DOE/RL-2009-106
Revision 0

Engineering Evaluation/ Cost Analysis for 105-KE Reactor Decommissioning

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF
ENERGY
Richland Operations
Office

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October 2010

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R. D. Arnold 10/13/2010
Release Approval Date

Executive Summary

This engineering evaluation/cost analysis (EE/CA) has been prepared to evaluate alternatives for the removal of the 105-K East (105-KE) Reactor located at the 100 Area of the Hanford Site. The evaluation assists the U.S. Department of Energy Richland Operations Office (DOE-RL) to identify the most effective approach for removal of the 105-KE Reactor using a non time-critical removal action (NTCRA) under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) (42 USC 9601, et seq.). The approach satisfies environmental review requirements, provides for stakeholder involvement, and creates a framework for selecting the appropriate alternative.

The 105-KE Reactor operated from 1955 to 1971 to produce weapons-grade plutonium. After operations were discontinued, most of the facilities were deactivated. In December 1992, the U.S. Department of Energy (DOE) issued a *National Environmental Policy Act of 1969* (NEPA) Record of Decision (ROD), "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington" (58 FR 48509), which established the decision to perform interim safe storage (ISS) for a period of approximately 75 years, followed by one-piece removal for eight retired nuclear reactors on the Hanford Site, including the 105-KE Reactor. Due to recent technological advances, DOE is now reevaluating the decision to place the 105-KE Reactor in ISS and is instead considering short-term dismantlement, removal, and disposal as a decommissioning approach.

This EE/CA evaluates the following four alternatives in terms of the effectiveness, implementability, and cost criteria set forth in the U.S. Environmental Protection Agency (EPA) guidance document, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002).

- Alternative 1: No Action
- Alternative 2: Safe Storage with Followed by One-Piece Removal
- Alternative 3: Safe Storage Followed by Dismantlement
- Alternative 4: Accelerated Dismantlement

Alternative 1 assumes that no further action is taken at the 105-KE Reactor and it would be abandoned in its present condition. Nothing would be done to address the potential for

release and/or spread of contamination in the environment or to minimize access to hazardous substances. This does not meet the EPA threshold criteria for effectiveness.

Alternative 2 is the alternative selected in the DOE's 1992 *Addendum (Final Environmental Impact Statement): Decommissioning of Eight Surplus Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119F) and associated ROD (58 FR 48509). This alternative consists of ISS for approximately 75 years, followed by transport of the intact reactor block from its present location in 100-K to an appropriate disposal facility. For the purpose of this EE/CA, it is assumed the action will begin in 2065 and conclude in 2068.

Alternative 3 incorporates an abbreviated ISS period followed by dismantlement of the reactor and transport of debris to the Environmental Restoration Disposal Facility (ERDF) for disposal. Newly available remote dismantlement technologies that limit radiation dose to workers make dismantlement a viable solution for reactor removal. The ISS activities are the same for Alternatives 2 and 3. The abbreviated ISS ensures the availability of the ERDF for waste disposal prior to its possible closure in 2035. For the purpose of this EE/CA, it is assumed that dismantlement will begin in 2031 and conclude by 2034.

Alternative 4 consists of immediate dismantlement of the reactor and transport of waste to the ERDF for disposal. The methodology for dismantlement and the viability are the same as for Alternative 3. For the purpose of this EE/CA, it is assumed that dismantlement will begin in 2011 and conclude in 2014.

Table ES-1 identifies the net present value cost estimates for the four alternatives based on present-day (2010) dollars (estimates are based on the best available information on anticipated scope).

Table ES-1. Summary of Cost Estimates for the Alternatives

Alternative	Non-Discounted Cost*	Net Present Value Cost*
Alternative 1: No Action	Not Evaluated	Not Evaluated
Alternative 2: Safe Storage Followed by One Piece Removal	$114,506,000	$61,552,000
Alternative 3: Safe Storage followed by Dismantlement	$92,237,000	$69,459,000
Alternative 4: Accelerated Dismantlement	$82,511,000	$76,679,000

* Accuracy range of the cost estimate is -30 percent to +50 percent.

Alternative 4, accelerated dismantlement, is the preferred alternative identified in this EE/CA. This alternative meets removal action objectives (RAOs) and EPA guidance criteria for effectiveness, implementability, and cost in the following ways: It (1) minimizes risk in the short term and long term for workers, the public, and the environment, (2) is protective of human health and the environment, and (3) can be implemented through use of new, proven technology. Beyond meeting the EPA criteria, immediate removal of the reactor facilitates CERCLA response actions at nearby soil remediation sites that cannot, due to structural stability issues, be completed while the reactor structure remains. DOE believes that Alternative 4 is consistent with and contributes to the efficient performance of the Hanford Site long-term remedial actions, and promotes protection of ecological resources and restoration of the environment consistent with U.S. Department of Energy, EPA, and Washington State Department of Ecology (Tri-Party) goals.

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Terms

105-KE	105-K East
105-KW	105-K West
ACM	Asbestos containing material
AEA	Atomic Energy Act of 1954
ALARA	as low as reasonably achievable
ALARACT	as low as reasonably achievable control technology
ARAR	applicable or relevant and appropriate requirement
BACT	best available control technology
BARCT	best available radionuclide control technology
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
Ci	curies
CLUP	Comprehensive Land-Use Plan
COC	contaminant of concern
CRMP	Cultural Resources Management Plan
CRR	cultural resource review
DOE	U.S. Department of Energy
DQO	data quality objective
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
ETF	200 Area Effluent Treatment Facility
HEPA	high-efficiency particulate air
HRNM	Hanford Reach National Monument
IC	institutional control
ISS	interim safe storage
K Basins	105-K East and 105-K West fuel storage basins
LLW	low-level waste

NCP	"National Oil and Hazardous Substances Pollution Contingency Plan"
NEPA	*National Environmental Policy Act of 1969*
NPL	"National Priorities List"
NTCRA	non time-critical removal action
OMB	U.S. Office of Management and Budget
OU	operable unit
PCB	polychlorinated biphenyl
RAO	removal action objective
RL	U.S. Department of Energy, Richland Operations Office
ROD	record of decision
S&M	surveillance and maintenance
SNF	spent nuclear fuel
TAP	toxic air pollutants
T-BACT	best available control technology for regulated emissions of toxic air pollutants
TBC	to be considered
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology

1 Introduction

The U.S. Department of Energy (DOE) is planning the demolition of the 105-K East (105-KE) nuclear reactor located in the 100-K Area of the Hanford Site. DOE will use a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) non-time-critical removal action (NTCRA).

DOE has prepared this engineering evaluation/cost analysis (EE/CA) to identify the objectives of the removal action and analyze the effectiveness, implementability, and estimated cost of the potentially applicable alternatives to satisfy these objectives. Following the issuance of this EE/CA for public comment and consideration of comments received during the public review period, an Action Memorandum documenting the selected alternative will be issued.

The *National Environmental Policy Act of 1969* (NEPA) Record of Decision (ROD) ("Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington" [58 FR 48509]), established a path forward for the Hanford Site reactors. The NEPA ROD selected one-piece disposal of the reactor cores after an interim safe storage (ISS) period of approximately 75 years, which allowed for decay of the radionuclide that presented the major risk for site workers. The current technology in nuclear reactor dismantlement includes engineering approaches such as development and deployment of advanced robotics, the availability of new approaches for reactor core sampling, worker safety advancements, and real-time lessons learned from reactor demolition activities at Brookhaven National Laboratory. Based on the Brookhaven experience, DOE is evaluating a decommissioning approach that provides for piece-by-piece dismantlement of the reactor core. This approach is consistent with an amended NEPA ROD that gives DOE the flexibility to demolish a reactor using one-piece removal, where the reactor block is removed intact after 75 years of ISS from the date of the original NEPA ROD, or near-term dismantlement.

This EE/CA was prepared to develop and evaluate removal action alternatives for the 105-KE Reactor block (including the core and shield materials). The EE/CA will undergo a 30-day public comment period. As the agency implementing this action, DOE will consider the comments received from the public and then confer with the U.S. Environmental Protection Agency (EPA) in the issuance of the Action Memorandum; the EPA is the lead regulatory agency for this action. The Action Memorandum will identify the selected alternative for dismantling the 105-KE Reactor.

1.1 Purpose and Scope

This EE/CA presents the results from an evaluation of removal action alternatives for the 105-KE Reactor block, including the core and shield materials. DOE will use this evaluation to support the selection of the appropriate approach to mitigate potential risks to human health and the environment from the 105-KE Reactor. The report was developed in accordance with CERCLA, as amended by the *Superfund Amendments and Reauthorization Act of 1986* (SARA) (42 UCS 103) and in accordance with the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP) (40 CFR 300).

This document identifies potentially applicable alternatives for the removal action and analyzes these alternatives for effectiveness, implementability, and cost. Additionally, this EE/CA evaluates the potentially applicable alternatives against the DOE's goal to reduce the "risk footprint" at the 105-KE Reactor by consolidating wastes, and reducing surveillance and maintenance (S&M) costs on the reactor building.

DOE has determined that there is a potential for the release of hazardous substances that, without action, could become a threat to human health and the environment. The threat from the continued deterioration

of the facility includes a potential release of radioactive and nonradioactive hazardous substances contained in, on, or around the 105-KE Reactor. Past leaks from the former adjacent 105-KE Basin have contaminated the underlying soil and groundwater. These contaminated soils are presumed to extend beyond the footprint of the basin itself and are located directly adjacent to the reactor structure. Soil remediation activities are restricted to areas currently accessible; therefore, contaminated soil beneath the reactor will remain in the environment until the reactor is removed to preclude jeopardizing the integrity of the reactor building.

1.2 Regulatory Overview

Portions of the Hanford Site are on the "National Priorities List" (NPL) (40 CFR 300, Appendix B). The cleanup of these NPL sites is implemented in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al., 1989a). The NTCRA approach for the 105-KE Reactor is consistent with the *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act* (also referred to as the Joint Policy) (DOE and EPA, 1995), which establishes the NTCRA process as the preferred approach for decommissioning surplus DOE facilities. Under this policy, a NTCRA may be taken when DOE determines that the action will prevent, minimize, stabilize, or eliminate a risk to human health and/or the environment. When this determination is made, DOE is authorized, subject to TPA approval requirements (Action Plan Section 7.2.4), to evaluate, select, and implement the removal action determined as most appropriate to address the potential risk posed by the release or threat of release.

