- Placement of asphalt to cover exposed surfaces on the ground
- Performance of minor repairs and placement of a cap on the 116-B exhaust stack
- Structural analysis of the 116-B exhaust stack.

4.3.3 Hazardous Substance Removal/Decontamination/Containment and Safety Upgrades in Publicly Accessible Areas

4.3.3.1 Front-Face Work Area and Hallway 227a. Major activities that would need to be performed at the front-face work area include encapsulating (e.g., painting over) lead paint and radiological contamination on floors, securing the canvas drop shield and canvas isolation barrier, removing oil and grease from the overhead crane in the front-face work area, and plugging floor drains. Hallway 227a mitigation would include encapsulating lead paint and asbestos and plugging floor drains.

4.3.3.2 Control Room. Major activities that would need to be performed in the control room include encapsulating lead paint, asbestos piping, and floor and ceiling tile.

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4.3.3.3 Accumulator. Major activities that would need to be performed in the accumulator room include encapsulating lead paint and asbestos, and draining, cleaning, and disposing of horizontal accumulators oil.

4.3.3.4 Electrical Equipment Room. Major activities that would need to be performed in the electrical equipment room include encapsulating lead paint and mitigating a tripping hazard through construction of a ramp.

4.3.3.5 Supply Fan Room. Major activities that would need to be performed in the supply fan room include encapsulating lead paint and asbestos, plugging a floor drain that may contain hazardous substances such as heavy metals and solvents, repairing roof panels, and placing a Plexiglas barrier to prevent public access to four connecting exhaust plenum rooms.

4.3.3.6 Basin Viewing Room, Corridor No. 4, and Hallway 211. Major activities that would need to be performed in the basin viewing room include encapsulating lead paint, suspending shielding under the redwood decking of the basin, and performing required characterization and release surveys. Miscellaneous maintenance activities such as glass repair, door security, and barricade installation would also be required. The transparent barricade (plexiglas) installation would prevent the public from contacting the viewing window, which would decrease risks associated with radiological exposure. Lead paint encapsulation would be required in corridor no. 4 and hallway 211. Mitigation of hazards in the adjacent hallway 211 would also include removing a contaminated step-off pad, characterizing and decontaminating radiologically contaminated areas, and repairing roof panels.

4.3.3.7 Offices 219a, 219b, 219c, and 228a. Mitigation activities have been either scheduled or performed for these rooms within the fiscal year 2001 budget. No additional hazard mitigation activities would be required in the office rooms. Office 228a would require placement of secure locks and doors to prevent visitor access to additional rooms.

4.3.3.8 Corridors 227b and 227c. Corridor 227b would require construction of a ramp to eliminate a tripping hazard. Corridor 227c would not require any hazard mitigation activities.

4.3.3.9 Valve Pit. Major activities that would need to be performed at the valve pit would include installing a decking cover on the grated walkway and installing a handrail to eliminate a tripping hazard.

4.3.3.10 Valve Pit (15 Feet Below Grade). Major activities that would need to be performed at the valve pit (4.6 m [15 ft] below grade) include encapsulating asbestos and characterizing unknown material on the lower level for the purposes of minimizing hazards from airborne contaminants. Although no access would be permitted in below-grade portions of the valve pit, the area is open and visible at grade and would require mitigation to prevent the potential release of hazardous substances.

4.3.3.11 Flow Lab/Machine Maintenance Room. Major activities that would need to be performed at the flow lab/machine maintenance room include encapsulating lead and asbestos, plugging a floor drain that may be a potential source of heavy metals and solvents, and

performing miscellaneous maintenance activities to eliminate tripping and striking hazards and to secure the room.

4.3.4 Surveillance and Maintenance

S&M activities would be similar in scope to those described in Alternative Two, including roof cover replacement and associated disposal costs. However, activities for S&M under this alternative would be slightly more expensive to account for the more rigorous actions necessary to ensure protection of the public and workers in those areas accessible to them.

4.3.5 Costs

The costs to implement this alternative for the 10-year period are provided in Table 4-2. Costs provided include the fixed costs as well as the costs to mitigate hazards on a room-by-room basis. Appendix C provides a more complete breakdown of fixed costs, and Appendix D provides a more complete breakdown of room-by-room costs.

Figure 4-1. B Reactor Tour Route.

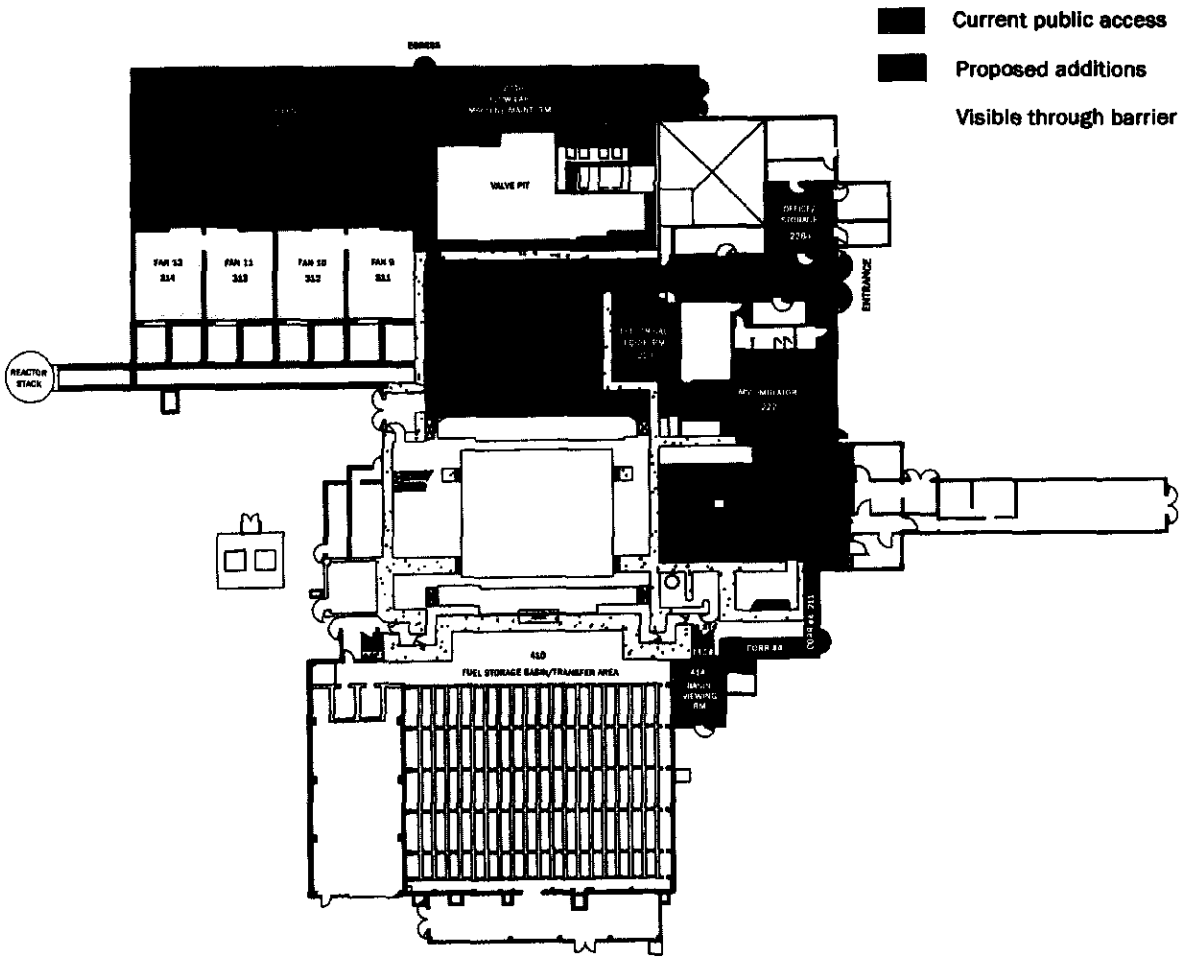


Table 4-1. Cost Estimates for Alternative Two – Surveillance and Maintenance for 10 Years.

Activity	Estimated Cost ($)
Surveillance and Maintenance	
105-B Facility	1,118,000*
Roof Replacement on Reactor Building	
One time replacement	395,000
Roof waste disposal = 1,053 m^3	145,000
Subtotal	$540,000
Grand Total	**$1,658,000**

*Includes $118,000 for electrical upgrades resulting from lessons learned at the B Reactor facility.
NOTE: Costs were obtained from *Engineering Evaluation/Cost Analysis for the 105-D Reactor Facility and Ancillary Facilities,* DOE/RL-2000-45, Rev. 0 (DOE-RL 2000a).

Table 4-2. Cost Estimates for Alternative Three – Hazards Mitigation for Public Access.

Activity	Estimated Cost ($)
Fixed Costs	
Electrical	178,169
Structural analysis	75,000
Structural upgrades	43,700
Ventilation	41,765
Roof replacement	540,000
Surveillance and maintenance (10 years)	1,250,000
Fire-suppression system	182,555
Engineering	144,000
Exterior hazards	269,542
Subtotal	**$2,724,731**
Room-by-Room Costs	
Front-face work area	11,884
Corridor 211	101,234
Control room	4,336
Accumulator	10,436
Electrical equipment room	2,804
Supply fan room	94,288
Basin viewing room	20,908
Hallway 211	512
Hallway 227a	100
Corridor 227b	900
Office 228a	1,843
Valve pit	2,900
Valve pit (4.6 m [15 ft] below grade)	3,400
Flow lab/machine maintenance room	17,598
Subtotal	**$273,143**
Grand Total	**$2,997,874**

NOTE: See Appendices C and D for detailed estimate and assumptions.

5.0 ANALYSIS OF ALTERNATIVES

CERCLA requires that the removal action alternatives be evaluated against three criteria: effectiveness, implementability, and cost. To provide a more comprehensive evaluation, this EE/CA divides the criterion of effectiveness into several subcategories. The removal action alternatives will be evaluated against the following:

- Effectiveness
  - Overall protection of human health and the environment
  - Compliance with applicable Federal and state laws and regulations (e.g., ARARs)
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
- Implementability
- Cost.

Public acceptance of the preferred alternative will be evaluated after the public has an opportunity to review and comment on this EE/CA. Because of the historical significance of the 105-B Facility, the Washington State Historic Preservation Office will also review this EE/CA. State acceptance will be evaluated by Ecology. EPA will evaluate and respond to public comments and address any significant issues that Ecology has.

Each criterion is briefly explained in the following sections. Subsequently, a detailed analysis of each alternative relative to each criterion is provided. Finally, the alternatives are compared against one another relative to each criterion.

The alternatives are reiterated below:

- Alternative One: No Action
- Alternative Two: Surveillance and Maintenance
- Alternative Three: Hazards Mitigation for Public Access.

5.1 EFFECTIVENESS

5.1.1 Overall Protection of Human Health and the Environment

The overall protection of human health and the environment is the primary objective of the removal action. This criterion addresses whether the alternative achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. The assessments of the other evaluation criteria are also drawn upon. This criterion must be met for a removal action to be eligible for consideration. Evaluation of the alternatives against this criterion was based on qualitative analysis and assumptions regarding the inventory of hazards in the facilities to be addressed by the removal action.

Alternative One would not eliminate, reduce, or control risks to human health and the environment. Therefore, Alternative One would not provide overall protection of human health and the environment and would not achieve the removal action objectives. Because implementation of this alternative would not meet the threshold criterion of protectiveness, it cannot be considered a viable alternative. On this basis, the No Action alternative was not carried through for further evaluation.

Alternative Two would provide overall protection of human health and the environment. Some contaminated materials from the facility would be removed and disposed at the ERDF, reducing the potential for a contaminant release. There would be a small potential for worker exposure and the potential for release of contaminants during the 10-year interim action. However, the use of proven control technologies and strict adherence to safety and environmental regulations during these activities would significantly minimize these risks. Additionally, lessons learned would be applied from the performance of the interim stabilization work activities conducted at the 105-C, 105-DR, and 105-F Reactor Facilities to further minimize worker exposure or the potential for releases. There are some uncertainties regarding the ability to maintain the integrity and protectiveness of the 105-B Facility during the 10-year interim period. The number and magnitude of repairs would likely increase as the facility ages. No specific issues have been identified, but there would be risks associated with unpredictable natural events, such as a fires, floods, high winds, or earthquakes.

Alternative Three would also provide overall protection of human health and the environment. Hazardous substances would be removed, decontaminated, or contained within the portions of the facility that will be open for public access, thus significantly lowering human health and environmental risk in these areas. Additional protection would be provided by continued surveillance and appropriate maintenance for the entire facility. As with Alternative Two, there would be a small potential for public exposure in addition to worker exposure, and a potential for a release of contaminants to the environment during the 10-year interim action. However, the use of proven control technologies, strict adherence to safety and environmental regulations, and use of lessons learned would significantly reduce these risks.

In summary, based on this analysis, Alternative One would fail to provide overall protection, whereas both Alternatives Two and Three would provide overall protection of human health and the environment and are therefore considered viable alternatives.

5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion addresses whether a removal action will, to the extent practicable, meet ARARs and other Federal and state environmental statutes. The ARARs must be met for onsite CERCLA actions (CERCLA Section 121[d][2]). Onsite actions are exempted from obtaining Federal, state, and local permits (CERCLA, Section 121[e][1]). Nonpromulgated standards, such as proposed regulations and regulatory guidance, are also to be considered, to the extent necessary for the removal action to be adequately protective. The ARARs criterion must be met for an alternative to be eligible for consideration.

Key ARARs for the two alternatives being considered include waste management standards, standards controlling releases to the environment, and standards for protection of cultural and ecological resources. A discussion of how the removal action alternatives would comply with the listed preliminary ARARs is provided in the following subsections. Where pertinent to the discussion of compliance, materials to be considered have also been included. Final ARARs, which must be complied with during implementation of the selected removal action, will be documented in the CERCLA Action Memorandum.

5.1.2.1 Waste Management Standards. RCRA Subtitle C, implemented via 40 CFR 260 through 279, governs the identification, treatment, storage, transportation, and disposal of hazardous waste. Authority for much of Subtitle C has been delegated to the State of Washington. Implementing state regulations contained in *Washington Administrative Code* (WAC) 173-303 would be applicable to any dangerous wastes generated during the removal action. The regulations require identifying and appropriately managing dangerous wastes and dangerous components of mixed wastes and identifying standards for treatment and disposal of these wastes. The land disposal restrictions (LDRs) established under RCRA (40 CFR 268) prohibit disposal of restricted wastes unless specific concentration- or technology-based treatment standards have been met. The LDRs would be applicable to the treatment and disposal of dangerous or mixed wastes that may be generated during the removal action.

Dangerous and mixed wastes would likely be generated under both Alternatives Two and Three. At this time, it is expected that these wastes would be primarily characteristic dangerous wastes (e.g., lead-contaminated materials). Some listed wastes (e.g., organic solvents) may also be generated. Both characteristic and listed dangerous or mixed wastes would be designated and managed in accordance with the dangerous waste management standards in WAC 173-303. Any wastes determined to be dangerous or mixed waste would be treated as appropriate to meet the treatment standards of 40 CFR 268. For example, lead-contaminated waste could be encapsulated and disposed at the ERDF.

The *Toxic Substances Control Act of 1976* (TSCA), implemented via 40 CFR 761, regulates the management and disposal of PCBs and PCB waste. At this time, PCBs are identified as potential contaminants in the facility covered by this EE/CA, and PCB-contaminated waste would likely be generated under both Alternatives Two and Three. In accordance with 40 CFR 761, any PCB-contaminated wastes generated would be managed as PCB remediation waste or as PCB bulk product waste, as applicable. The ERDF is authorized to accept nonliquid PCB wastes for disposal. All waste suspected to contain PCBs would be evaluated to determine if the waste meets ERDF waste acceptance criteria, and disposed at the ERDF if it meets the criteria. Any PCB waste that does not meet the ERDF waste acceptance criteria would be sent to an onsite PCB storage area meeting the substantive requirements for TSCA storage and would be transported for disposal at a TSCA-approved disposal facility. An offsite determination would be approved by EPA, and Ecology would be notified in this case.

Radioactive wastes are governed under the authority of the *Atomic Energy Act of 1954*. U.S. Nuclear Regulatory Commission performance objectives for land disposal of low-level radioactive waste are provided in 10 CFR 61, Subpart C. Although not applicable to DOE facilities, these standards are relevant and appropriate to any disposal facility that would accept

low-level waste generated under this removal action. EPA requirements for disposal of transuranic waste are specified under the "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste" (40 CFR 191). This regulation generally prohibits near-surface disposal of transuranic waste and establishes disposal methods and requirements that include the expectation that containment will be provided for 10,000 years. Radioactive low-level waste would likely be generated under both Alternatives Two and Three. This waste would be disposed at the ERDF, which is authorized to receive low-level waste resulting from remediation activities, as long as the waste meets the ERDF waste acceptance criteria. Transuranic waste may be generated under Alternatives Two and Three. This waste would be transferred to the CWC for interim storage pending offsite disposal at a geologic repository such as the Waste Isolation Pilot Plant.

Removal of asbestos and asbestos-containing material (ACM) is regulated under the *Clean Air Act of 1955* (40 CFR 61, Subpart M) and by the Occupational Safety and Health Administration (29 CFR 1910.1101 and WAC 296-62). These regulations provide standards to ensure that emissions from asbestos are minimized during collection, processing, packaging, and transportation, and to protect asbestos workers. It is possible that some asbestos or ACM would have to be handled during the removal action during S&M (when major repairs are required). In this case, asbestos and ACM would be removed and disposed in accordance with the cited regulations, including appropriate worker protection and packaging. The asbestos and ACM would be disposed at the ERDF.

In addition to the ARARs specified above, because both alternatives propose disposal of waste at the ERDF, the ERDF waste acceptance criteria must be met. The ERDF waste acceptance criteria define radiological, chemical, and physical characteristics for waste proposed for disposal placement and compaction requirements. Waste generated during the implementation of either alternative that could not meet or be treated to meet the ERDF waste acceptance criteria would be stored or disposed at an alternate Ecology- and EPA-approved facility. Any waste disposal occurring off of the Hanford Site requires an offsite determination by EPA and the notification of Ecology.

The *Hazardous Materials Transportation Act of 1974* (49 U.S.C. 1801-1813), implemented via the "U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials" (49 CFR 100 through 179), governs the transportation of potentially hazardous materials, including samples and waste. It is applicable to any wastes or contaminated samples that would be shipped off of the Hanford Site. Both alternatives would require offsite transportation of potentially contaminated samples and, potentially, of waste. Through implementation of DOE orders and Federal procedures (e.g., DOE Order 460.1A, *Packaging and Transportation Safety,* and EPA's *Revised Procedures for Planning and Implementing Off-Site Response Actions* [EPA 1987]), compliance with this ARAR would be achieved for the handling and shipping of wastes and samples.

5.1.2.2 Standards Controlling Releases to the Environment. The Federal and state *Clean Air Acts* regulate both toxic and radioactive airborne emissions. Under implementing regulations found in 40 CFR 61, Subpart H, and WAC 246-247, radionuclide airborne emissions from all combined operations at the Hanford Site may not exceed 10 mrem/yr effective dose equivalent to

the hypothetical offsite maximally exposed individual. WAC 246-247 requires verification of compliance, typically through periodic confirmatory air sampling. WAC 173-400-040 establishes requirements for the control and/or prevention of the emission of air contaminants, including dust.

The radionuclide emission standards would apply to any fugitive air emissions of radionuclides generated during S&M and D&D activities associated with Alternatives Two and Three. If it is determined that there is a potential for a nonzero radioactive emission, best available radionuclide control technology would be required. Alternatives Two and Three would primarily use decontamination/stabilization of surfaces to control radiological contaminants and standard construction techniques to provide dust control during demolition. An air monitoring plan will be prepared during design and will be developed with the removal action work plan..

No liquid discharges are anticipated under either Alternative Two or Three.

5.1.2.3 Cultural and Ecological Resource Protection Standards. The *Archeological and Historic Preservation Act of 1974* (16 U.S.C. 469-469c) provides for the preservation of historical and archeological data (including artifacts) that might be irreparably lost or destroyed as the result of a proposed action. The *National Historic Preservation Act of 1966* (16 U.S.C. 470, et seq.) and its implementing regulations (36 CFR 800) require Federal agencies to evaluate and mitigate adverse effects of Federal activities on any site eligible for inclusion on the National Register of Historic Places. A total of 14 buildings and structures within the reactor compound have been recorded on historic property inventory forms. Of that number, 10 properties, which include the 105-B Facility, have been determined eligible for the National Register as contributing properties within the Historic District recommended for individual documentation (DOE-RL 1998b). Both Alternatives Two and Three will comply with the provisions of these historic preservation requirements by maintaining the historically significant 105-B Facility while not impacting the actions necessary to protect human health and the environment.

Ecological resource protection standards would have limited applicability to Alternatives Two and Three because very few actions will occur outside of the 105-B Facility. The *Endangered Species Act of 1973* (16 U.S.C. 1531, 50 CFR 402, and WAC 232-012-297) requires the conservation of critical habitat upon which endangered or threatened species depend and prohibits activities that threaten the continued existence of listed species or destroy critical habitat. The *Migratory Bird Treaty Act* (16 U.S.C. 703) makes it illegal to remove, capture, or kill any migratory bird or any part of nests or the eggs of any such birds. Threatened and endangered species are known to be present in the 100 Areas, but no adverse impacts on protected species or critical habitat resulting from implementation of either alternative would be anticipated, as activities will largely occur indoors. Facility-specific ecological reviews would be conducted to identify potentially adverse impacts prior to the performance of any demolition work.

5.1.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action has been performed. It also refers to the ability of a removal action to maintain long-term reliable protection of human health and the environment after removal action objectives have been met.

Alternative Two would be protective of human health and the environment for the interim removal action period. The facility structure could be maintained for the interim period such that releases to the environment from remaining hazardous substances do not occur or are minimized.

Alternative Three would allow public access into the 105-B Facility during the 10-year interim action. Therefore, there would be more potential for human exposure to hazardous substances. However, Alternative Three will effectively mitigate hazards associated with hazardous substances to the extent that exposure is minimized or eliminated. Alternative Three would involve slightly more hazardous substance mitigation (removal, decontamination, and/or containment of contamination) than Alternative Two. With both alternatives, the long-term effectiveness may slightly diminish because, as the facility ages, its structural integrity would require greater amounts of maintenance to ensure that releases do not occur. However, because the interim action is only for a 10-year period, any reduction of long-term effectiveness would not be significant.

To some extent under both alternatives, but more so under Alternative Three, wastes would be generated during maintenance and removal activities. These wastes would be disposed at the ERDF, which would provide reliable long-term protection.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The reduction of toxicity, mobility, or volume through treatment criterion refers to an evaluation of the anticipated performance of the treatment technologies that may be employed in a removal action. It assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. This could be accomplished by destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants. Reduction of toxicity, mobility, and/or volume contributes to overall protectiveness.

Both Alternatives Two and Three would generate small quantities of waste that might require treatment as necessary to meet waste acceptance criteria at ERDF or other disposal facilities. However, the fraction of waste requiring treatment would likely be low, and neither alternative would involve a specific treatment technology as part of the removal action. Therefore, toxicity, mobility, or volume would not be significantly reduced through treatment, nor would there be a difference between the alternatives. Alternatives Two and Three would employ recycling options for nonregulated material to reduce the volume of material disposed.

5.1.5 Short-Term Effectiveness

The short-term effectiveness criterion refers to an evaluation of the speed with which the remedy achieves protection. The criterion also refers to any potential adverse effects on human health and the environment during the implementation phases of the removal action.

Both Alternatives Two and Three would achieve protection in a like time frame, but Alternative Three provides for additional protective measures during the 10-year time frame. Regarding short-term protection during the implementation of the alternatives, there would be a greater potential for worker exposure and releases to the environment under Alternative Three. Removal, decontamination, or containment of hazardous substances to levels that do not pose a risk to the public would be required under Alternative Three. The increased handling of contaminated materials to achieve this end point, relative to Alternative Two, would increase the potential for worker exposure and releases to the environment, especially to the air. Strict adherence to all appropriate environmental regulations would ensure that the potential to release would be minimized. Limiting workers' time in contaminated areas and providing the necessary protective clothing and equipment appropriate for the tasks would mitigate the risk to workers under either alternative.

5.2 IMPLEMENTABILITY

Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution.

Alternative Two is implementable. S&M techniques are currently and widely used throughout the Hanford Site, and no specialized materials or services would be required except when major repairs would be needed on a contaminated area. As time passes, there may be a slight increase in difficulty with implementation due to the increasing deterioration of the facilities. This would result in possibly increasing the potential for worker exposure or physical hazards, although these risks would be mitigated through appropriate health and safety precautions. The deterioration would also present increasing challenges in maintaining the integrity of the facilities to prevent contaminant releases both within the building and to the environment.

Alternative Three is also implementable and would use readily available materials and services on the Hanford Site. Like Alternative Two, this alternative has similar concerns with increased difficulty in implementation as the facility ages. Hazardous substances in areas that are to be publicly accessible can be removed, decontaminated, or contained using standard industrial practices.

5.3 COST

The cost criterion evaluates the cost of the alternatives and includes capital, operation and maintenance, and monitoring costs.

As shown in Table 4-1, the cost estimate for Alternative Two is estimated at $1,658,000. The cost estimate for Alternative Three, as shown in Table 4-2, is estimated at $3,000,000.

5.4 STATE ACCEPTANCE

The state acceptance criterion evaluates whether the technical and administrative concerns of the state have been addressed. The criterion also evaluates the position of Washington State concerning the recommended alternative. State acceptance will be evaluated by Ecology, and EPA will evaluate any significant State issues.

5.5 COMMUNITY ACCEPTANCE

The community acceptance criterion evaluates how the alternatives address the concerns of the public and whether the public concurs with the preferred alternative. Public acceptance of the preferred alternative will be evaluated after the public has had an opportunity to review and comment on this EE/CA and its recommended alternative, and response to public comment is complete.

5.6 OTHER CONSIDERATIONS

In accordance with DOE Order 451.1A and NEPA policy, DOE CERCLA documents are required to incorporate NEPA values (e.g., analysis of cumulative, offsite, ecological, and socioeconomic impacts) to the extent practicable.

Cumulative impacts may occur in both the short term and the long term because of the interrelationships among other activities occurring in the 100 Areas. Other current or future activities in the 100 Areas include the following:

- Remediation of contaminated waste sites, groundwater, and burial grounds in the 100 Area reactor areas
- ISS activities at the 105-D, 105-DR, 105-H, and 105-F Facilities
- Storage and removal of spent fuel contained in the basins at the 100-K Area
- D&D of ancillary facilities in the 100 Areas
- Disposition of the reactor blocks.