The 105-KE Reactor is considered a key facility as defined in Section 8, "Facility Decommissioning Process" in the *Tri-Party Agreement Action Plan* (Ecology et al., 1989). Section 8.3 of the Plan, "Decommissioning Process Planning," provides for decommissioning of key facilities per DOE guidelines and applicable regulations. Because the 105-KE Reactor contains CERCLA hazardous substances and the integrity of the inactive structure and internal systems has degraded, the result is an increased potential for the release of hazardous substances to the environment. Past leaks from the former adjacent basin have resulted in contaminated soil and groundwater adjacent to and presumed to be beneath the reactor structure. On this basis, DOE has determined that a NTCRA is warranted, pursuant to authority delegated under Executive Order 12580, *Superfund Implementation* (and in accordance with Section 8.3 of the *Tri-Party Agreement Action Plan* [Ecology et al., 1989b]), to mitigate the threat of release of hazardous substances and to facilitate remediation of contaminated media. The proposed removal action is also consistent with the provisions of the NCP and the Joint Policy (DOE and EPA, 1995).

Under the *National Environmental Policy Act Compliance Program* (DOE O 451.1B, section 5.a.[13]), DOE will "…incorporate NEPA values, such as analysis of cumulative, offsite, ecological, and socioeconomic impacts, to the extent practicable, in DOE documents prepared under CERCLA." The basis for the NEPA values included in Section 5.4.1 of this document is the *Supplement Analysis: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119F-SA-01).

As the lead agency, DOE has determined that a removal action is an appropriate means to place the 105-KE Reactor in a safe configuration that is protective of human health and the environment. EPA concurs that a NTCRA is warranted. The Action Memorandum will authorize implementation of the removal action. Following implementation of the selected alternative for the 105-KE Reactor, follow-on activities, if necessary to protect human health and the environment, may be deferred to a later remedial action.

2 Site Characterization

The Hanford Site is a 1,517 km^2 (586 mi^2) federal facility located along the Columbia River in southeastern Washington State (Figure 1) and operated by DOE. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. The 100 Area is the site of nine retired nuclear reactors that were constructed and operated to produce weapons-grade plutonium. In December 1992, DOE issued the *Addendum (Final Environmental Impact Statement* [EIS]*): Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119F). The Final EIS analyzed alternatives for decommissioning eight of these water-cooled, graphite-moderated plutonium-production reactors (Reactors B, C, D, DR, F, H, KE, and K West [KW]). The NEPA ROD (58 FR 48509) documented the selection of ISS followed by one-piece reactor block removal for the eight surplus reactors. The ninth reactor, N Reactor, is undergoing deactivation under a separate CERCLA action.

2.1 Site Description and Background

Construction of the 105-KE and 105-KW Reactor areas began in 1952 as part of the "Project X" expansion program. Project X was, in part, a response to the Korean conflict and tensions with the Chinese and Russians during the Cold War. The reactors and many of the associated supporting facilities were designed to withstand an enemy attack. This was accomplished through a variety of techniques that included the following:

- Construction of facilities below grade and/or as low as possible
- Physical separation of facilities
- Alternate sources of power
- Critical piping and wiring placed below grade
- Water and fuel storage placed below grade
- Facilities designed with easily breakable walls and roofs

Completion of the reactors was accomplished in 27 months from beginning to end (Figure 2). Startup of the reactors began in 1955. At that time, the 105-KE and 105-KW were the largest reactors at the Hanford Site and, at their peak, produced 4,000 megawatts of power. Operations were discontinued in 1970 for the 105-KW Reactor and in 1971 for the 105-KE Reactor. Most of the facilities were deactivated when the reactors were shutdown, with the exception of the fuel storage basins, the alum tanks adjacent to the 183.1-KE Building, the 1706-KE Building (where research and development was ongoing), one pump house, one water treatment facility, and septic tanks and drain fields used for sanitary waste.

Past operations, disposal practices, spills, and unplanned releases resulted in contamination of the facility structures, underlying soil, and underlying groundwater in the 100 Area. Consequently, in November 1989, the 100 Area was one of four areas of the Hanford Site that was placed on the NPL.