These activities are expected to be ongoing for some time, with the exception of removal of the reactor blocks. The reactor blocks are expected to be addressed within 75 years. Each of these activities contributes toward meeting the goals of 100 Area remediation, including protection of

the Columbia River. However, due to the competition for financial resources to accomplish the work, each activity is in competition with others for priority allocation of funding. In addition, each of the activities presents the potential for offsite impacts such as airborne releases.

Neither Alternative Two nor Alternative Three would commit relatively significant resources (including waste disposal costs, workers, equipment, and supplies) during the interim removal action time frame. Alternative Three would commit a larger proportion of these resources and therefore would impose a slightly greater cumulative burden in terms of additional competition for remediation dollars and work force resources than Alternative Two.

Offsite impacts include potential effects on the public or the environment due to the release of contaminants resulting from an activity being performed at the Hanford Site. Alternatives Two and Three would not be expected to result in adverse offsite impacts during the interim action and thus would not add to the cumulative impact of other near-term activities in the 100 Areas.

Neither alternative would be expected to affect existing natural resource conditions. Although Federally listed bald eagles frequent the Columbia River during the winter, there are no identified roosts near the 100-B/C Area that would affect work on the 105-B Facility (DOE-RL 1994). The area where work would be performed is not identified as critical habitat for any other listed species. However, prior to commencing any field activity, an ecological review of the facility and surrounding area would be conducted to ensure that there would be no impacts to natural resources of special concern (e.g., migratory birds).

Disturbance maps indicate that, due to previous Hanford Site era construction activities, no archeological deposits likely remain intact in the immediate vicinity of the reactor area. However, with implementation of either alternative, cultural resource surveys would be conducted before any proposed work started. If surveys indicate the presence of cultural resources, a mitigation plan would be developed.

Both alternatives would require a small irreversible and irretrievable commitment of resources in terms of land that would be committed for disposal of waste to the ERDF.

Socioeconomic impacts from implementing either alternative would be minimal. Personnel required to implement both alternatives would be selected from existing S&M and remediation work force resources at the Hanford Site, or the opportunity to fill these positions would be made available to subcontractors, based upon the Plant Forces Work Review determination.

6.0 RECOMMENDED ALTERNATIVE

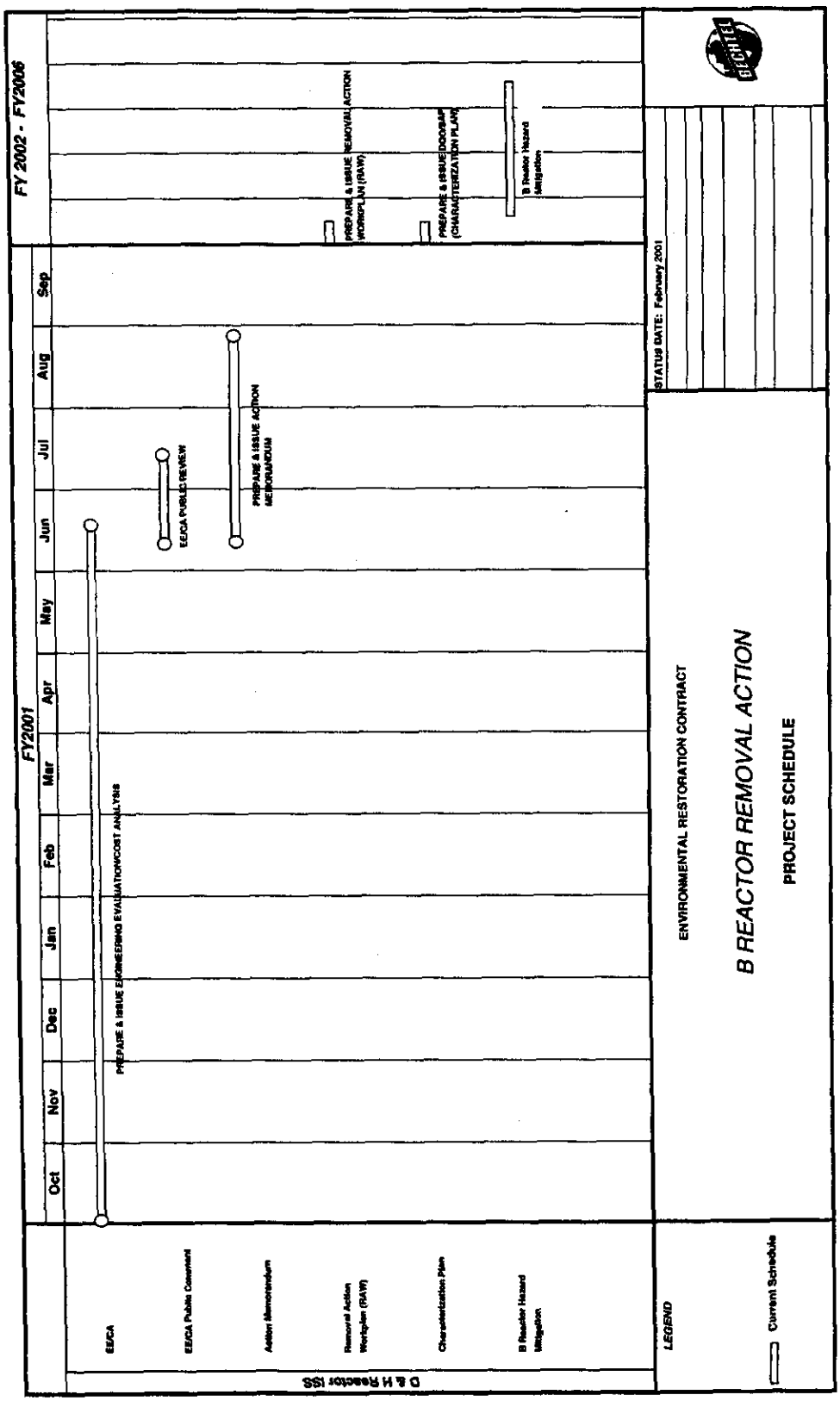
The recommended interim removal action alternative for 10 years at the 105-B Facility is Alternative Three. Alternative Three would afford the best balance between providing protection of human health and the environment, meeting removal action objectives, achieving cost effectiveness, and providing an end state that supports and is consistent with DOE's intent to preserve the facility for historical interpretation. Alternative Three allows interim use of the 105-B Facility for this purpose while a decision is made regarding its final configuration. This interim use is supported by the DOE and EPA.

Alternative Three would involve continued S&M of the 105-B Facility and mitigation of hazardous substances to allow public access into the portions of the facility identified in Figure 4-1. Waste generated during the removal action would be disposed at the Hanford Site's ERDF, which provides an engineered disposal facility that is protective of the environment.

7.0 SCHEDULE

Figure 7-1 provides a schedule of the proposed removal action alternative for information purposes only. Sampling and analysis plans (for waste designation and final verification) and the removal action work plan identified will be submitted to the regulatory agencies for concurrence.

Figure 7-1. B Reactor EE/CA Project Schedule.



8.0 REFERENCES

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

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

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

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

40 CFR 191, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste," *Code of Federal Regulations*, as amended.

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

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

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

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

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

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

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

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

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

40 CFR 300.440, "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*, as amended.

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

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

50 CFR 17, "Endangered and Threatened Wildlife and Plants," *Code of Federal Regulations*, as amended.

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

58 FR 48509, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site," Final Rule, *Federal Register*, Vol. 58, pp. 48509, September 16, 1993.

64 FR 61615, "Record of Decision: Hanford Comprehensive Land Use Plan Environmental Impact Statement (HCP EIS)," Final Rule, *Federal Register*, Vol. 64, pp. 61615, November 12, 1999.

American Antiquities Act of 1906, 16 U.S.C. 431, et seq.

Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469-469c.

Atomic Energy Act of 1954, 42 U.S.C. 2011, et seq.

BHI, 1994, *Pre-Existing Conditions Survey of the Hanford Site Facilities to be Managed by Bechtel Hanford, Inc.*, BHI-00081, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997, *Hanford Surplus Facilities Hazards Identification Document,* BHI-00066, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000a, *105-B Reactor Museum Feasibility Assessment (Phase II)*, BHI-01384, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *105-B Reactor Museum Phase II Project Supplemental Cost Estimate*, BHI-01385, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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

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

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

DOE, 1994, *Secretarial Policy on the National Environmental Policy Act,* (Memorandum from H. O'Leary to Secretarial Offices and Heads of Field Elements, June 1994) U.S. Department of Energy, Washington, D.C.

DOE, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, DOE/EIS-0222-F, U.S. Department of Energy, Washington, D.C.

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

DOE Order 460.1A, *Packaging and Transportation Safety,* as amended, U.S. Department of Energy, Washington, D.C.

DOE and EPA, 1995, *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, May 22, 1995, U.S. Department of Energy and U.S. Environmental Protection Agency, Washington, D.C.

DOE-RL, 1994, *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington,* DOE/RL-94-150, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996, *Hanford Site Biological Resources Management Plan,* DOE/RL-96-32, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

DOE-RL, 1998b, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

DOE-RL, 2000b, *U.S. Department of Energy Hanford Site Threatened and Endangered Species Management Plan, Salmon and Steelhead*, DOE/RL-2000-27, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1996, *U.S. Department of Energy Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington, Explanation of Significant Difference (ESD)*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order*, 2 vol., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

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

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

Gerber, M. S., 1993, *Summary of 100-B/C Reactor Operations and Resultant Wastes*, WHC-SD-EN-RPT-004, Westinghouse Hanford Company, Richland, Washington.

Griffin, P. W., Battelle Pacific Northwest Laboratories, and Parsons Environmental Services, Inc., 1995, *105-B Reactor Facility Museum Phase I Feasibility Study Report*, BHI-00076, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Griffin, P. W. and J. J. Sharpe, 1999, *Hanford B Reactor Building Hazard Assessment Report*, BHI-01282, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

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

Migratory Bird Treaty Act, 16 U.S.C. 703, et seq.

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

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

Neitzel, D. A., 2000, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 11, Pacific Northwest National Laboratory, Richland, Washington.

NFPA, 2000, *Life Safety Code*, NFPA 101, National Fire Protection Association, Quincy, Massachusetts.

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

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

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

USDI, 1992, *The Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings*, Preservation Assistance Division of the National Park Service, U.S. Department of the Interior, Washington, D.C.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-400-040, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

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

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

WAC 296-62, "Occupational Health Standards -- Safety Standards for Carcinogens," *Washington Administrative Code*, as amended.

WHC, 1993, *Risk Management Study for the Retired Hanford Site Facilities: Qualitative Risk Evaluation for the Retired Hanford Site Facilities,* WHC-EP-0619, Volume 3, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994, *105-B Damaged Roof Panel Repair*, Engineering Change Notice 600275, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

INTERIM SAFE STORAGE COSTS FOR INFORMATION PURPOSES

APPENDIX A
INTERIM SAFE STORAGE COSTS FOR INFORMATION PURPOSES

For information purposes, the costs and activities for performing interim safe storage (ISS) of another reactor facility, the 105-D Facility, are included. ISS was previously chosen as the removal alternative for five reactor facilities (the 105-C, 105-D, 105-DR, 105-H, and 105-F Facilities). Costs and activities identified below would be similar for the 105-B Facility under an ISS alternative.

Table A-1. Cost Estimates for Interim Safe Storage of the 105-D Facility Followed by Long-Term Surveillance and Maintenance and Decontamination and Demolition[a].

Facility	Estimated Cost ($)
Interim Safe Storage of the 105-D Facility	
Sampling and analysis[b]	350,000
Engineering[c]	200,000
Construction[d]	11,527,000
Equipment/materials[e]	1,390,000
Waste disposal[f,g] = 5,106 m^3	701,000
Basin structure removal to 4.6 m below surrounding grade[h]	
Decontamination and demolition	1,193,000
Waste disposal[g,f] = 1,843 m^3	253,000
Post-construction surveillance and maintenance[i]	336,000
Total	**$15,950,000**

[a]Cost estimate for decontamination and demolition (D&D) of the 105-D Facility does not include costs required for preparation for transport and disposal of the 105-D Reactor block.
[b]Sampling and analysis: Costs associated with sample planning (e.g., data quality objectives and characterization plan), preparation, collection, and analysis. This activity provides pre-engineering information to assist in D&D planning and waste disposition planning.
[c]Engineering: Costs associated with all up-front engineering. Activity to include documentation associated with *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* planning, engineering evaluation/cost analysis, hazard classification, removal action work plan, etc.
[d]Construction: Costs associated with the actual demolition and safe storage of the reactor. This activity includes the demolition and the subcontract and other field support activities, as well as continued engineering in support of the safe storage.
[e]Equipment and materials: Costs associated with the procurement of materials and the rental/lease of heavy equipment. Activity will cover all costs of equipment and materials starting from the pre-engineering walkdowns through the final site restoration activities.
[f]Waste disposal volume estimates were derived from actual waste volume shipments from interim safe storage of the C Reactor. The waste volumes do not delineate between waste type (e.g., low level or mixed) because it is assumed that all of the waste will meet the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria.
[g]Disposal cost assumptions: Disposal of low-level radioactive, dangerous, and mixed wastes at the ERDF at $137.33/$m^3$ ($105/$yd^3$). Includes all direct and indirect costs and cost of transportation from area to ERDF.
[h]Removal of complete basin structure additional waste would increase cost by $581,920.
[i]Surveillance and maintenance assumptions:

80 hours/year x $40/hour x 75 years	=	$240,000
160 hours x $40/hour x (75 years/5)	=	$96,000
for a total of $336,000		

APPENDIX B

COSTS FOR FULL HAZARDOUS SUBSTANCE MITIGATION OVER 75 YEARS

APPENDIX B
COSTS FOR FULL HAZARDOUS SUBSTANCE MITIGATION OVER 75 YEARS

Figures B-1 through B-7 show the below grade, at grade, and above grade levels of the 105-B Facility.

Table B-1 identifies full mitigation (75-year) cost estimates for every room within the 105-B Facility. Table B-2 identifies fixed costs required to upgrade the facility for public access.

Figure B-1. Schematic Drawing Below Grade of the 105-B Facility.

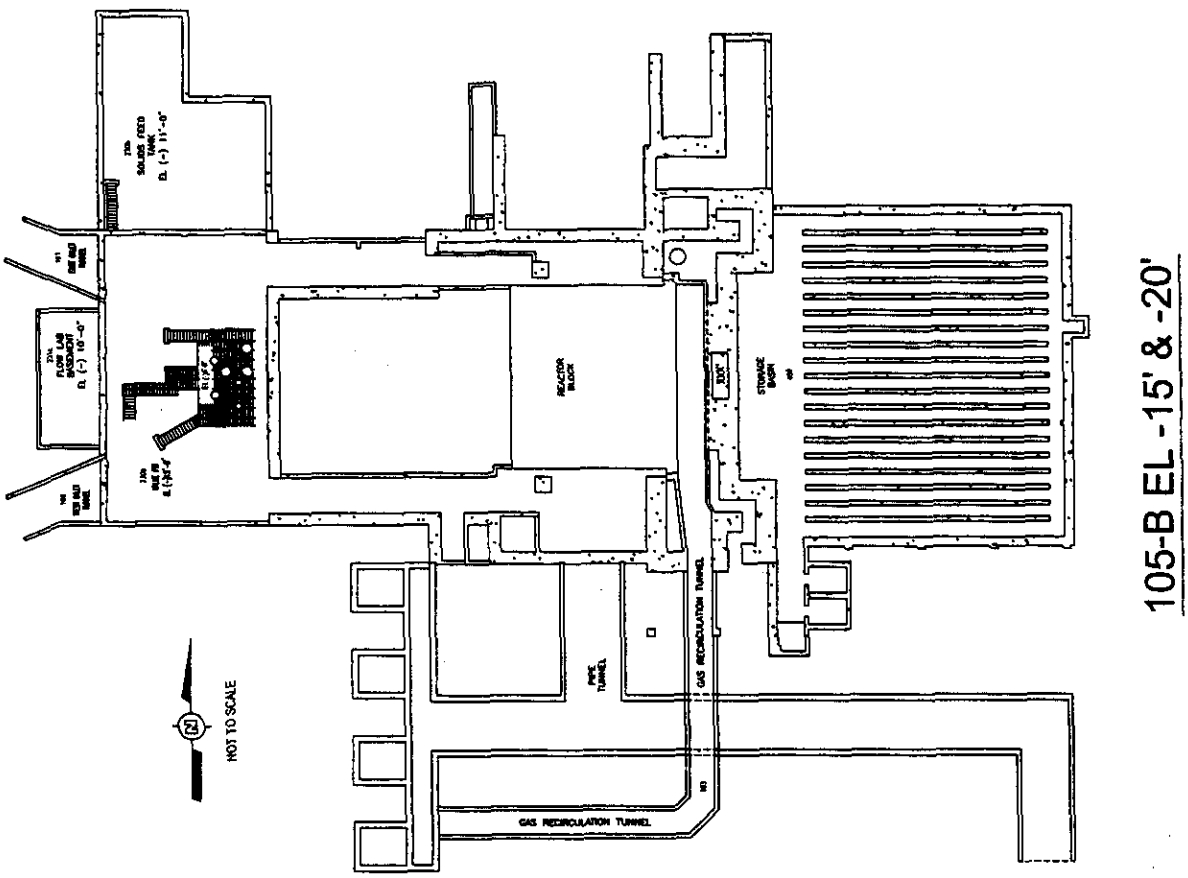


Figure B-2. Schematic Drawing of the Ground Floor of the 105-B Facility.

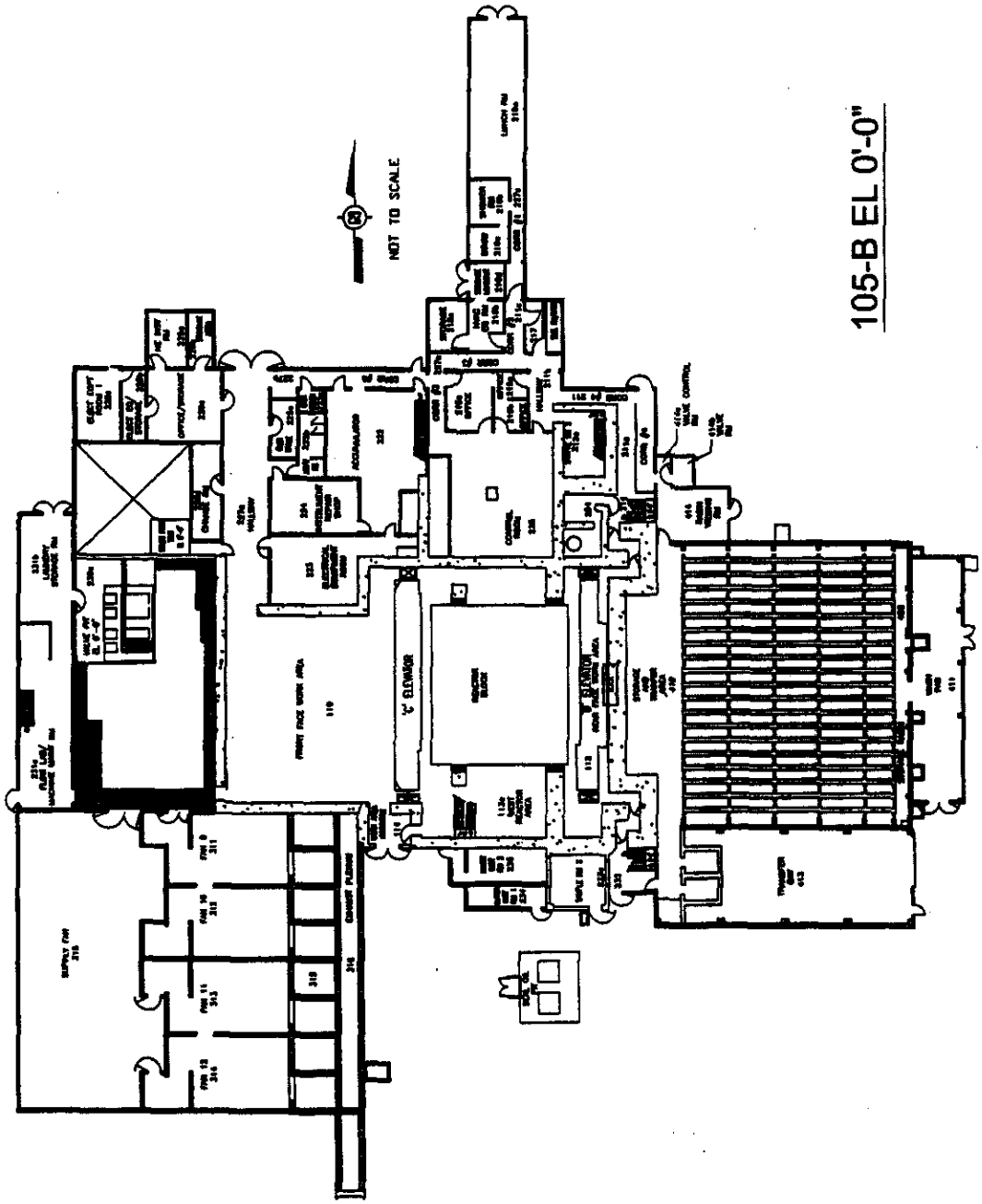


Figure B-3. Schematic Drawing Above Grade Portions of the 105-B Facility.

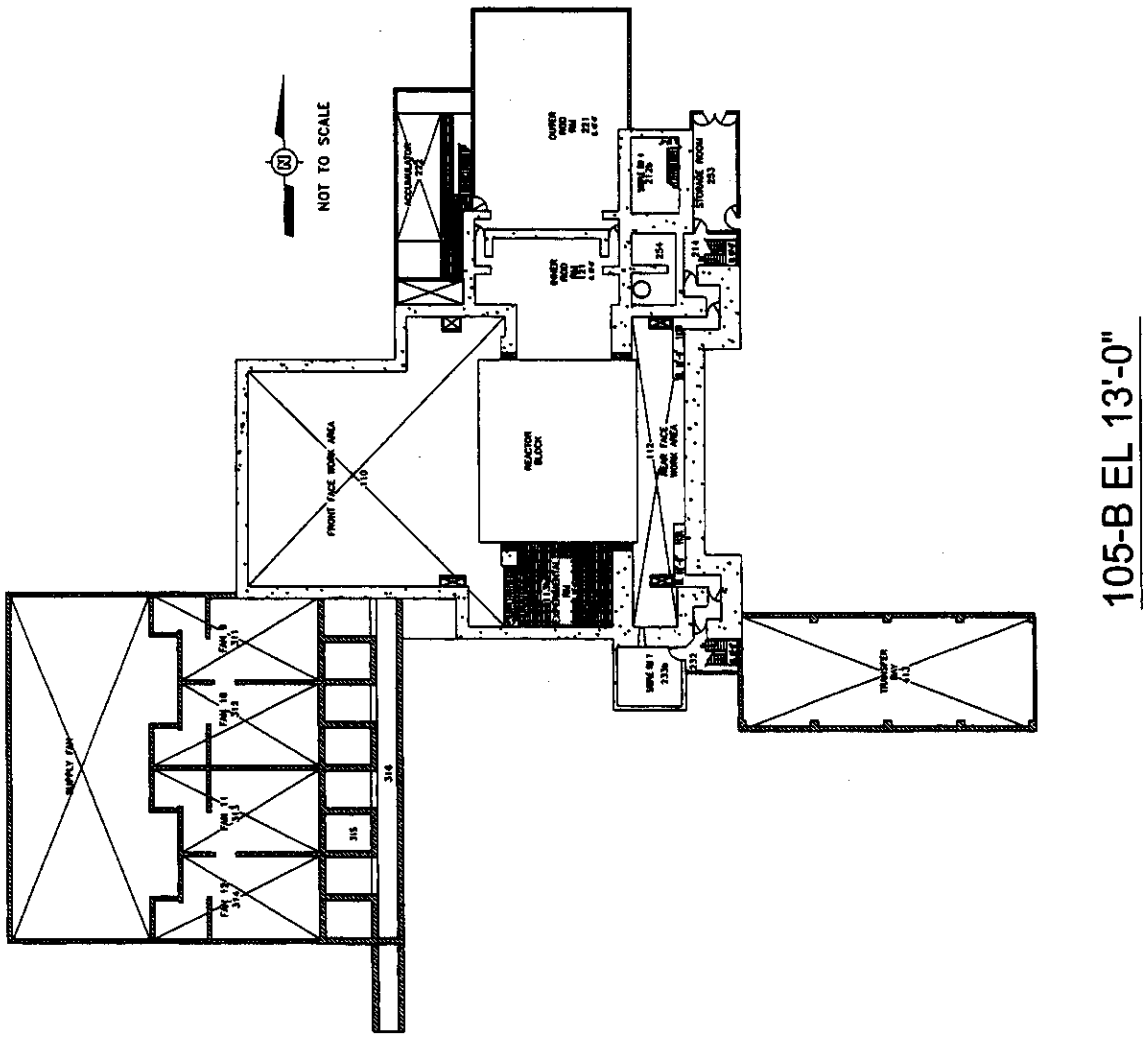


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Figure B-4. Schematic Drawing Above Grade Portions of the 105-B Facility.

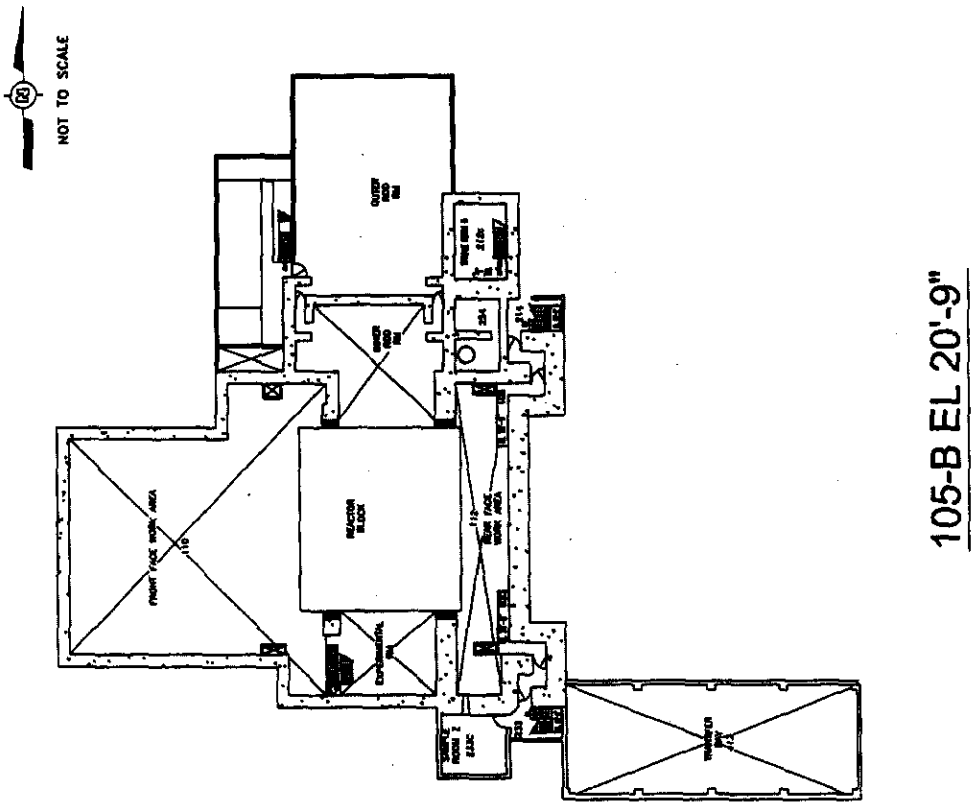

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Figure B-5. Schematic Drawing Above Grade Portions of the 105-B Facility.