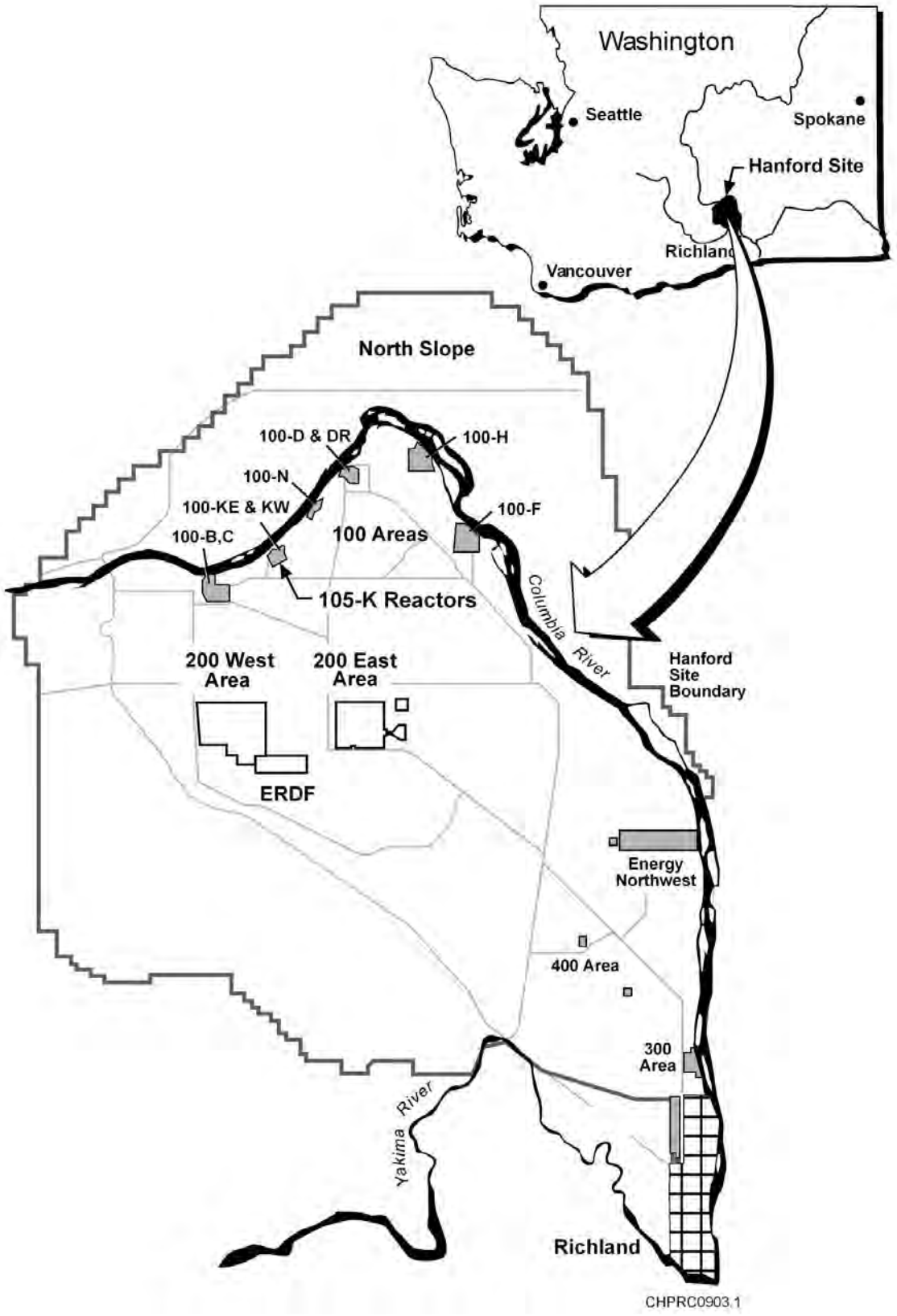

Figure 1. Hanford Site Map

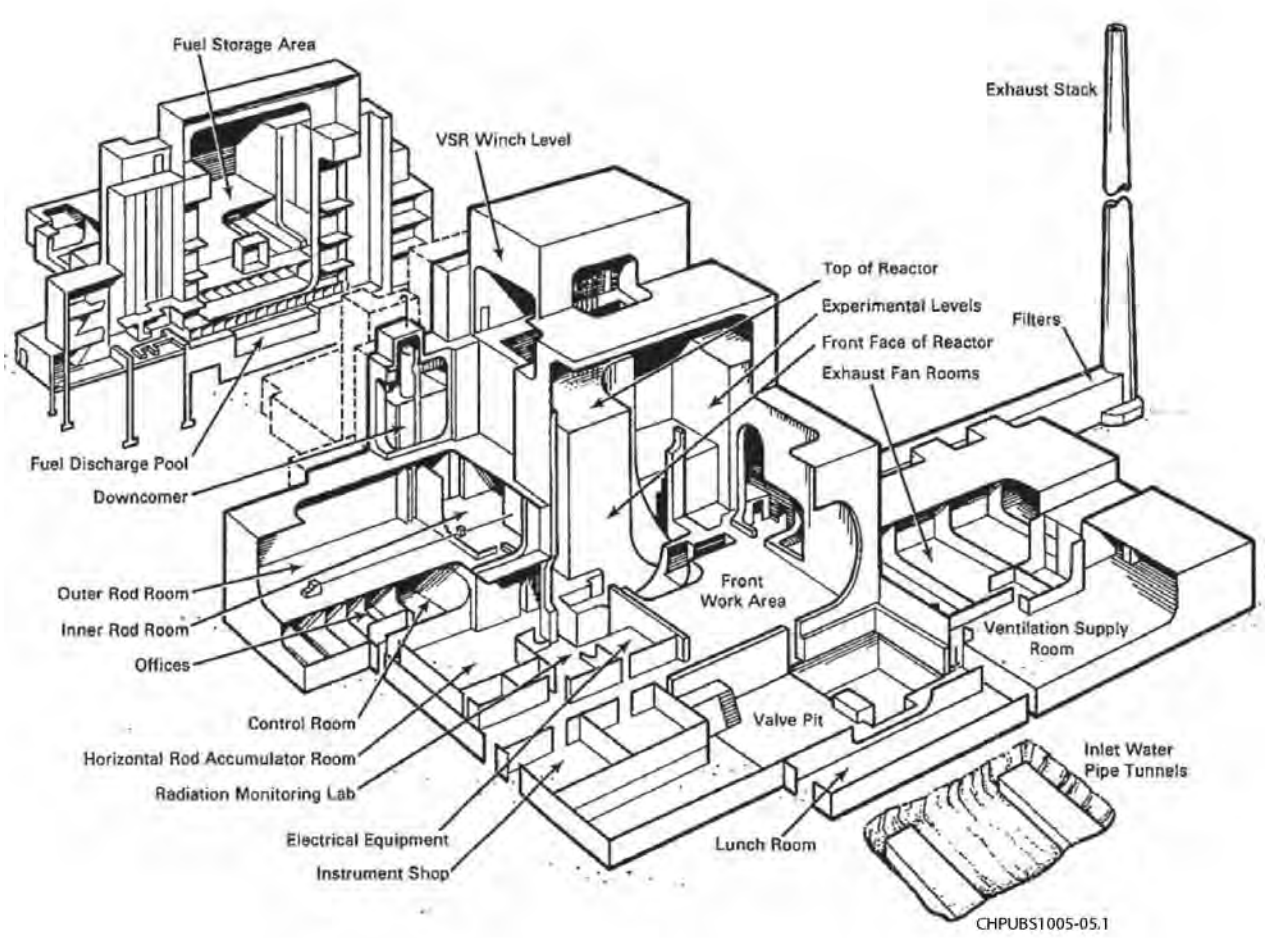

Figure 2. 105-KE Reactor Layout

The 100-K Area is the portion of the 100 Area that contains the 105-KE and 105-KW Reactors (Figure 3). The area is subdivided into the following three operable units (OUs) to address cleanup of the soil and groundwater contamination resulting from past operations:

- The 100-KR-1 and 100-KR-2 OUs encompass liquid waste disposal sites, burial grounds, and soil waste sites. Geographically, the 105-KE Reactor is co-located with 100-KR-1 and 100-KR-2 OU waste sites.
- The 100-KR-4 OU addresses groundwater contamination underlying 100-K.
- Since the 1980s, a portion of 100-K infrastructure has been maintained to support the storage and remediation of spent nuclear fuel (SNF) in the 105-KE and 105-KW fuel storage basins (K Basins).

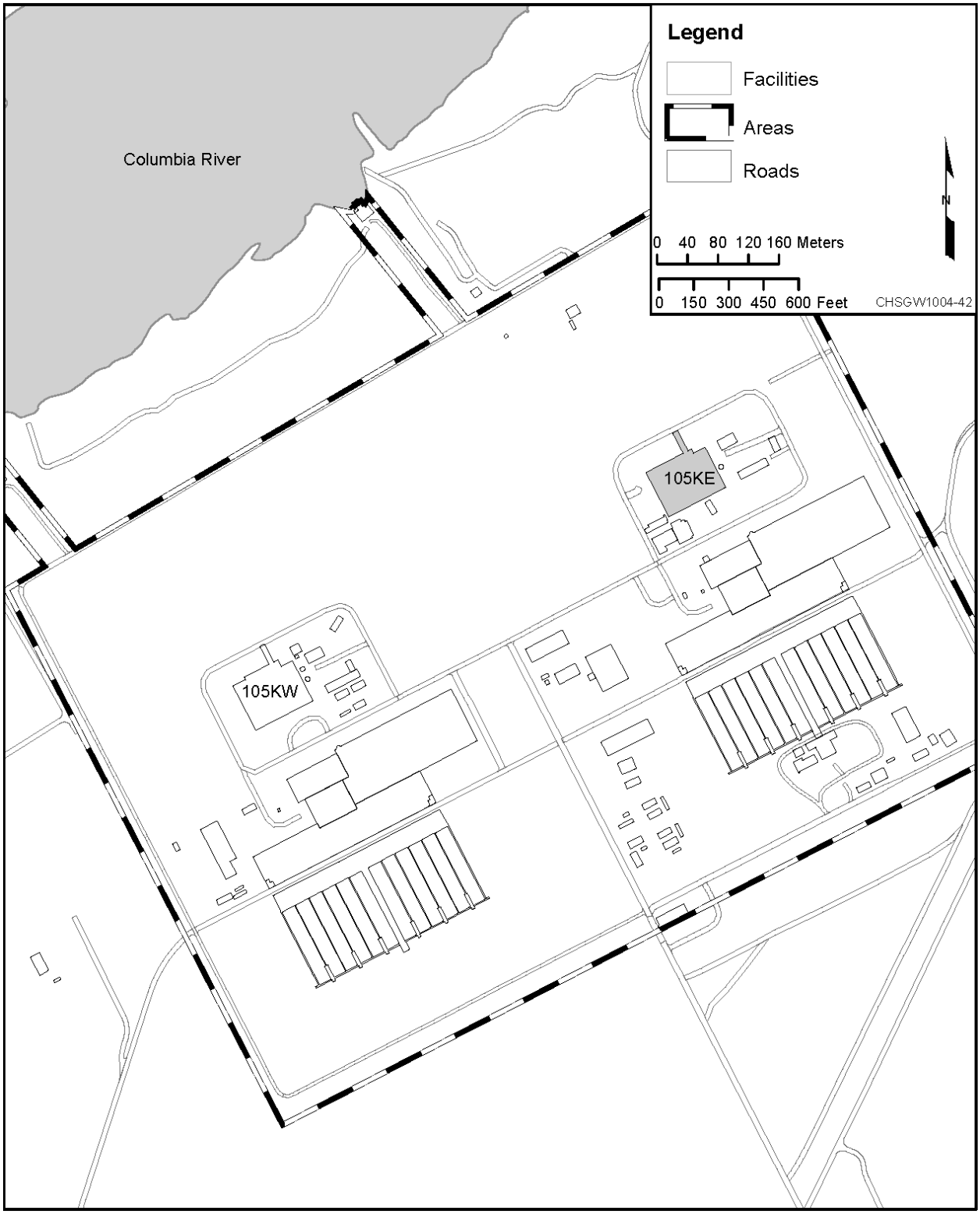

Figure 3. Map of the 100-K Area

While the 105-KE Basin has been deactivated and dismantled, some of these buildings and systems remain active to support the final spent fuel removal, sludge removal, and deactivation of the 105-KW Basin. As these activities are completed, the remaining facilities and systems will be dispositioned in accordance with other EE/CAs (*Engineering Evaluation/Cost Analysis for the105-KE and 105-KW Reactor Facilities and Ancillary Facilities* [DOE/RL-2005-86] [referred to as the EE/CA for KE and KW Facilities] and the *Engineering Evaluation/Cost Analysis for the 100-K Area Ancillary Facilities* [DOE/RL-2004-43] [referred to as the EE/CA for 100-K Ancillary Facilities]) and their associated Action Memoranda (*Action Memorandum for the Non-Time Critical Removal Action for the 100-K Area Ancillary Facilities* [EPA, 2005 and 2007] [referred to as the Action Memo for 100-K Ancillary Facilities]).

2.1.1 Land Use and Access

Land uses at the Hanford Site are strictly controlled to preserve public health and safety and to support national security. Federal control is asserted throughout Hanford Site planning processes for Site development. Current land use in 100-K consists of environmental cleanup activities, including the removal of materials from the 105-KW Basin. Adjacent to and north of 100-K, the Columbia River is accessible to the public for recreational use (e.g., boating and sport fishing).

The land in and around the reactor area is restricted from development by various federal land use determinations. Islands in the Columbia River and riparian land within the full Hanford arc of the river, including portions of the Hanford 100 and 300 Areas, are included in the 78,914 ha (195,000 ac) Hanford Reach National Monument (HRNM), created in 2000 by Presidential "Proclamation 7319 of June 9, 2000: Establishment of the Hanford Reach National Monument" (65 FR 37253) under authority of the *Antiquities Act of 1906* (16 USC 431-433). The width of the riparian land varies and is determined by a map published with the Proclamation. The Proclamation states that lands within the HRNM (including the designated portion of 100-K) will not be developed for residential or commercial use in order to protect the area's cultural and natural resources in perpetuity. The portions of 100-K that are outside the monument are governed by DOE-RL land use designations.

The *Final Hanford Comprehensive Land-Use Plan* (CLUP) *Environmental Impact Statement* (EIS) (DOE/EIS-0222-F and DOE/EIS-0222-SA-01, *Supplement Analysis: Hanford Comprehensive Land-Use Plan Environmental Impact Statement*) analyzed the impacts of alternatives for implementing a land-use plan for DOE's Hanford Site for minimally the next 40-year planning period. The CLUP, established through the 1999 DOE ROD, "Hanford Comprehensive Land Use Plan Environmental Impact Statement" (64 FR 61615), includes a land use map that addressed the Hanford Site. The 100-K area was included within a conservation (mining) land-use geographic area, and is a component of the River Corridor cleanup area.

2.1.2 Flora and Fauna

The ecological setting within 100-K perimeter fence is highly disturbed, with large graveled areas adjacent to the facilities. The area near 100-K is characterized as an arid to semi-arid shrub-steppe vegetation zone. The plant community to the west is a sagebrush/Sandberg's bluegrass association. The plant community to the east (that surrounds the pump-and-treat facilities) is dominated by cheatgrass (*Bromus tectorum*), Sandberg's bluegrass *Poa secunda* formerly *sandbergii*), rabbitbrush (*Chrysothamnus* sp. and *Ericameria* sp.), Russian thistle (*Salsola kali*), and tumble-mustard (*Sisymbrium altissimum*). The animal community in the surrounding area includes species of birds, mammals, reptiles, and insects that are adapted to the semi-arid environment. The ecological setting of the Hanford Site, including 100-K, is described in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL-6415).