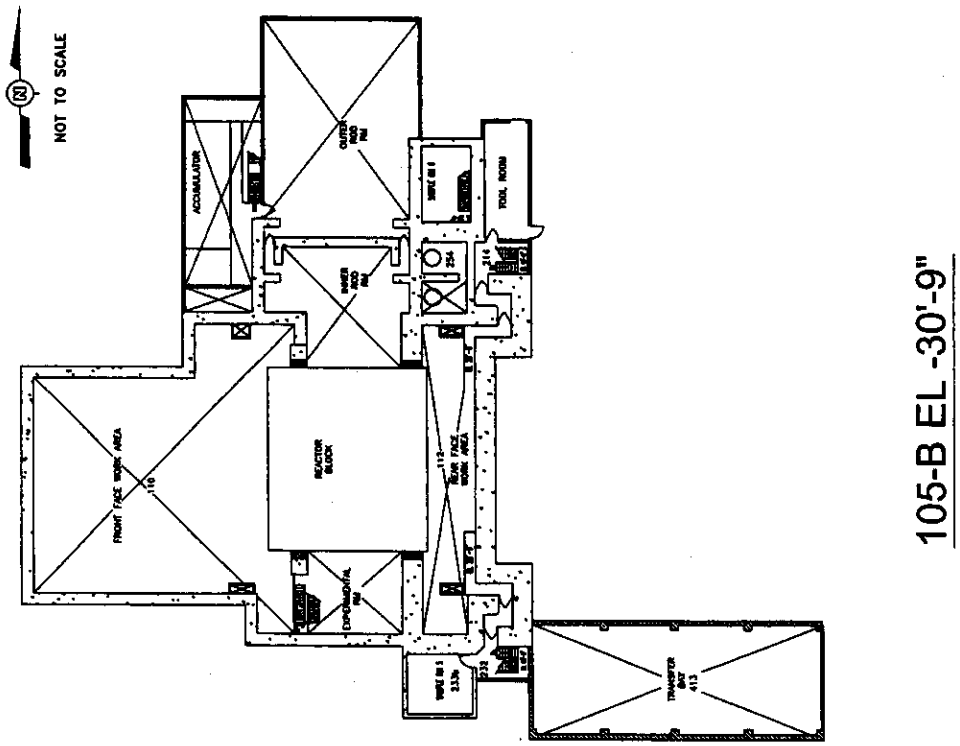

Figure 3-6. Schematic Drawing Above Grade Portions of the 105-B Facility.

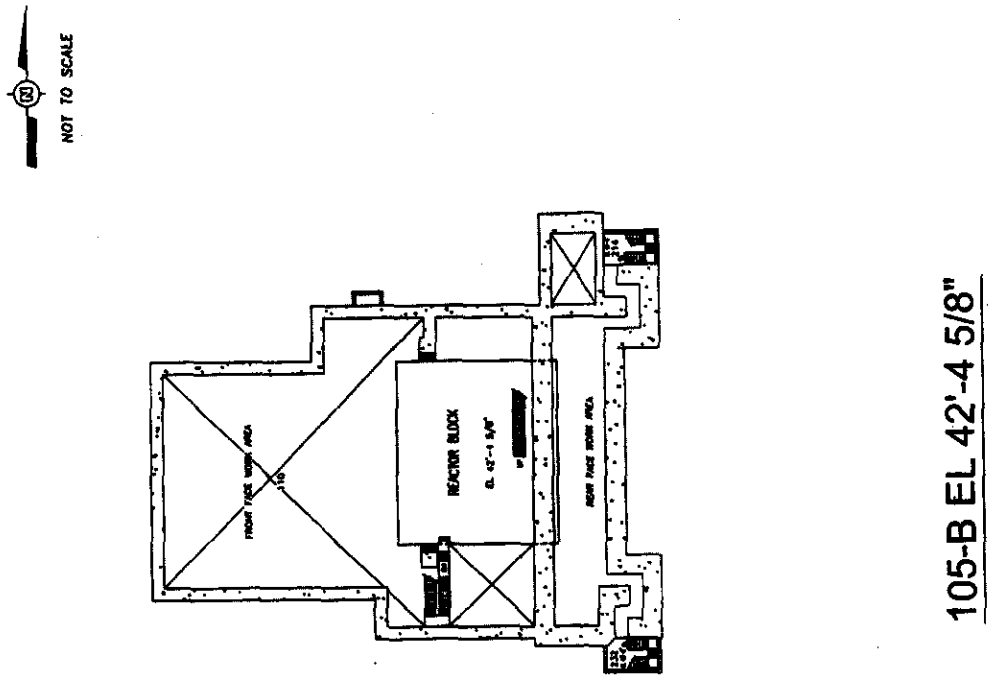

Figure 3-7. Schematic Drawing Above Grade Portions of the 105-B Facility.