Within 100-K, most of the area has been characterized as highly disturbed by industrial/waste management operations to the extent that plant communities are sparse, and complete ecological communities represented by common food webs are limited. No plants or animals on federal or state lists of endangered or threatened species are known to occur within the 100-K perimeter fence. No perennial or ephemeral streams or regulated wetlands are located within the area.

Although the bald eagle (*Haliaeetus leucocephalus*) has been removed from the federal list of endangered species, it is still protected under the *Bald and Golden Eagle Protection Act of 1940* (16 USC 668-668d). Outside the northwest corner of 100-K, a grove of trees serves as a communal night roost site for bald eagles during winter months. This roost is within 100 m (328 ft) of the fence, and appropriate mitigation actions must be conducted when activities could impact the roost. In this situation, the *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington* (DOE/RL-94-150), should be consulted for direction on the appropriate manner in which to proceed.

Steelhead trout (*Oncorhynchus mykiss*) and spring-run Chinook salmon (*Oncorhynchus tshawytscha*) are endangered species that are found in the Hanford Reach of the Columbia River. Activities that occur at or near the shoreline that have the potential to affect these fish or their habitat must provide mitigation measures to reduce or eliminate potential impacts. In this situation, the *Threatened & Endangered Species Management Plan: Salmon & Steelhead* (DOE/RL-2000-27) should be consulted for direction on the appropriate manner in which to proceed.

Before initiating a project on the Hanford Site, ecological reviews are conducted to determine whether sensitive plant or animal species are present and prescribe mitigation actions as appropriate. If federally listed species are identified and there is a potential effect on those species, substantive provisions of the *Endangered Species Act of 1973* (16 USC 1531) will be followed. Although not required, consultation will be considered if appropriate. Because 100-K is highly disturbed within the perimeter fence, the most likely ecological concern is from nesting birds protected by the *Migratory Bird Treaty Act of 1918* (16 USC 703). At locations with nesting migratory birds, the nests cannot be disturbed until the young have fledged. Ecological reviews will be carried out before work begins in areas where there is a potential for adverse impacts to sensitive or rare biological resources, consistent with existing routine procedures (*Ecological Compliance Assessment Management Plan* [DOE/RL-95-11]). Impacts on ecological resources near the proposed action will continue to be mitigated in accordance with the *Hanford Site Biological Resources Management Plan* (DOE/RL-96-32) and the *Biological Resources Mitigation Strategy* (DOE/RL-96-88).

2.1.3 Cultural Resources

The 100-K Area bounds a culturally sensitive area, occupied prehistorically and historically by Native Americans. Building construction and general industrial activities have disturbed much of 100-K, including the geographical area addressed in this EE/CA. Native American village sites and at least one cemetery still exist within undisturbed areas adjacent to the area addressed in this EE/CA.

A *National Historic Preservation Act of 1966* (16 USC 4321), Section 106, cultural resource review (CRR) will be conducted to address the proposed action. All structures addressed by this NTCRA are located in areas that have been extensively disturbed by past construction activities. Hanford Site buildings/structures have been evaluated for their National Register of Historic Places eligibility as part of the *Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) (*Treatment Plan*). The 105-KE Reactor was determined to be a non-contributing property within the *Treatment Plan*. As such, the 105-KE Reactor does not qualify for the National Register of Historic Places. Appropriate CRR documentation will be finalized before commencing field activities.

2.2 Previous Investigations and Removal Actions

Approximately 150 waste sites with a range of radioactive and nonradioactive contaminants have been identified in 100-K as part of the 100-KR-1 and 100-KR-2 OUs.

2.2.1 Waste Sites within the 105-KE Reactor Area

The following waste sites are or were within proximity or associated directly with the 105-KE Reactor.

- 118-KE-1 (105-KE Reactor Building)
- 130-KE-1 (105-KE Emergency Diesel Oil Storage Tank)
- 100-K-3 (Fish Pond Heat Exchanger Pit)
- UPR-100-K-1
- 100-K-69 (Sump)
- 100-K-42 (Fuel Storage Basin)
- 100-K-56 (100-KE Reactor Cooling Water Effluent Pipeline)
- 100-K-70 (105-KE Radioactive Waste Storage Tank)
- 100-K-68 (105-KE Pump Gallery and Catch Tank “D Sump”)
- 100-K-47 (1904-K Process Sewer)
- 100-K-53 (100-KE Glycol Heat Recovery Underground Pipelines)
- 100-K-71 (105-KE Collection Box)
- 116-KE-3 (105-KE Fuel Storage Basin Injection Well)
- 100-K-62 (117-KE Filter Building)
- 132-KE-1 (116-KE Reactor Exhaust Stack)
- 100-K-6 (Vacuum Pit, Cyclone Separator)
- 100-K-46 (119-KE French Drain)

2.2.2 105-KE Fuel Storage Basin

The 105-KE Fuel Storage Basin was a primarily belowground structure located directly adjacent to the reactor building. It was used to store SNF from the 1970s until its deactivation in 2008 in accordance with the K Basins Interim ROD, *Interim Remedial Action Record of Decision for the 100-KR-2 Operable Unit K Basins, Hanford Site, Benton County, Washington* (EPA/ROD/R10-99/059). At the time deactivation began, the basin contained contaminated sludge, water, debris, SNF, and fuel fragments. Immediately following deactivation of the basin, the basin structure (waste site 100-K-42) was substantially demolished in accordance with the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (EPA/ROD/R10-99/039) (hereafter referred to as the Remaining Sites ROD), and ROD amendments. The entire structure and substructure were removed with the exception of an area around the discharge chute (a portion of the concrete wall and footer). This wall and footer are scheduled to be removed in FY 2011. Soils below the basin, which were contaminated by known basin leakage, have been assigned waste site number UPR-100-K-1. These contaminated soils are presumed to extend beyond the footprint of the basin itself and are located directly adjacent to the reactor structure. Because soil contamination extends to the edge of the 105-KE structure at a depth at which soil removal would jeopardize the integrity of the building, soil remediation for UPR-100-K-1 cannot be completed until the reactor is removed.

2.2.3 Groundwater Remediation

Remediation of chromium in groundwater is being conducted under *Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington* (EPA/ROD/R10-96/134). Outside of nominal coordination of field activities, no specific impacts on 100-K remediation activities are anticipated from this NTCRA.

2.3 Source, Nature, and Extent of Contamination

Most contamination at the 105-KE Reactor resulted from activities associated with the reactor's operation while producing weapons-grade plutonium. Both radiological and hazardous materials contamination have been associated with this facility.

To the extent practicable, hazardous substances (including bulk chemicals that are no longer in use) have been, or will be, removed from the 105-KE Reactor during routine operations and S&M. Residual contamination remains or will remain on facility surfaces (including the roof), in piping and ductwork, and in structural materials. The primary contaminants of concern (COCs) include the following radionuclides:

- Americium-241
- Barium-133
- Barium-137m
- Calcium-41
- Carbon-14
- Cesium-137
- Chlorine-36
- Cobalt-60
- Europium-152
- Europium-154
- Nickel-59
- Niobium-93m
- Niobium-94
- Molybdenum-93
- Plutonium-238
- Plutonium-239
- Plutonium-240
- Plutonium-241
- Strontium-90
- Yittrium-90
- Technetium-99
- Tritium
- Silver-108
- Silver-108m
- Uranium-235m

The 105-KE Reactor also is expected to contain one or more nonradioactive hazardous substances known to be present in most Hanford Site facilities either as contaminants resulting from facility operations or as components of structural materials. These may include the following:

- Friable and nonfriable forms of asbestos
- Lead
- Chromium
- Polychlorinated biphenyls (PCBs)
- Mercury (in switches, gauges, and thermometers)
- Refrigerants (Freon)
- Petroleum products
- Water treatment chemicals
- Lubricants
- Corrosives
- High-efficiency particulate air filter media
- Sodium-vapor and mercury-vapor lighting

The concentrations of contaminants will be determined, as needed, through data quality objective (DQO) directed sampling and analysis tasks before disposal.

2.4 Analytical Data

Pacific Northwest National Laboratory (PNNL) created estimated radiological inventories for the 105-KE Reactor in the early 1980s (*Radionuclide Inventory and Source Terms for the Surplus Production Reactors at Hanford* [UNI-3714]). These inventory estimates were based, in part, upon direct measurements made by PNNL on samples from DR and KW reactor samples. The sample data were combined with theoretical activation of materials of construction of the other 100 Area reactors, including 105-KE Reactor, derived from the known operating duration and conditions of each reactor.

Since that time, DOE conducted a more recent characterization effort to provide additional information on the range of potential concentrations in individual samples or waste container loads.

The major components of the 105-KE Reactor were sampled in accordance with *100-K Area Interim Safe Storage and D4 Project Waste Sampling and Analysis Plan* (SAP) (DOE/RL-2005-33). The broad objective of the sampling was to gather samples of the major components of the reactor (exterior paint, exterior steel plate, bioshield, interior steel plate, thermal shield, and graphite pile) for chemical and radiological analysis to verify that, during reactor demolition, these materials could be disposed at the ERDF on the Hanford Site. The results were also to support various safety calculations. Physical samples of reactor components were collected from April 27 through September 10, 2010.

Radiological Control Technicians performed dose rate monitoring during the core boring activities. Four locations were chosen for this activity, one at the 8 m (28 ft) level, two at the 5 m (18 ft) level and one at the (0 m 0 ft) level. On each of these levels, dose rates were taken at the outer one-inch steel plate, the bioshield, the inner one-inch steel plate and the thermal shield.

- The dose rates for the each of the outer 2.5 cm (1 in.) steel plates were less than 0.5 mR/hr.
- The dose rates for the each of the inner most bioshield samples were less than 1.0 mR/hr.
- The dose rates for the each of the inner 2.5 cm (1 in.) steel plates were 1.0 mR/hr or less.
- The dose rate for the thermal shield at the 8 m (28 ft) level was 700 mR/hr on contact.
- The dose rates for the thermal shields at the 5 m (18 ft) level were 200 and 260 mR/hr on contact.
- The dose rate for the thermal shield at the 0 m (0 ft) level was 100 mR/hr on contact.

2.5 Risk Evaluation Results

The primary COCs at the 105-KE Reactor are radionuclides that are known carcinogens. The 105-KE Reactor may contain low levels of radiological contamination as surface contamination or as a part of the structural material. Hazardous substances, including asbestos insulation, heavy metals (e.g., mercury in switches and lead shielding), and PCBs in building materials are present in the 105-KE Reactor.

Contaminants could be released directly to the environment through a breach in a pipe, containment wall, roof, or other physical control as the building ages and deteriorates. Contaminants also could be released to the environment indirectly through animal intrusion into the contaminated structure and systems.

Historically, intrusion and spread of contamination by rodents, insects, birds, and other organisms have been difficult to control and prevent.

Potential release of contaminants is currently mitigated through an ongoing S&M program. As the 105-KE Reactor continues to age and deteriorate, the potential for release of radioactive and hazardous

substances increases, and it becomes more difficult to isolate these materials from the environment. The S&M activities required to confine the hazardous substances also may increase the risk of personnel exposure. The potential exposure to workers and wildlife, the threat of future releases, and the risks associated with contamination at the 105-KE Reactor justify an NTCRA. Potential for application of newly developed technologies, as demonstrated at Brookhaven National Laboratory, provide an additional basis for considering alternative approaches. In addition, removal of the reactor allows risk from known contamination in the underlying soils and groundwater to be addressed earlier and may allow installation of a more effective groundwater remediation system.

3 Identification of Removal Action Objectives

CERCLA removal actions are used to abate, prevent, minimize, stabilize, mitigate, or eliminate the threat or threat of release when the lead agency has made the determination, based on the factors in 40 CFR 300.415(b)(2), "Removal Action," that there is a threat to public health or welfare of the United States or the environment. Based on the potential hazards discussed in Section 2, the following removal action objectives (RAOs) have been established for the disposition of the 105-KE Reactor.

- Protect human receptors from exposure to contaminants above acceptable exposure levels within the facility structure.
- Control the migration of contaminants from the facility into the environment.
- Facilitate and, to the extent practicable, be consistent with anticipated remedial actions within 100-K OUs, while expediting actions that will provide access to underlying contamination.
- Meet applicable or relevant and appropriate requirements (ARARs) to the extent practicable.
- Safely treat, as appropriate, and dispose of waste streams generated by the removal action.
- In addition to the previously identified objectives, the end state of the removal action must be supportive of institutional controls prescribed in the Remaining Sites ROD (EPA/ROD/R10-99/039) for the period between completion of the facility removal action and initiation of the waste site remedial actions.

3.1 Determination of Removal Scope

The scope of the removal action is to implement the most effective alternative for disposition of the 105-KE Reactor. Where an existing waste site in the reactor building footprint or layback is to be fully removed, the remediation of that waste site may be completed in conjunction with this removal action and verified to meet the cleanup requirements of the applicable ROD. The 105-KE Fuel Storage Basin and subsurface structures have been substantially addressed as part of other remedial activities (Section 2.2.2). An area around the discharge chute (concrete wall and footer) remains. This wall and footer are scheduled to be removed in FY 2011.

3.2 Planned Remedial Activities

Some contaminated soils associated with the UPR-100-K-1 OU remain adjacent to and likely under the reactor structure. Contaminated soil directly adjacent to and potentially beneath the reactor cannot be removed without jeopardizing the structural stability of the reactor. These soils will be remediated upon removal of the reactor. There also exists the potential to encounter unanticipated contamination in surrounding soil during the reactor demolition work. Soil that is contaminated with substances that are known or easily determined to be associated with normal building/structure operations or maintenance will be removed for disposal during the demolition, as appropriate. If the contaminated soil is not removed, the site will be identified by DOE as a new waste information data system (WIDS) site under the Tri-Party Agreement, with concurrence by Ecology and EPA.

4 Identification of Removal Action Alternatives

The removal action alternatives for the 105-KE Reactor must meet the following criteria.

- Protect human health and the environment.
- Facilitate remedial action at 100-KR-1 and 100-KR-2 OU waste sites near the reactor.
- Abate, prevent, minimize, stabilize, eliminate, or mitigate the threat of release of radioactive and nonradioactive hazardous substances contained in, on, or around the reactor.
- Address the impacts of facility deterioration.

Based on these considerations, the following removal action alternatives described were identified for the 105-KE Reactor.

4.1 Alternative 1—No Action

Alternative 1, No Action, assumes that the 105-KE Reactor would be abandoned without any further actions. Surveillance, maintenance, and periodic inspection activities would be discontinued and degradation would continue indefinitely. Ultimately, access to the 105-KE Reactor would become unrestricted. Industrial and potential radiological hazards would continue to exist because controls to prevent access would not be maintained. Initial risks of Alternative 1 are minimal to the environment, provided there are no significant weather or fire events. Risks over time are expected to increase, as the reactor building deteriorates and structural integrity is compromised. This alternative would do nothing to address the potential for release and/or spread of contamination in the environment or minimize access to hazardous substances. As this alternative does not meet threshold criteria, it will be used as a baseline for comparison only.

4.2 Alternative 2—Safe Storage Followed by One-Piece Removal

Alternative 2, safe storage followed by one-piece removal, is the remedy that was selected in the Final EIS (DOE/EIS-0119F) and the associated ROD (58 FR 48509). It consists of safe storage followed by one-piece removal of the reactor block. The 105-KE Reactor block includes the graphite core, the thermal and biological shields, and the concrete base (Figure 4). This alternative includes continued routine surveillance, monitoring, and maintenance followed by transport of the intact reactor block from its present location in 100-K for disposal at the Environmental Restoration Disposal Facility (ERDF) or another appropriate disposal facility.

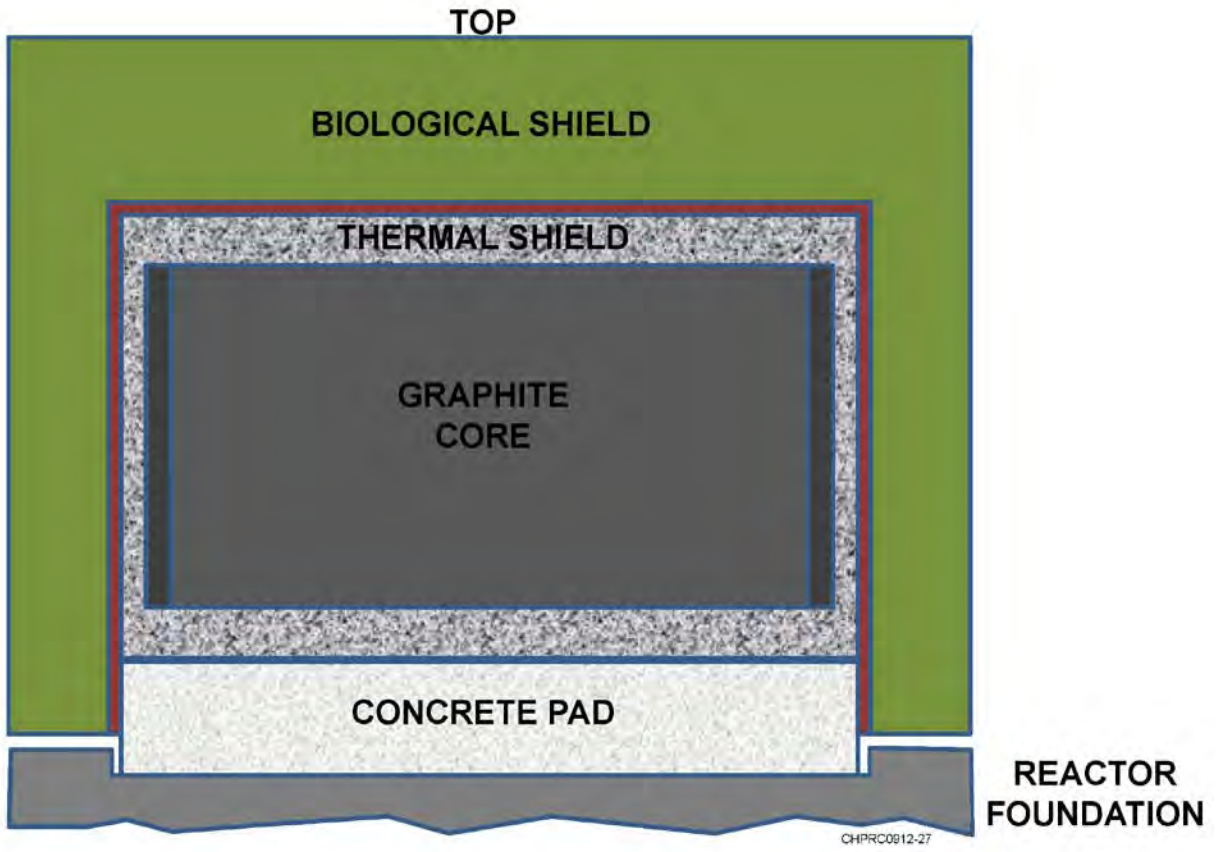

Figure 4. Reactor Block Layout

Contaminated equipment and components in the building that houses the reactor would be removed for transport to the selected disposal facility. The 105-KE Reactor building would then be demolished and an excavation prepared through the former location of the fuel storage basin and under the reactor block. Before excavation, the weight of the reactor block would be transferred to I-beams inserted through holes drilled in the concrete base and grouted in place. If contaminated soil were identified during the excavation, it would be removed and transported to the selected disposal facility. A tractor-transporter would be driven under the reactor block, and the block would be lifted from its remaining foundation by hydraulic apparatus on the transporter (Figure 5). It is assumed that the intact reactor core would then be carried on a specially constructed haul road to the selected disposal facility. The existing roads cannot accommodate the proposed tractor-transporter.