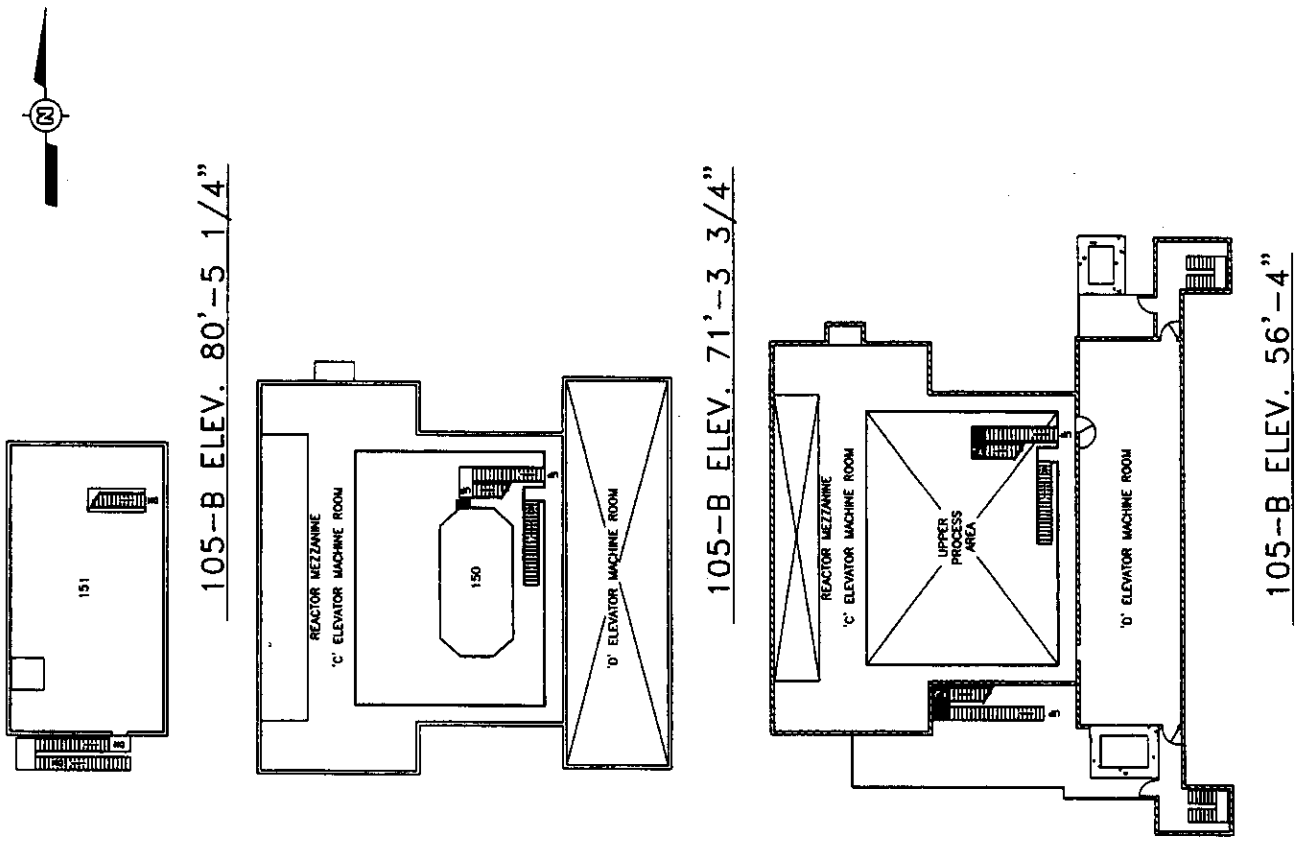

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
100 West Inlet Tunnel		
Secure with Grout	30,000	The estimating assumption is that this tunnel will require a grout seal to ensure safety and security. This estimate assumes a crew of four working 10 days at $50/hr plus equipment and supplies. Due to the confined space, a factor of 1.5 will be applied to productivity. Equipment, concrete forms, and pumper truck costs are an additional $6,000. (4 crew x 10 days x 8 hrs/day x $50/hr x 1.5 productivity factor) = $30,000.
Totals	30,000	
100 East Inlet Tunnel		
Secure with Grout	30,000	The estimating assumption is that this tunnel will require a grout seal to ensure safety and security. This estimate assumes a crew of four working 10 days at $50/hr plus equipment and supplies. Due to the confined space, a factor of 1.5 will be applied to productivity. Equipment, concrete forms, and pumper truck costs are an additional $6,000. (4 crew x 10 days x 8 hrs/day x $50/hr x 1.5 productivity factor) = $30,000.
Totals	30,000	
103 Gas Recirculating Tunnel		
Secure with Grout	30,000	The estimating assumption is that this tunnel will require a grout seal to ensure safety and security. This estimate assumes a crew of four working 10 days at $50/hr plus equipment and supplies. Due to the confined space, a factor of 1.5 will be applied to productivity. Equipment, concrete forms, and pumper truck costs are an additional $6,000. (4 crew x 10 days x 8 hrs/day x $50/hr x 1.5 productivity factor) = $30,000.
Totals	30,000	
110 Front Face Work Area		
Lead Paint Removal	10,906	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	176,400	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Canvas Drop Shield	7,500	BHI-01282 (BHI 1999) identifies a fall hazard. Mitigation assumes securing drop shield with cables mounted from I-beams. A man basket would be required. Set-up and take-down costs are applied to a two-man crew.
Overhead Crane (Oil & Grease)	2,000	BHI-01282 (BHI 1999) identifies hazardous chemicals. Mitigation assumes draining oil and grease reservoirs. A man basket would be required. Set-up and take-down costs are applied to a two-person crew.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Total	194,806	
112 D Elevator		
Decontamination	2,000,000	Identified during the walkdown as an area that contains radiological contamination. The contamination is within the nozzles and pipes on the back side of the reactor. This would be a major effort to fully mitigate contaminants. Cost estimate based on best engineering judgement.
Lead Paint Removal	15,618	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	1,000	BHI-01282 (BHI 1999) identifies concerns associated with the removal of asbestos.
Lead Shielding	500	Identified during the site walkdown. Mitigation will require the removal of lead shielding.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Mercury	1,500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of mercury.
Totals	2,019,118	
114 Work Area Corridor		
Lead Paint Removal	4,308	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Contaminated Equipment	8,000	BHI-01385 (BHI 2000b) identified a concern with contaminated equipment. Mitigation will require the disposal, decontamination of the equipment.
Maintenance on Stairs	7,000	BHI-01385 (BHI 2000b) identified a safety concern with the stairwell within this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	19,308	
121 Inner Rod Room		
Lead Paint Removal	12,144	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Decontamination	2,000,000	The control rods are activated; decontamination is not an option. Grouting and shielding may offer a mitigation option. The components and equipment within the room will also require decontamination. Potential airborne issues may require additional resources. Based on best engineering judgement.
Totals	2,012,144	
150 No Title		
Lead Paint Removal	8,078	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Totals	15,578	
151 No Title		
Lead Paint Removal	16,695	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	14,000	The site walkdown identified a safety concern associated with the two stairwells in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies for each stairwell.
Total	30,695	
211 Corridor #4		
Lead Paint Removal	8,617	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Decontamination	13,840	BHI-01385 (BHI 2000b) identifies a potential RCA. Currently used as step-off pad for access/egress for contaminated portions of the reactor. Mitigation assumes relocation of step-off pad to an unused portion of the reactor. Perform radiological characterization/ decontamination for radiological release area.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Roof Panels	85,826	BHI-01385 (BHI 2000b) identifies a striking/falling hazard. Five panels have been identified as being cracked and needing repair, and one has been repaired. Mitigation assumes the use of the Unistrut system (WHC 1994a) similar to repairs in the valve pit area.
Total	108,283	
214 Stairwell 0-0		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
214 Stairwell 13-0		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
214 Stairwell 20-9		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
214 Stairwell 30-9		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
214 Stairwell 42-4		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
214 Stairwell 56-4		
Lead Paint Removal	3,231	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	10,231	
217 Tool Room		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,847	
220 Control Room		
Lead Paint Removal	15,080	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	30,625	WHC-EP-0619 (WHC 1994b) identifies a cost associated with the removal of asbestos.
Totals	45,705	
221 Outer Rod Room		
Lead Paint Removal	16,544	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Decontamination	21,280	WHC-EP-0619 (WHC 1994b) identifies a contamination cost associated with this room.
Asbestos	33,250	WHC-EP-0619 (WHC 1994b) identifies a cost associated with the removal of asbestos.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Totals	74,074	
222 Accumulator		
Lead Paint Removal	15,080	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Oil	500	BHI-01282 (BHI 1999) and BHI-01385 (BHI 2000b). Based on discussions with the BHI craft supervisor, this is oil that has leaked from the compressor under the stairs. Mitigation assumes draining oil reservoir. Disposal costs are included.
Asbestos	36,000	WHC-EP-0619 (WHC 1994b) identifies a cost associated with the removal of asbestos.
Totals	58,580	
223 Electrical Equipment		
Lead Paint Removal	10,502	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Tripping Hazard	900	Identified in BHI-01282 (BHI 1999) and by the BHI craft supervisor as a tripping hazard due to the difference in elevation between the accumulator room and the electrical equipment room. Mitigation assumes the construction of a ramp to allow smooth transition from room to room. Includes two carpenters, 1 day at $50/hr, plus $100 equipment and supplies.
Electrical Costs	0	Assumed to be covered within the facility costs.
Totals	11,402	
224 Instrument Repair Room		
Lead Paint Removal	7,001	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Asbestos	7,500	WHC-EP-0619 (WHC 1994b) identifies a cost associated with the removal of asbestos.
Miscellaneous Maintenance	1,587	BHI-01385 (BHI 2000b) identifies a cost associated with miscellaneous maintenance for this room.
Totals	16,088	
232 Stairwell 0-0		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
232 Stairwell 13-0		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
232 Stairwell 20-9		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
232 Stairwell 30-9		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
232 Stairwell 42-4		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
232 Stairwell 56-4		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	11,847	
234 Outer Instrument		
Lead Paint Removal	5,116	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	5,116	
235 Inner Instrument Room		
Lead Paint Removal	6,463	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	6,463	
253 Storage		
Lead Paint Removal	7,540	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Contaminated Equipment	8,000	During the site walkdown contaminated tools were identified. Mitigation will require the disposal or decontamination of the equipment.
Miscellaneous Maintenance	5,000	BHI-01385 (BHI 2000b) identifies a cost associated with miscellaneous maintenance for this room
Totals	23,540	
254 0-0 Elevation		
Lead Paint Removal	5,924	Based on a RSMeans Environmental Cost Data – Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	5,924	
311 Fan 9		
Lead Paint Removal	9,694	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Totals	10,194	
312 Fan 10		
Lead Paint Removal	9,694	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Totals	10,194	
313 Fan 11		
Lead Paint Removal	9,694	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Totals	10,194	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
314 Fan 12		
Lead Paint Removal	9,694	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Totals	10,194	
315 Supply Fan		
Lead Paint Removal	38,507	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	208,800	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Egress	0	Covered within fixed costs for 75 years.
Roof Panels	77,308	BHI-01385 (BHI 2000b) identifies a striking/falling hazard. Four panels have been identified as being cracked and needing repair. Mitigation assumes the use of the Unistrut system (WHC 1994a) similar to repairs in the valve pit area.
Electrical	0	Assumed to be covered within the fixed costs for 75 years.
Fire Alarm Upgrades	0	Assumed to be covered within the fixed costs for 75 years.
Miscellaneous Maintenance	500	BHI-01385 (BHI 2000b) identifies a cost associated with miscellaneous maintenance for this room
Decontamination	51,356	BHI-01385 (BHI 2000b) identifies costs associated with the contamination within this room. Mitigation requires the decontamination.
Totals	379,471	
316 Exhaust Plenum		
Lead Paint Removal	19,927	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	19,927	
400 Fuel Storage Basin		
Lead Paint Removal	18,311	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Lead	500	During the site walkdown lead bricks and lead shielding were identified. Mitigation requires the removal of lead.
Miscellaneous Maintenance	4,000	BHI-01385 (BHI 2000b) identifies a cost associated with miscellaneous maintenance for this room
Asbestos Removal	149,850	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	173,161	
400 Fuel Storage Basin –15		
Decontamination	1,000,000	Contamination has been identified within the fuel storage basin. The actual scope of work is undefined at this time. Based on best engineering judgement.
Totals	1,000,000	
410 Storage and Trans.		
Lead Paint Removal	11,040	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	11,040	
411 Wash Pad		
Lead Paint Removal	15,080	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	18,425	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Oil	500	BHI-01282 (BHI 1999) identifies concerns associated with the removal of oil.
Decontamination	21,000	BHI-01385 (BHI 2000b) identifies a cost associated with contamination within this room.
Totals	55,005	
423 Transfer Bay		
Lead Paint Removal	16,157	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Decontamination	4,100,000	BHI-01385 (BHI 2000b) identifies a contamination concern associate with this room. Mitigation costs will be high. At this time, the scope of this task is unknown.
Asbestos Removal	53,650	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Floor Drain	9,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants. Assumes three drains at $3,000 each.
Pit Handrail	2,300	BHI-01385 (BHI 2000b) identifies a cost associated with miscellaneous maintenance for pit handrail.
Total	4,181,107	
414 Basin Viewing Room		
Lead Paint Removal	6,463	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Radiological Control	0	With the full hazard mitigation option, the fuel storage basin will be decontaminated and will eliminate the need for radiological control.
Miscellaneous Maintenance	12,661	BHI-01385 (BHI 2000b) identifies costs associated with glass repair, barricade installation, and door security. Barricade installation prevents visitors from contacting the viewing window and creates less exposure to the fuel storage basin.
Fire Alarm Upgrades	0	Assumed to be covered within the fixed costs.
Breaker Box Barrier	250	Based on discussions with the BHI craft supervisor, a barrier is needed on the breaker box within the viewing room to prevent visitor access. Mitigation assumes one person 1/2 day at $50/hr to complete task., plus $50 for equipment and supplies
Totals	19,374	
113a West Reactor Area		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Asbestos Removal	24,750	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	37,136	
113b Experimental Room		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Grated Walkway	2,900	Identified in site walkdown and addressed in BHI-01385 (BHI 2000b) as a tripping hazard. Decking cover must meet OSHA Code. Mitigation assumes ¾-in. AC plywood covering. Assumes two carpenters at $50/hr taking 3 days to complete. Materials and equipment costs include an additional $500.
Totals	8,286	
210a North Lunch Room		
Lead Paint Removal	10,771	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	10,771	
210b Shower Room		
Lead Paint Removal	3,770	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	3,770	
210c Bathroom		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,847	
210d Storage Load out		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,847	
211a Hallway		
Lead Paint Removal	4,308	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,308	
211 Hallway		
Lead Paint Removal	2,827	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	2,827	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
211c Corridor #2		
Lead Paint Removal	2,693	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	2,693	
212a Sample Room #2		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Decontamination	5,600	BHI-01385 (BHI 2000b) identifies a potential contaminated area. Mitigation requires the removal of contamination. Also, perform characterization/decontamination for radiological release area.
Asbestos Removal	8,100	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	26,086	
212b Sample Room #4		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Totals	12,386	
212c Sample Room #6		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height
Maintenance on Stairs	7,000	The site walkdown identified a safety concern associated with the stairwell in this room. The mitigation of this safety concern will require a crew of three carpenters working 5 days at $50/hr, plus equipment and supplies.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Asbestos	1,500	Asbestos was identified in BHI-01385 (BHI 2000b) for this room. Assumes minor removal required.
Totals	16,886	
218a Storage		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	6,300	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	11,147	
218b Storage		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	5,488	BHI-01282 (BHI 1999) identifies a potential source of heavy metals to reduce any migration potential of contaminants.
PCBs	3,818	BHI-01385 (BHI 2000b) identified a cost associated with PCBs for this room.
Totals	14,153	
219a Office		
Lead Paint Removal	5,655	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	7,200	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	12,855	
219b Office		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	4,000	During the site walkdown asbestos was identified within the floor and ceiling tiles. Assumes a minor mitigation cost.
Totals	8,847	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
219c Office		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	4,000	During the site walkdown asbestos was identified within the floor and ceiling tiles. Assumes a minor mitigation cost.
Totals	8,847	
225a Engineering Office		
Lead Paint Removal	4,308	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	4,000	During the site walkdown asbestos was identified within the floor and ceiling tiles. Assumes a minor mitigation cost.
Totals	8,308	
225b Men's Room		
Lead Paint Removal	5,924	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	6,276	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Asbestos Removal	3,000	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
PCBs	11,531	BHI-01385 (BHI 2000b) identified a cost associated with PCBs for this room.
Totals	26,731	
225c Mask Decon (Women's)		
Lead Paint Removal	2,154	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	3,000	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
PCBs	5,439	BHI-01385 (BHI 2000b) identified a cost associated with PCBs for this room.
Hazardous Supplies	1,713	BHI-01385 (BHI 2000b) identifies a cost associated with hazardous supplies for this room.
Totals	12,306	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
227a Hallway		
Lead Paint Removal	12,387	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Asbestos Removal	4,000	During the site walkdown asbestos was identified within the floor and ceiling tiles. Assume a minor mitigation cost.
Totals	19,387	
227b Corridor #5		
Lead Paint Removal	8,078	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Tripping Hazard	900	BHI-01282 (BHI 1999) identifies a tripping hazard due to the difference in elevation between the door ways. Mitigation assumes the construction of a ramp to allow smooth transition from room to room. Includes two carpenters, 1 day at $50/hr, plus $100 equipment and supplies.
Totals	8,978	
227c Corridor #3		
Lead Paint Removal	9,156	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	9,156	
227x Corridor #1		
Lead Paint Removal	5,924	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	5,924	
228a Office-Storage		
Lead Paint Removal	7,540	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Security	1,843	BHI-01385 (BHI 2000b) identifies a security issue. Room requires secure lock and doors to prevent visitors access to additional rooms.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
PCBs	3,856	BHI-01385 (BHI 2000b) identified a cost associated with PCBs for this room.
Asbestos Removal	4,000	During the site walkdown asbestos was identified within the floor and ceiling tiles. Assume a minor mitigation cost.
Totals	17,239	
228b Electrical Equip Room		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Security	1,843	BHI-01385 (BHI 2000b) identifies a security issue. Room requires secure lock and doors to prevent visitors access to additional rooms.
Asbestos Removal	4,000	BHI-01385 (BHI 2000b) identifies costs associated with the removal of asbestos for this room.
Totals	10,690	
228c Electrical Equip #1		
Lead Paint Removal	5,924	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Miscellaneous Maintenance	1,500	BHI-01385 (BHI 2000b) identifies a minor cost associated with miscellaneous maintenance for this room.
Totals	10,424	
228d Change Room		
Lead Paint Removal	6,463	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	6,463	
229a Storage Area		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,847	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
229b Storage		
Lead Paint Removal	4,039	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	34,000	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	38,039	
230a Valve Pit		
Lead Paint Removal	0	This room has exposed concrete walls.
Asbestos Removal	78,600	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Grated Walkway	2,900	Identified in site walkdown and addressed in BHI-01385 (BHI 2000b) as a tripping hazard. Decking cover must meet OSHA Code. Mitigation assumes ¾-in. AC plywood covering. Assumes two carpenters at $50/hr taking 3 days to complete. Materials and equipment costs include an additional $500.
Breaker Box	0	Identified during the site walkdown as a potential electrical hazard. Assuming the cost associated with the mitigation of this issue falls within the fixed costs for 10 years.
Totals	81,500	
230b Valve Pit -15 Elev.		
Lead Paint Removal	0	This room has exposed concrete walls.
Asbestos Removal	169,625	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Hazard Removal	21,000	Identified during discussions with the BHI craft supervisor and the BHI project engineer. Characterization of unknown material on the lower level is recommended to ensure air quality of the visitors ($3,000). Cleaning, removal, and disposal of unknown material will require a crew of three approximately 15 days to complete. At $50/hr this equates to $18,000.
Totals	190,625	
230b Solids Feed Tank		
Totals	0	No mitigation required.
231a Lunch Room		
Lead Paint Removal	11,848	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Floor Drain	1,670	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Asbestos Removal	1,811	BHI-01385 (BHI 2000b) identifies a cost associated with the removal of asbestos for this room.
Miscellaneous Maintenance	15,038	BHI-01385 (BHI 2000b) identifies miscellaneous maintenance costs associated with a tripping hazard ($7,611), a security issue ($3,906), and a striking hazard ($3,521).
Bio Hazard	0	Previously completed.
Totals	30,367	
231b Laundry Storage		
Lead Paint Removal	8,078	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Removal	12,600	WHC-EP-0619 Vol. 4 (WHC 1994b) identifies costs associated with the removal of asbestos in this room.
Totals	20,678	
231c Flow Lab Basement		
Lead Paint Removal	8,617	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	2,800	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Asbestos Removal	3,000	BHI-01385 (BHI 2000b) identifies asbestos within this room. Assume minor removal costs.
Totals	14,417	
233a Sample Room X		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	5,386	
233b Sample Room 4		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Decontamination	3,000	During the site walkdown tools within this room were identified as being contaminated. Mitigation will require decontamination or disposal.
Totals	8,386	
233b Sample Room 5		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Decontamination	3,000	During the site walkdown tools within this room were identified as being contaminated. Mitigation will require decontamination or disposal.
Totals	11,386	
233c Sample Room Z		
Lead Paint Removal	5,386	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Floor Drain	3,000	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes grouting the drain to reduce any migration potential of contaminants.
Miscellaneous Maintenance	2,000	BHI-01385 (BHI 2000b) identifies miscellaneous maintenance that is required within this room.
Totals	10,386	
414a Valve Room		
Lead Paint Removal	2,424	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	2,424	
414b Valve Room		
Lead Paint Removal	4,847	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	4,847	