Following reactor removal, the site formerly occupied by the reactor would be backfilled, graded, seeded, and released for other DOE use. (In this context, the term “other use” indicates that a new or alternate use is not precluded because of the presence of radioactivity.) For the purpose of this EE/CA, it is assumed the action will begin in 2065 and end in 2068.

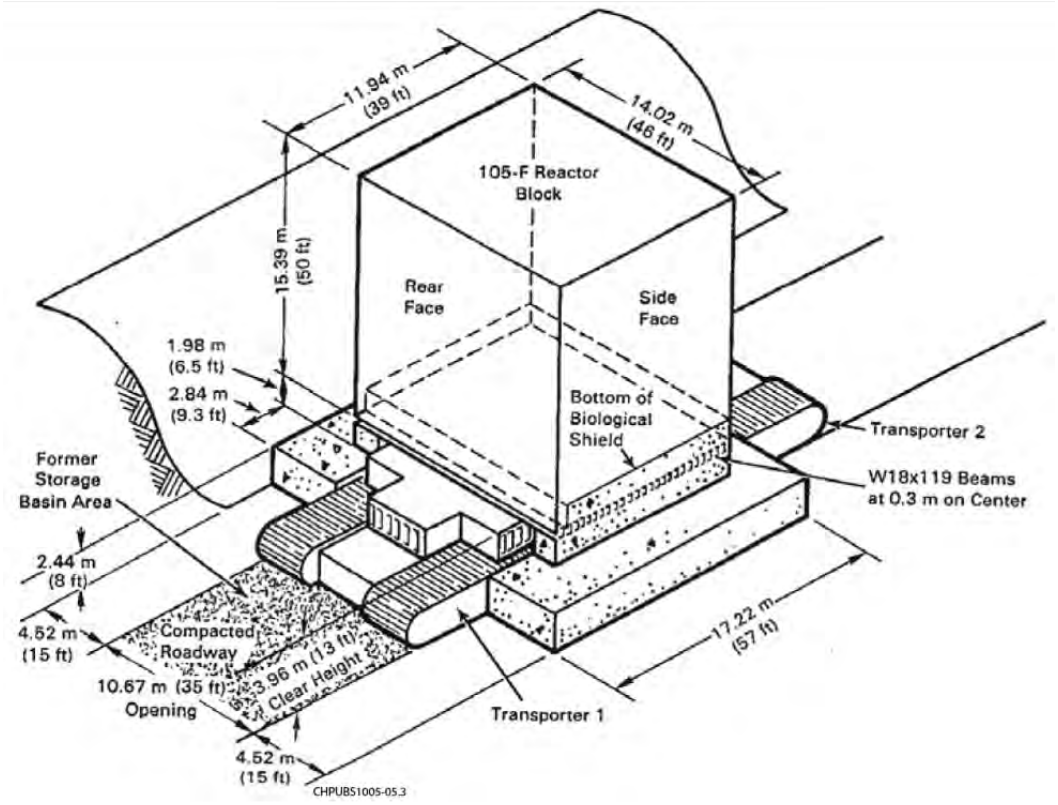

Figure 5. Depiction of Reactor Block Transport

4.3 Alternative 3—Safe Storage Followed by Dismantlement

Alternative 3, safe storage followed by dismantlement, includes an abbreviated surveillance, monitoring, and maintenance period, followed by piece-by-piece dismantlement of the 105-KE Reactor, and subsequent transport of radioactive debris to the ERDF for disposal. Piece-by-piece dismantlement is a reasonable alternative because of remote dismantlement technologies that have recently become available. These technologies, which have been successfully implemented at Brookhaven National Laboratory, reduce the radiation dose to workers, the public, and the environment. ISS activities are the same as those described for Alternative 2.

The 105-KE Reactor block would be disassembled piece by piece remotely, and all contaminated equipment and components would be packaged and transported to the ERDF for disposal (Figure 6). Contaminated structural surfaces would be removed, packaged, and transported to the ERDF for disposal. Non-contaminated material and equipment would be released for salvage, disposed in place, or disposed in a *Resource Conservation and Recovery Act of 1976* (RCRA) Subtitle D landfill (nonhazardous municipal and solid waste) or appropriate onsite disposal facility. Contaminated soils beneath the reactor would be excavated and disposed to the ERDF. The site would be backfilled, graded, seeded, and released for other uses by DOE. For the purposes of this EE/CA, it is assumed the dismantlement will begin in 2031 and end by 2034 in order to use the ERDF for waste disposal. The anticipated closure of the ERDF is scheduled for 2035, based on the *Comprehensive Closure Plan for the Hanford Central Plateau* (HNF-24234-FP).

4.4 Alternative 4—Accelerated Dismantlement

Alternative 4, accelerated dismantlement, would include immediate piece-by-piece dismantlement of the 105-KE Reactor and transport of radioactive debris to the ERDF for disposal. As described in Alternative 3, piece-by-piece dismantlement has become a viable option because of the newly available remote dismantlement technologies.

Performing this work in the near term supports soil cleanup associated with UPR-100-K-1 in the 105-KE Fuel Storage Basin footprint that cannot be completed without potentially destabilizing the reactor (Section 2.2.2). This alternative also takes advantage of a trained, experienced, and available work force.

The process for dismantlement would be the same as presented in Alternative 3, where the 105-KE Reactor block would be disassembled piece by piece remotely, and all contaminated equipment and components would be packaged and transported to the ERDF for disposal (Figure 6). Contaminated soils encountered beneath the reactor core would be removed and disposed to the ERDF, or deferred for remediation under the ongoing soil cleanup activities for adjacent OUs. For the purpose of this EE/CA, it is assumed that dismantlement activities would begin in 2011 and conclude in 2014.

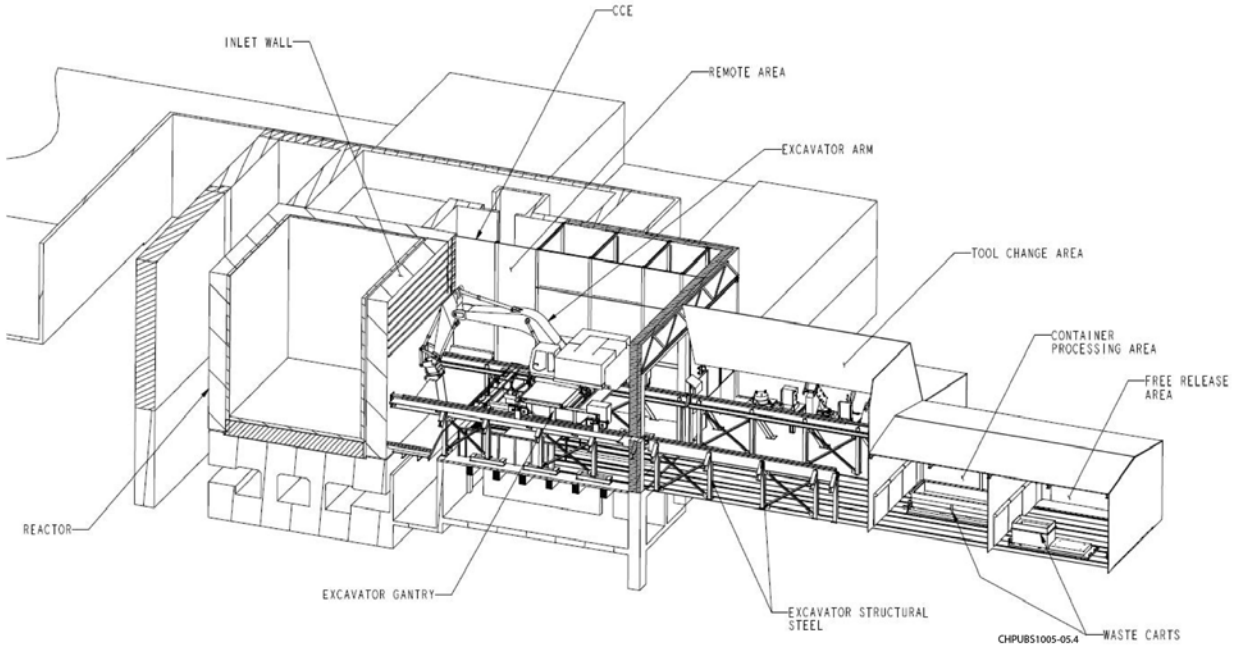

Figure 6. Depiction of Reactor Block Dismantlement Setup

5 Analysis of Removal Action Alternatives

This chapter analyzes each removal action alternative and provides a comparative evaluation of each alternative. The sections of this chapter of the EE/CA are used to compare the effectiveness, implementability, and cost of each alternative.

5.1 Effectiveness of Removal Action Alternatives

The effectiveness criterion refers to the ability to meet the removal objective and to protect human health and the environment.

5.1.1 Overall Protection of Human Health and the Environment

Protection of human health and the environment is the primary objective of the removal action. This criterion addresses whether the action achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. This criterion must be met for a removal action to be eligible for consideration. Evaluation of the alternatives against this criterion is based on qualitative analysis and assumptions.

Alternative 1, No Action, would not eliminate, reduce, or control risks to human health and the environment. Because implementation of this alternative would not meet RAOs or the threshold criterion for overall protectiveness, it cannot be considered a viable alternative. Consequently, Alternative 1 is not carried forward for further evaluation.

Alternatives 2 and 3 provide effective protection for the duration of the ISS period through continued S&M of the 105-KE Reactor. There is some limited exposure potential, however, for site personnel associated with S&M activities. At the end of the ISS period, the remediation activities (assessment, reactor block removal [either one-piece or dismantled], reactor building demolition, and waste disposal) would provide protection that is more permanent.

Alternative 4 provides the shortest timeframe for removing the threat of release to the environment and enabling further remediation. Remediation of the 100-KR-1/100-KR-2 OU waste sites adjacent to the reactor building would likely be delayed until the 105-KE Reactor is removed under the other alternatives. Contaminated soil directly adjacent to and potentially beneath the reactor cannot be removed without jeopardizing the structural stability of the reactor. Under Alternative 4, the timeframe for soil remediation would be greatly accelerated, better aligning the site with the DOE's geographic closure strategy.

Each alternative requires planning for the transportation and disposal of the reactor block, or its component parts. The transportation of the one-piece reactor block under Alternative 2 would require the installation of a haul road from the 105-KE Reactor site to an appropriate disposal facility. For Alternatives 2, 3, and 4, the 105-KE Reactor structure would be demolished once the reactor block was removed and contaminated materials would be disposed, providing reliable long-term protection. The ERDF would be used for Alternatives 3 and 4 and an appropriate available disposal site would be used for Alternative 2. Alternative 4 would move the reactor block and associated structure into a permanent disposal site in a shorter period than Alternatives 2 and 3.

Alternative 4, which would dismantle the reactor core and the surrounding structure within approximately 3 years, has the advantage of an existing, trained work force available to perform this activity. Use of personnel who have extensive experience working with radioactively contaminated materials is an advantage due to their familiarity with the hazards. This "hands-on" experience may not be available after the longer ISS period associated with Alternatives 2 and 3, which could result in a higher potential for human or environmental exposure.

Alternatives 2, 3, and 4 each provide overall protection of human health and the environment and are considered viable alternatives.

5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements and Other Standards

Section 121 of CERCLA (42 USC 9621) requires the responsible CERCLA implementing agency to ensure that the substantive standards of HWMA/RCRA and other applicable laws will be incorporated into the federal agency's design and operation of its long-terms remedial actions and into its more immediate removal actions. RL is the implementing agency for this NTCRA. Both Ecology and EPA concur that a NTCRA is warranted to protect HHEs through the NTCRA. The risks presented in this document will be mitigated in a timely manner.

Key ARARs associated with the remaining alternatives include waste management standards, standards controlling releases to the environment, health standards, and standards for protection of cultural and ecological resources. The potentially applicable alternatives would meet these preliminary ARARs for environmental and health standards. Although it is currently anticipated that the ERDF would be closed in 2035, it is likely that there would be a land disposal site available or one would be constructed to accept the reactor debris generated under Alternative 2. Because of the need for a haul road to transport the reactor block, Alternative 2 has a higher potential for impacts to cultural and/or ecological resources.

Appendix A provides a detailed discussion of how the removal action alternatives would comply with ARARs, including other advisories or guidance documents to be considered. The CERCLA Action Memorandum associated with this EE/CA will document final ARARs to be met during implementation of the selected removal action.

5.2 Implementability of the Removal Action Alternatives

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.

Environmental restoration workers at the Hanford Site are experienced in performing demolition and waste disposal operations. Techniques and lessons learned from ongoing Hanford projects would be applied to the Alternative 4 removal action. For Alternatives 2 and 3, it is unknown whether there will be a similar wealth of experienced radiological workers available onsite by the end of the ISS period, which may require extensive recruitment and training efforts to staff the operation.

Recent experience at the Brookhaven National Laboratory demonstrated the effective use of remote-handled equipment to dismantle a reactor core safely. The experience at Brookhaven has shown that the technology will allow the work to be performed under Alternatives 3 and 4 with a significant reduction in risk, compared to the results of the 1992 analysis. With the development of new remote demolition and waste packaging capabilities, Alternatives 3 and 4 are easier to implement, as dismantlement of the reactor block could begin before the one-piece block removal process, due to the required decay period, transportation issues, and haul road installation needed to support Alternative 2.

In terms of waste disposal, the ERDF has been designated by the *Declaration of the Interim Record of Decision for the Environmental Restoration Disposal Facility* (EPA/ROD/R10-95/100) to receive CERCLA wastes generated on the Hanford Site that meet its acceptance criteria. Construction of the facility began in 1995 and operation in 1996. Procedures for handling waste at the ERDF are well established; therefore, the facility and processes for disposal of waste generated under Alternatives 3 and 4 are readily available. the ERDF is currently scheduled to be in operation at least through 2035, based on

plans for closure of the Central Plateau. It is difficult to predict what disposal facilities will be available in 2065 to support Alternative 2.

For purposes of this analysis, Alternatives 2, 3, and 4 are all implementable.

5.3 Cost of the Removal Action Alternatives

Cost estimates have been prepared for the alternatives evaluated in this EE/CA. The estimates were prepared in accordance with *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA/540-R-00-002), along with DOE's *Cost Estimating Guide*, DOE G 430.1-1.

Table 1 shows the cost estimate for the four alternatives, starting from a present day, non-discounted cost, also called constant dollars. Non-discounted costs are not affected by general price inflation (i.e., they represent "units of stable purchasing power"); thus, the cost of a particular product or service would be the same in Year 0, Year 1, Year 2, and so forth. The non-discounted cost essentially assumes that the work is performed today. Because non-discounted costs do not reflect the changing value of money over time, presentation of this information under CERCLA is for information purposes only, not for response action alternative selection purposes.

Consistent with guidance from EPA and the U.S. Office of Management and Budget (OMB), present worth analysis is used as the basis for comparing costs of cleanup alternatives under the CERCLA program (OMB, 2009, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*). A discount rate of 2.7 percent (OMB, 2009) is applied for cost estimates that span multiple years, making it possible to evaluate expenditures associated with alternatives that occur during different periods (EPA/540-R-00-002). Because of the time-dependent value of money, future expenditures are not considered directly equivalent to current expenditures. The present-worth cost method shows the amount required at the initial point in time (e.g., in the current year) to fund activities occurring over the life of the alternative. Present-worth analysis assumes that the funding set aside at the initial point in time increases in value as time goes on, similar to how money placed in a savings account gains in value because of interest paid on the account. Although the federal government typically does not set aside funds in this manner, the present-worth analysis is specified under CERCLA as the approach for establishing a common baseline to evaluate and compare alternatives that have costs occurring at different times, although actual costs could vary. While the funds might not actually be set aside, the present-worth costs were considered directly comparable for evaluating the costs of the alternative.

The information in the cost estimate is based on the best available information regarding the anticipated scope of the removal action alternatives. Changes in the cost elements are likely to occur because of new information and data collected during preparation and performance of the removal action. Consistent with EPA guidance, this is an order of magnitude engineering cost estimate that was developed to be within -30 percent to +50 percent of actual project cost.

Table 1. Cost Estimate for the Four Alternatives

Alternative	Description	Total Capital Cost ($)	Non-Discounted Annual and Periodic Cost ($)	Non-Discounted Cost ($)	Net Present Value Cost ($)
1	No Action	0	0	0	0
2	Safe Storage Followed by One-Piece Removal	107,661,000	6,845,000	114,506,000	61,552,000
3	Safe Storage Followed by Dismantlement	89,480,000	2,757,000	92,237,000	69,459,000
4	Accelerated Dismantlement	82,511,000	0	82,511,000	76,679,000

5.4 Other Considerations—NEPA Values

This section identifies the NEPA values associated with the proposed action.

In accordance with the NEPA Compliance Program (DOE O 451.1B Chg 1), DOE CERCLA documents are required to incorporate NEPA values (e.g., analysis of cumulative, offsite, ecological, and socioeconomic impacts) to the extent practicable.

Table 2 describes the NEPA values most relevant to and potentially affected by the actions taking place under this removal action. Additional discussion of potential impacts is found in the Supplement Analysis (DOE/EIS-0119F-SA-01).

Table 2. NEPA Values Evaluation

NEPA Values	Description	Evaluation (Includes the Evaluation for Each Alternative)
Transportation	Considers impacts of the proposed action on local traffic (i.e., traffic at the Hanford Site) and traffic in the surrounding region.	Implementation of Alternatives 2, 3, and 4 would be expected to produce short-term impacts on local traffic. Most of the impacts would be associated with increased truck traffic when transporting wastes and debris to the ERDF. Transportation impacts associated with transport of contaminated material to the ERDF were considered in DOE/RL-93-99, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility*, as part of the evaluation of short-term effectiveness and implementability. NEPA values specifically associated with the ERDF were addressed in DOE/RL-94-41, *NEPA Roadmap for the Environmental Restoration Disposal Facility Regulatory Package*. See the discussion of cumulative impacts for a perspective of transportation to the ERDF.

Table 2. NEPA Values Evaluation

NEPA Values	Description	Evaluation (Includes the Evaluation for Each Alternative)
Air Quality	Considers potential air quality concerns associated with emissions generated during the proposed action.	Airborne releases associated with Alternatives 2, 3, and 4 are expected to be minor with the use of appropriate work controls (e.g., use of water within the well housing of the Hanford Site excess industrial buildings/structures, sampling during favorable wind conditions, and use of fixatives). Any potential for airborne release of contaminants during these removal actions would be controlled in accordance with DOE radiation control and air pollution control standards to minimize emissions of air pollutants at the Hanford Site and protect communities outside the Hanford Site boundaries. Operation of trucks and other diesel-powered equipment for these alternatives would be expected, in the short-term, to introduce quantities of sulfur dioxide, nitrogen dioxide, particulates, and other pollutants to the atmosphere, typical of similar-sized construction projects. These releases would not be expected to cause any air quality standards to be exceeded and (as needed) dust generated during removal activities would be minimized by watering or other dust control measures. Vehicular and equipment emissions will be controlled and mitigated in compliance with the substantive standards for air quality protection that apply to the Hanford Site.
Natural, Cultural, and Historical Resources	Considers impacts of the proposed action on wildlife, wildlife habitat, archeological sites and artifacts, and historically significant properties.	Impacts on ecological resources near the removal actions would continue to be mitigated in accordance with DOE/RL-96-32, *Hanford Site Biological Resources Management Plan* and DOE/RL-96-88, *Biological Resources Mitigation Strategy*, and the applicable standards of all relevant biological species protection regulations. Appropriate ecological reviews would be conducted before implementing field activities (see Section 2.1.2). For Alternative 2, the development of a haul road from 100-K to the ERDF could impact habitat and culturally sensitive areas, including Gable Butte. For Alternatives 3 and 4, the 105-KE Reactor site has already been disturbed; it is anticipated that only isolated artifacts would be encountered during project activities under these alternatives. Implementation of CRMP and consultation with area Tribes would help ensure appropriate mitigation to avoid or minimize any adverse cultural or historical resource effects and address any relevant concerns. Potential impacts to cultural and historical resources that may be encountered during the short-term activities associated with implementing Alternative 4 would be mitigated through compliance with the appropriate substantive requirements of the *National Historic Preservation Act of 1966* and other ARARs related to cultural preservation. As appropriate, cultural resource reviews would be conducted before implementing field activities (see Section 2.1.3).