Table B-1. Full Hazard Mitigation Costs by Room. (22 Pages)

Room	Cost $	Basis of Estimate
Tool Room		
Lead Paint Removal	7,540	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Decontamination	3,000	During the site walkdown tools within this room were identified as being contaminated. Mitigation will require decontamination or disposal.
Totals	10,540	
Reactor Mezzanine		
Lead Paint Removal	25,851	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Decontamination	21,000	BHI-01385 (BHI 2000b) identified contamination issues related to this room. Mitigation will require decontamination.
Maintenance on Canvas	3,200	During the site walkdown the canvas shield above the front-face work area was identified as a striking hazard. Mitigation will require replacement of shield. Assumes a crew of two working 4 days at $50/hr.
Totals	50,051	
D Elevator Room		
Lead Paint Removal	18,311	Based on a RSMeans Environmental Cost Data - Unit price of $11/SF to remove lead paint from wall surfaces, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	18,311	
Total Fixed Cost	30,047,453	
Costs by Room Total	11,587,489	
Grand Total	41,634,942	

Table B-2. Full Hazard Mitigation Costs by Activity. (4 Pages)

Activity	Cost $	Basis of Estimate
Electrical	750,000	The potential electrical hazards are identified in BHI-01384 (BHI 2000a). To mitigate hazards, the existing electrical systems in the facility shall be deactivated. All concerns with touch-and-reach shock hazards will be eliminated. A new 400-amp, 208/120-volt, three-phase, four-wire panelboard will be installed. According to the BHI project engineer, the costs to upgrade the entire facility would be approximately $750,000.
Structural Analysis	300,000	Based on best engineering judgement and past experience from the BHI project engineer. This type of analysis would be required approximately every 20 years until 2075 (4 x $75,000 = $300,000).
Structural Upgrades	12,000,000	Due to the age and design life of the facility, major structural upgrades will be needed to maintain the structural integrity throughout the proposed 75 years. Based on best engineering judgement, within the next 15 years a major facility upgrade will occur. This will happen three times prior to 2075 for a cost of $4M each time.
Engineering	2,896,382	According to the SM&T design engineering group lead, hours associated with DCNs, DPs, JHAs, and WPs are needed. This can be accomplished in three separate work packages composed of 400 field engineering/craft hours and 200 design engineering hours. This equals, 1,800 hours. Assume $30/hr, this equates to $144,000 for 10 years. Using a ratio to determine costs associated with this work for 75 years equates to the following derivation: Total 10 year cost = 2,997,874 Minus Engineering = 144,000 Minus S&M = 1,250,000 S&M includes engineering costs 1,603,874 Ratio = 144,000/1,603,874 = 0.0898 Total 75 year cost = 41,634,942 Minus Engineering = 2,896,382 Minus S&M = 9,375,000 S&M includes engineering costs 32,259,942 Engineering for 75 years = 32,259,942 x 0.0898 = 2,896,382

Table B-2. Full Hazard Mitigation Costs by Activity. (4 Pages)

Activity	Cost $	Basis of Estimate
Ventilation	360,000	BHI-01384 (BHI 2000a) identifies costs associated with ventilation concerns. This cost includes additional fans to ventilate the facility. Originally, opening doors were adequate to ventilate the facility; however, due to air duct maintenance, the free exchange of air has been severely reduced. This cost of $41,765 only includes an estimate for the proposed tour route and does not address any issues related to possible air permitting activities that may be required in the future. To pro-rate the ventilation upgrade estimate to the entire facility would be a total cost of approximately $360,000.
Roof Replacement	2,160,000	Based on discussions with the BHI project engineer and referenced within DOE/RL-2000-45 (DOE-RL 2000), B Reactor will require a roof membrane replacement approximately every 20 years until 2075. (4 x $540,000 = $2,160,000)
Surveillance & Maintenance	9,375,000	Based on actual 1999 S&M costs ($111,505/per year) supplied by the BHI project engineer. However, this will not account for increases in cost that are expected as the facility continues to age. Based on engineering judgement, round to $125,000 per year. (75 x $125,000 = 9,375,000)
Fire Suppression System	1,480,000	Fire-suppression upgrades are identified in BHI-01384 (BHI 2000a) ($102,555). To mitigate deficiencies associated with the fire-suppression system, additional fire extinguishers are recommended and an automatic sprinkler system (dry system) is required. This estimate only covers the proposed tour route, to pro-rate this estimate to account for the entire facility would increase the estimate to approximately $880,000. This estimate does not include the cost of mandatory routine inspections conducted by the Dyncorp Fire Department. This would be an additional annual cost of $8,000. The total would equal $880,000 + (75 x $8,000) = $1,480,000.
Exterior Hazards		
Wooden Surfaces	115,372	BHI-01385 (BHI 2000b) identifies a lead paint and striking hazard associated with the outside exposed wooden surfaces ($28,843). All exposed wooden surfaces are weathered and have peeling paint in various stages of deterioration. The paint is assumed to contain lead. Mitigation will require the removal of loose paint, repainting of wooden surfaces, and replacement of rotten wood. This type of activity can be assumed to reoccur at least every 20 years. (4 x $28,843 = $115372)
Pipes and Conduits	6,493	BHI-01385 (BHI 2000b) identifies an exterior striking hazard associated with miscellaneous pipes and conduits hanging from the outside of the facility. Mitigation will require the removal of hanging pipes and conduit.
Transformers	9,994	BHI-01385 (BHI 2000b) identifies an electrical shock and biohazard associated with the open abandoned transformers. Mitigation will include cleaning out the transformers and securing all doors and openings.

Table B-2. Full Hazard Mitigation Costs by Activity. (4 Pages)

Activity	Cost $	Basis of Estimate
Wooden Structures	9,400	Identified in BHI-01385 (BHI 2000b) and on the site walkdown are three wooden structures on the south side of the facility that pose a striking, lead, and biohazard. Mitigation will include either demolish or a restore option. Restoration would include sealing all openings, repainting, reroofing, and adding a door to the structure next to the stack. Estimate assumes two carpenters 8 days at $50/hr plus supplies at $1,000, plus two painters for 2 days at $50/hr plus $400 of supplies.
Wooden Doors	39,900	Identified during the site walkdown and in BHI-01385 (BHI 2000b) are lead and intrusion issues associated with 19 exterior wooden/metal doors. Loose paint is assumed to contain lead. Mitigation requires the replacement of wooden doors with metal, where appropriate, and the repair/replacement of casing as required. An average cost per door is assumed to be two carpenters for 2 days at $50/hr plus $500 of supplies and equipment, which is $2,100/per door multiplied by 19 doors, which equals $39,900.
Outside Stairwells	37,000	BHI-01282 (BHI 1999) and the site walkdown identified striking hazards associated with the outside stairwell. Currently, the stairwell requires maintenance to either demolish or restore. Restoration will include a crew of four carpenters for 20 days at $50/hr ($32,000), plus a man basket, supplies, and scaffling ($5000).
Bldg. Penetrations	3,000	BHI-01282 (BHI 1999) identifies potential intrusion openings for birds and animals. Mitigation will include blocking and securing of openings. Minor maintenance costs of approximately $3,000.
Misc. Pipe	4,784	BHI-01385 (BHI 2000b) identifies striking hazards associated with protruding pipes and equipment from reactor walls. Mitigation includes the installation of appropriate barricades and/or appropriate signage to warn visitors.
Stack	200,000	BHI-01385 (BHI 2000b) identifies the need to perform a structural analysis on the stack at $30,000. Assuming the analysis will not identify any major deficiencies, $50,000 will be adequate for minor repairs and a cap. This is based on best engineering judgement and past experience by the BHI project engineer. Based on the age and the design life of the stack, additional analysis will be required throughout the 75 years to ensure the integrity of the stack and the safety of the facility. Assumes a total of five analyses at $30,000 each plus the $50,000 minor repairs and cap, for a total of $200,000.
Fence	21,040	Based on security issues, the facility will require a fence to ensure safety and visitor intrusion. Assumes the use of new, recycled, and used fencing at a cost of $20/LF at 1,052 LF.
Asphalt	29,088	Assumes asphalt is required to cover the exposed surface at a radius of 25 ft around the entire facility. Estimate is based on 28,800 SF of surface at $1.01/SF – RSMeans Heavy Construction Cost Data, 13th Edition.

Table B-2. Full Hazard Mitigation Costs by Activity. (4 Pages)

Activity	Cost $	Basis of Estimate
Underground Pipes Totals	250,000	Assumes the 100-B/C Pipeline remediation effort will mitigate and cap underground effluent lines/pipes within 25 ft of the facility. Potential contamination still exists within the 25 ft of remaining pipe. Mitigation will require the removal and disposal of all effluent pipelines and associated soil.
Grand Total	30,047,453	

REFERENCES

BHI, 1999, *Hanford B Reactor Building Hazard Assessment Report*, BHI-01282, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

BHI, 2000a, *105-B Reactor Museum Feasibility Assessment (Phase II)*, BHI-01384, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *105-B Reactor Museum Phase II Project Supplemental Cost Estimate*, BHI-01385, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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

R. S. Means, *Environmental Remediation Cost Data – Unit Cost Book*, R. S. Means Company, Inc., Kingston, Massachusetts.

R. S. Means, *Heavy Construction Cost Data*, 13th Edition, R. S. Means Company, Inc., Kingston, Massachusetts.

WHC, 1994a, *105-B Damaged Roof Panel Repair*, Engineering Change Notice 600275, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *Risk Management Study for the Retired Hanford Site Facilities: Risk-Reduction Cost Comparison for the Retired Hanford Site Facilities*, WHC-EP-0619, Volume 4, Westinghouse Hanford Company, Richland, Washington.

APPENDIX C

FIXED COSTS FOR 10-YEAR HAZARDS MITIGATION FOR PUBLIC ACCESS

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Table C-1. Fixed Costs for 10-Year Hazards Mitigation for Public Access. (3 Pages)

Activity	Cost $	Basis of Estimate
Electrical	178,169	The potential electrical hazards are identified in BHI-01384 (BHI 2000a) ($118,169). To mitigate hazards, the existing electrical systems in the facility shall be deactivated while isolating electrical power to only equipment that is needed and determined to be safe. All concerns with touch and reach shock hazards will be eliminated to ensure that both visitor tour route and routine surveillance routes are safe. A new 400-amp, 208/120-volt, three-phase, four-wire panelboard will be installed. Plus, the addition of four breaker upgrades at $15K each, equaling $60K.
Structural Analysis	75,000	Based on best engineering judgement and past experience from the BHI project engineer.
Structural Upgrades	43,700	Due to the design life of the facility, minor upgrades are expected based on the results from the structural analysis. Cost includes a protective netting to mitigate striking hazards associated with the front face on the reactor. Netting costs are based on actual costs accrued at H Reactor.
Ventilation	41,765	BHI-01384 (BHI 2000a) identifies costs associated with ventilation concerns. This cost includes additional fans to ventilate the facility. Originally, opening doors were adequate to ventilate the facility; however, due to air duct maintenance, the free exchange of air has been severely reduced. This cost does not address any issues related to possible air permitting activities that may be required in the future.
Roof Replacement	540,000	Based on discussions with the BHI project engineer and referenced within DOE/RL-2000-45 (DOE-RL 2000), B Reactor will require a roof membrane replacement within the next 10 years. This cost is considered to be included with the S&M option.
Surveillance & Maintenance	1,250,000	Based on actual 1999 S&M costs ($111,505/year) supplied by the BHI project engineer. However, this will not account for increases in cost that are expected as the facility continues to age. Based on engineering judgement, round to 125,000 per year for 10 years.
Fire Suppression System	182,555	Fire-suppression upgrades are identified in BHI-01384 (BHI 2000a) ($102,555). To mitigate deficiencies associated with the fire-suppression system, additional fire extinguishers are recommended and an automatic sprinkler system (dry system) is required. This estimate does not include the cost of mandatory routine inspections conducted by the Dyncorp Fire Department. This would be an additional annual cost of $8,000.

Table C-1. Fixed Costs for 10-Year Hazards Mitigation for Public Access. (3 Pages)

Activity	Cost $	Basis of Estimate
Engineering	144,000	According to the SM&T design engineering group lead, hours associated with DCNs, DPs, JHAs, and WPs are needed. This can be accomplished in three separate work packages composed of 400 field engineering/craft hours and 200 design engineering hours. This equals 1,800 hours. Assuming $80/hr, this equates to $144,000/
Exterior Hazards		
Wooden Surfaces	28,843	BHI-01385 (BHI 2000b) identifies a lead paint and striking hazard associated with the outside exposed wooden surfaces. All exposed wooden surfaces are weathered and have peeling paint in various stages of deterioration. The paint is assumed to contain lead. Mitigation will require the removal of loose paint, repainting of wooden surfaces, and replacement of rotten wood.
Pipes and Conduits	6,493	BHI-01385 (BHI 2000b) identifies an exterior striking hazard associated with miscellaneous pipes and conduits hanging from the outside of the facility. Mitigation will require the removal of hanging pipes and conduit.
Transformers	9,994	BHI-01385 (BHI 2000b) identifies an electrical shock and biohazard associated with the open abandoned transformers. Mitigation will include cleaning out the transformers and securing all doors and openings.
Wooden Structures	9,400	Identified in BHI-01385 (BHI 2000b) and on the site walkdown are three wooden structures on the south side of the facility that pose a striking, lead, and biohazard. Mitigation will include either demolish or a restore option. Restoration would include sealing all openings, repainting, reroofing, and adding a door to the structure next to the stack. Estimate assumes two carpenters 8 days at $50/hr plus supplies at $1,000, and two painters for 2 days at $50/hr plus $400 of supplies.
Wooden Doors	39,900	Identified during the site walkdown and in BHI-01385 (BHI 2000b) are lead and intrusion issues associated with 19 exterior wooden/metal doors. Loose paint is assumed to contain lead. Mitigation requires the replacement of wooden doors with metal, where appropriate, and the repair/replacement of casing as required. An average cost per door is assumed to be two carpenters for 2 days at $50/hr plus $500 of supplies and equipment, which is $2,100/per door multiplied by 19 doors equals $39,900.
Outside Stairwells	37,000	BHI-01282 (BHI 1999) and the site walkdown identified striking hazards associated with the outside stairwell. Currently, the stairwell requires maintenance to either demolish or restore. Restoration will include a crew of four carpenters for 20 days at $50/hr ($32,000), plus a man basket, supplies, and scaffling ($5,000).

Table C-1. Fixed Costs for 10-Year Hazards Mitigation for Public Access. (3 Pages)

Activity	Cost $	Basis of Estimate
Bldg. Penetrations	3,000	BHI-01282 (BHI 1999) identifies potential intrusion openings for birds and animals. Mitigation will include blocking and securing openings. Minor maintenance costs of approximately $3,000.
Misc. Pipe	4,784	BHI-01385 (BHI 2000b) identifies striking hazards associated with protruding pipes and equipment from reactor walls. Mitigation includes the installation of appropriate barricades and/or appropriate signage to warn visitors.
Stack	80,000	BHI-01385 (BHI 2000b) identifies the need to perform a structural analysis on the stack at $30,000. Assuming the analysis will not identify any major deficiencies, $50,000 will be adequate for minor repairs and a cap. This is based on best engineering judgement and past experience by the BHI project engineer.
Fence	21,040	Based on security issues, the facility will require a fence to ensure safety and visitor intrusion. Assumes the use of new, recycled, and used fencing at a cost of $20/LF at 1,052 LF.
Asphalt	29,088	Assumes asphalt is required to cover the exposed surface at a radius of 25 ft around the entire facility. Estimate is based on 28,800 SF of surface at $1.01/SF - RSMeans Heavy Construction Cost Data, 13th Edition.
Underground Pipes	0	Assumes the 100-B/C Pipeline remediation effort will mitigate and cap underground effluent lines/pipes within 25 ft of the facility. No costs will be accrued.
Totals	2,724,731	

REFERENCES

BHI, 1999, *Hanford B Reactor Building Hazard Assessment Report*, BHI-01282, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

BHI, 2000a, *105-B Reactor Museum Feasibility Assessment (Phase II)*, BHI-01384, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *105-B Reactor Museum Phase II Project Supplemental Cost Estimate*, BHI-01385, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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

R. S. Means, *Heavy Construction Cost Data*, 13th Edition, R. S. Means Company, Inc., Kingston, Massachusetts.

APPENDIX D

ROOM-BY-ROOM COSTS FOR 10-YEAR HAZARDS MITIGATION FOR PUBLIC ACCESS

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ROOM-BY-ROOM COSTS FOR 10-YEAR HAZARDS MITIGATION FOR PUBLIC ACCESS

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
110 Front-Face Work Area		
Lead Paint Encapsulation	1,984	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Encapsulation	0	Asbestos for this room has previously been encapsulated.
Canvas Drop Shield	7,500	BHI-01282 (BHI 1999) identifies a fall hazard. Mitigation assumes securing drop shield with cables mounted from I-beams. A man basket would be required. Set-up and take-down costs are applied to a two-man crew.
Overhead Crane (Oil & Grease)	2,000	BHI-01282 (BHI 1999) identifies hazardous chemicals. Mitigation assumes draining oil and grease reservoirs. A man basket would be required. Set-up and take-down costs are applied to a two-man crew.
Floor Drain	400	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes a plastic plug requiring a total of 15 minutes for installation. Cost includes supplies. Assumes four drains.
Total	11,884	
211 Corridor #4		
Lead Paint Encapsulation	1,568	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Decontamination	13,840	BHI-01385 (BHI 2000) identifies a potential RCA. Currently used as a step-off pad for access/egress for contaminated portions of the reactor Mitigation assumes relocation of step-off pad to an unused portion of the reactor. Perform radiological characterization/ decontamination for radiological release area.
Roof Panels	85,826	BHI-01385 (BHI 2000) identifies a striking/falling hazard. Five panels have been identified as being cracked and needing repair, and one has been repaired. Mitigation assumes the use of the Unistrut system (WHC 1994) similar to repairs in the valve pit area.
Total	101,234	
220 Control Room		
Lead Paint Encapsulation	2,736	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	1,600	Asbestos piping for this room has previously been encapsulated. However, based on site walkdown and discussion with the BHI craft supervisor, asbestos floor and ceiling tile were identified. Mitigation assumes a two-person crew 2 days (8 hrs/day) multiplied by $50/hr.
Totals	4,336	

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
222 Accumulator Room		
Lead Paint Encapsulation	2,736	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Oil	500	Identified in BHI-01282 (BHI 1999) and BHI-01385. Based on discussions with the BHI craft supervisor, this is oil that has leaked from the compressor under the stairs. Mitigation assumes draining oil reservoir. Disposal costs are included.
Asbestos Encapsulation	7,200	Identified in WHC-EP-0619 Vol. 4 (WHC 1994b) with a total hazard mitigation cost of $36,000. Mitigation assumes encapsulation at 20% of total mitigation cost.
Totals	10,436	
223 Electrical Equip Room		
Lead Paint Encapsulation	1,904	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Tripping Hazard	900	Identified in BHI-01282 (BHI 1999) and by the BHI craft supervisor as a tripping hazard due to the difference in elevation between the accumulator room and the electrical equipment room. Mitigation assumes the construction of a ramp to allow smooth transition from room to room. Includes two carpenters, 1 day at $50/hr, plus $100 equipment and supplies.
Electrical Costs	0	Assumed to be covered within the fixed costs for 10 years.
Totals	2,804	
315 Supply Fan Room		
Lead Paint Encapsulation	7,008	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos Encapsulation	100	Identified in WHC-EP-0619 Vol. 4 (WHC 1994b). However, most of the encapsulation has been completed. Based on discussions with the BHI craft supervisor, 2 hours of repair is needed. Assume $50/hr.
Plexiglas Barrier	9,772	To allow access to the fan room, Plexiglas barriers are required to prevent access to four connecting rooms. This estimate is based on Plexiglas doorway costs from BHI-01385 (BHI 2000) at $2441/per doorway.
Floor Drain	100	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes a plastic plug requiring a total of 15 minutes for installation. Cost includes supplies. Assumes one drain.
Egress	0	Covered within fixed costs for 10 years.
Roof Panels	77,308	BHI-01385 (BHI 2000) identifies a striking/falling hazard. Four panels have been identified as being cracked and needing repair. Mitigation assumes the use of the Unistrut system (WHC 1994a) similar to repairs in the valve pit area. Prevent access to four connecting rooms. This estimate is based on Plexiglas doorway costs from BHI-01385 (BHI 2000) at $2,443/doorway.
Electrical	0	Assumed to be covered within the fixed costs for 10 years.

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
Fire Alarm Upgrades	0	Assumed to be covered within the fixed costs for 10 years.
Totals	94,288	
414 Basin Viewing Room		
Lead Paint Encapsulation	1,168	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	0	Asbestos piping for this room has previously been encapsulated.
Radiological Control	6,829	Based on discussions with the BHI project engineer, to suspend shielding under the decking should cost approximately $4,500. This estimate is based on best engineering judgement. BHI-01282 (BHI 1999) identifies an amount of $2,329 to perform required characterization/release surveys.
Miscellaneous Maintenance	12,661	BHI-01385 (BHI 2000) identifies costs associated with glass repair, barricade installation, and door security. Barricade installation prevents visitors from contacting the viewing window and creates less exposure to the fuel storage basin.
Fire Alarm Upgrades	0	Assumed to be covered within the fixed costs for 10 years.
Breaker Box Barrier	250	Based on discussions with the BHI craft supervisor, a barrier is needed on the breaker box within the viewing room to prevent visitor access. Mitigation assumes 1 person 1/2 day at $50/hr to complete task and $50 for equipment and supplies.
Totals	20,908	
211 Hallway		
Lead Paint Encapsulation	512	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	512	
219a Office		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $880. Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	0	This activity is scheduled to be completed in the FY01 budget. Identified in WHC-EP-0619 Vol. 4 (WHC 1994b), encapsulation is assumed to be 20% of total mitigation cost. This would equate to $1,440.
Totals	0	
219b Office		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $881. Based on a RSMeans Environmental Cost Data - Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
Asbestos	0	This activity is scheduled to be completed in the FY01 budget. Identified on the site walkdown, floor tiles that contain asbestos requires removal and disposal. Assumed mitigation cost of $5,000.
Totals	0	
219c Office		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $881. Based on a RSMeans Environmental Cost Data - Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	0	This activity is scheduled to be completed in the FY01 budget. Identified on the site walkdown, floor tiles that contain asbestos requires removal and disposal. Assumed mitigation cost of $5,000.
Totals	0	
227a Hallway		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $2,252. Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	0	This activity is scheduled to be completed in the FY01 budget. Identified on the site walkdown, floor tiles that contain asbestos requires removal and disposal. Assumed mitigation cost of $1,400.
Floor Drain	100	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes a plastic plug requiring a total of 15 minutes for installation. Cost includes supplies. Assumes one drain.
Totals	100	
227b Corridor #5		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $1,469. Based on a RSMeans Environmental Cost Data - Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Asbestos	0	This activity is scheduled to be completed in the FY01 budget. Identified on the site walkdown, floor tiles that contain asbestos require removal and disposal. Assumed mitigation cost of $1,400.
Tripping Hazard	900	BHI-01282 (BHI 1999) identifies a tripping hazard due to the difference in elevation between the doorways. Mitigation assumes the construction of a ramp to allow smooth transition from room to room. Includes two carpenters, 1 day at $50/hr, plus $100 for equipment and supplies.
Totals	900	

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
227c Corridor #3		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $1,665. Based on a RSMeans Environmental Cost Data - Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Totals	0	
228a Office-Storage		
Lead Paint Encapsulation	0	Identified within the FY01 budget as scheduled repairs. This would normally cost approximately $1,371. Based on a RSMeans Environmental Cost Data - Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.
Security	1,843	BHI-01385 (BHI 2000) identifies a security issue. Room requires secure lock and doors to prevent visitors access to additional rooms.
Totals	1,843	
230a Valve Pit		
Lead Paint Encapsulation	0	Exposed concrete walls, no lead paint.
Asbestos	0	Asbestos for this room has previously been encapsulated.
Grated Walkway	2,900	Identified in site walkdown and addressed in BHI-01385 (BHI 2000) as a tripping hazard. Decking cover must meet OSHA Code. Mitigation assumes ¾-in. AC plywood covering. Assumes two carpenters at $50/hr taking 3 days to complete. Materials and equipment costs include an additional $500.
Breaker Box	0	Identified during the site walkdown as a potential electrical hazard. Assuming the cost associated with the mitigation of this issue falls within the fixed costs for 10 years.
Totals	2,900	
230b Valve Pit -15 Elevation		
Lead Paint Encapsulation	0	Exposed concrete walls, no lead paint.
Asbestos	400	Based on discussion with the BHI craft supervisor, 1 day of work remains to encapsulate the asbestos associated with this room.
Decontamination	0	BHI-01385 (BHI 2000) identifies a contamination issue relating to the process supply line. According to the BHI craft supervisor, this issue has been mitigated.
Characterization	3,000	Identified during discussions with the BHI craft supervisor and the BHI project engineer. Characterization of unknown material on the lower level is recommended to ensure air quality of the visitors. Assumes no major finding resulting from characterization study.
Totals	3,400	
231a Lunch Room		
Lead Paint Encapsulation	2,160	Based on a RSMeans Environmental Cost Data – Unit price of $2/SF, applied to the room's linear footage multiplied by 8 ft for wall height.

Table D-1. Room-By-Room Costs for 10-Year Hazards Mitigation for Public Access. (6 Pages)

Room	Cost $	Basis of Estimate
Floor Drain	100	BHI-01282 (BHI 1999) identifies a potential source of heavy metals and solvents. Mitigation assumes a plastic plug requiring a total of 15 minutes for installation. Cost includes supplies. Assumes one drain.
Asbestos	300	Assumes minor encapsulation effort.
Miscellaneous Maintenance	15,038	BHI-01385 (BHI 2000) identifies miscellaneous maintenance costs associated with a tripping hazard ($7,611), a security issue ($3,906), and a striking hazard ($3,521).
Bio Hazard	0	Previously completed.
Grand Total	17,598	

REFERENCES

BHI, 1999, *Hanford B Reactor Building Hazard Assessment Report*, BHI-01282, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

BHI, 2000, *105-B Reactor Museum Phase II Project Supplemental Cost Estimate*, BHI-01385, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

R. S. Means, *Environmental Remediation Cost Data – Unit Cost Book*, R. S. Means Company, Inc., Kingston, Massachusetts.

WHC, 1994a, *105-B Damaged Roof Panel Repair*, Engineering Change Notice 600275, Westinghouse Hanford Company, Richland, Washington.

WHC, 1994b, *Risk Management Study for the Retired Hanford Site Facilities: Risk-Reduction Cost Comparison for the Retired Hanford Site Facilities,* WHC-EP-0619, Volume 4, Westinghouse Hanford Company, Richland, Washington.

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