Table 2. NEPA Values Evaluation

NEPA Values	Description	Evaluation (Includes the Evaluation for Each Alternative)
Socioeconomic Impacts	Considers impacts pertaining to employment, income, other services (e.g., water and power utilities), and the effect of implementation of the proposed action on the availability of services and materials.	The proposed action is within the scope of current RL environmental restoration activities and would have minimal impact on the current availability of services and materials. This work is expected to be accomplished mainly using employees from the existing contractor workforce. Even if the removal activities create additional service sector jobs, the total expected increase in employment would be expected to be less than 1 percent of the current employment levels. The socioeconomic impact of the project would contribute to the continuing overall positive employment and economic impacts on eastern Washington communities from Hanford Site cleanup operations.
Environmental Justice	Considers whether the proposed response actions would have inappropriately or disproportionately high and adverse human health or environmental effects on minority or low-income populations.	Per Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, DOE seeks to ensure that no group of individuals bears a disproportionate share of negative environmental consequences resulting from proposed federal actions. No impacts are associated with proposed activities associated with the 105-KE Reactor structure and debris that could reasonably be determined to affect any member of the public; therefore, they would not have the potential for high and disproportional adverse impacts on minority or low-income groups.
Cumulative Impacts (Direct and Indirect)	Considers whether the proposed action could have cumulative impacts on human health or the environment when considered together with other activities locally, at the Hanford Site, or in the region.	The concern is associated directly with the targeted area. Because of the temporary nature of the activities and their remote location, cumulative impacts on air quality or noise with other Hanford Site or regional construction and cleanup projects would be minimal. When materials such as the 105-KE Reactor structure debris at a site in this area are found to be contaminated with hazardous substances in concentrations presenting a material threat to human health and the environment, that threat would be mitigated. The net anticipated effect could be a positive contribution to cumulative environmental effects at the Hanford Site through removal, treatment, and disposal of such hazardous substances to a building/structure such as the ERDF that has been designed and legally authorized to contain such contaminants safely. The 105-KE Reactor structure debris removed under Alternatives 2, 3, and 4 would meet the ERDF waste acceptance criteria as described in *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (WCH-191). Wastes generated during the proposed activities would be manageable within the capacities of existing facilities. For perspective, the ERDF received more than 700,000 tons of waste in calendar year 2008 and more than 430,000 tons in calendar year 2007. It is expected that the total amount of waste that could be generated for disposal in the ERDF for this removal action is ~36,240 tons. The ERDF received approximately 22,500 curies (Ci) of radioisotopes in calendar year 2008 and approximately 13,000 Ci in calendar year 2007. Radiological contamination is expected to be within the acceptance criteria for the ERDF disposal.

Table 2. NEPA Values Evaluation

NEPA Values	Description	Evaluation (Includes the Evaluation for Each Alternative)
Mitigation	Considers whether, if adverse impacts cannot be avoided, response action planning should minimize them to the extent practicable. This value identifies required mitigation activities.	Compliance with the substantive requirements of the ARARs would mitigate potential environmental impacts on the natural environment, including migratory birds and endangered species. DOE also has established policies and procedures for the management of ecological and cultural resources when actions might affect such resources (DOE/RL-96-32; DOE/RL-96-88; DOE/RL-98-10, *Hanford Cultural Resources Management Plan*). Cultural resource and biological species reviews/surveys provide suggested mitigation activities to ensure adverse effects associated with implementing the actions are minimized or avoided. Health and safety procedures, documented in a Health and Safety Plan established by site contractors, mitigate risks to workers from the removal activities.

Source:

16 USC 470, *National Historic Preservation Act of 1966*.

DOE/RL-93-99, 1994, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* [revision].

DOE/RL-94-41, 1994, T*oxic air Pollutants Notice of Construction Multi-Function Waste Tank Facility*, Rev. 0.

DOE/RL-96-32, 2001, *Hanford Site Biological Resources Management Plan* [revision].

DOE/RL-96-88, 2003, *Hanford Site Biological Resources Mitigation Strategy* [revision].

DOE/RL-98-10, 2003, *Hanford Cultural Resources Management Plan* [revision].

Executive Order 12898, 1994, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*.

WCH-191, 2008, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*.

ARAR = applicable or relevant and appropriate requirements

CRMP = Cultural Resource Management Plan

DOE = U.S. Department of Energy

ERDF = Environmental Restoration Disposal Facility

NEPA = *National Environmental Policy Act of 1969*

6 Comparative Analysis of Removal Action Alternatives

Alternative 1, which does not meet the threshold effectiveness criteria for protection of human health and the environment, received no further evaluation in Sections 4 and 5. Alternatives 2, 3, and 4 would meet the threshold effectiveness criteria and RAOs, and would provide long-term risk reduction. Of these, Alternative 4 is the most expeditious in terms of risk reduction because reactor removal is immediate and underlying soil contamination can be addressed years before other alternatives, whereas Alternatives 2 and 3 include an ISS period that increases the potential to release hazardous substances.

All three alternatives are implementable, but the presence and availability of the ERDF for waste disposal makes the path forward for Alternatives 3 and 4 more readily implementable. Alternative 4 also has the potential to use a trained workforce. Of the three alternatives, Alternative 4 most effectively supports soil remediation activities associated with waste sites near the 105-KE Reactor, particularly UPR-100-K-1, which cannot be completed without risk of structural destabilization of the reactor (Section 2.2.2).

Alternative 4 most effectively mitigates the threat of release of hazardous substances to the environment, satisfies the RAOs, and limits exposure for site workers performing the action. It is also consistent with the overall Hanford Site cleanup mission by reducing the footprint of contamination in the near-term and accelerating the elimination of contaminant sources in the River Corridor. Alternative 4 is an extremely viable alternative.

Table 3 provides a brief summary of the comparative analysis with respect to each selection criterion.

Table 3. Summary of Comparative Analysis of Removal Action Alternatives for the 105-KE Reactor

	Alternatives	Effectiveness	Implementability	Estimated Duration	Non-Discounted Cost ($000)	Net Present Value Cost ($000)
1	No Action	Low	*	*	*	*
2	Safe Storage Followed by One-Piece Removal	Moderate	Low to Moderate	ISS + 3 years	114,506	61,552
3	Safe Storage Followed by Dismantlement	Moderate to High	High	ISS + 3 years	92,237	69,459
4	Accelerated Dismantlement	High	High	3 years	82,511	76,679

* Not evaluated—did not meet threshold criteria.

7 Recommended Removal Action Alternative

Four alternatives were identified, evaluated, and compared based on the criteria discussed in Chapter 5.

- Alternative 1: No Action
- Alternative 2: Safe Storage Followed by One-Piece Removal
- Alternative 3: Safe Storage Followed by Dismantlement
- Alternative 4: Accelerated Dismantlement

The recommended removal action is Alternative 4, accelerated dismantlement. This alternative has been selected as the preferred alternative because it meets the proposed RAOs regarding long-term risk, minimizes short-term worker risk and radiation exposure, and is protective of public health and safety and the environment. Alternative 4 provides the following benefits.

- Protects public health and safety and the environment
- Meets the RAOs
- Provides high short-term and long-term effectiveness
- Provides high technical feasibility and low administrative requirements due to the ability to use existing roadways for waste transportation for disposal at the ERDF

- Makes use of existing work force with extensive radiological experience
- Uses existing waste disposal capacity at the ERDF
- Supports DOE mission of reducing the waste footprint in the River Corridor

DOE also believes that Alternative 4 is consistent with and contributes to the efficient performance of Hanford Site long-term remedial actions and promotes protection of ecological resources and restoration of the environment consistent with Tri-Party goals.

Subsequent to approving the recommendation provided through this EE/CA and contingent on public response and Agency approval, DOE will issue an Action Memorandum that will document its decision. Alternative 4, which would commence in FY 2011, is estimated to take three years to complete (FY 2014).

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Appendix A

Applicable or Relevant and Appropriate Requirements

A1 Applicable or Relevant and Appropriate Requirements

For the removal action being considered in this document, any selected alternative will be designed to comply with the applicable or relevant and appropriate requirements (ARARs) cited in this section to the extent practicable. ARARs are defined to include only substantive requirements of environmental standards. ARARs do not include administrative requirements, including requirements to obtain any federal, state, or local permits (40 CFR 300.400(e), 42 USC.9621[e]).

Because Alternatives 2, 3, and 4 would result primarily in waste generation and potential for air emissions, the key ARARs identified for the alternatives considered include waste management standards, standards controlling releases to the environment, standards for protection of natural resources, and health and safety standards.[1] Alternative 1 did not meet threshold criteria and therefore was not evaluated for compliance with ARARs.

A1.1 Waste Management Standards

A variety of waste streams would be generated under the proposed removal action alternatives. It is anticipated that most of the waste will be determined to be low-level waste (LLW). Quantities of dangerous or mixed waste, polychlorinated biphenyl (PCB) waste, and asbestos and asbestos containing material (ACM) also could be generated. The majority of the waste will be in a solid form; however, some liquid wastes might be generated.

Radioactive waste is managed by the U.S. Department of Energy (DOE) under the authority of the *Atomic Energy Act of 1954* (AEA).

The identification, storage, treatment, and disposal of hazardous waste and the hazardous component of mixed waste are governed by the *Resource Conservation and Recovery Act of 1976* (RCRA). The State of Washington, which implements RCRA requirements under WAC 173-303, "Dangerous Waste Regulations," has been authorized to oversee most elements of the RCRA program. The dangerous waste standards for generation and storage would apply to the management of any dangerous or mixed waste produced through the removal action for the 105-KE Reactor. Treatment standards for dangerous or mixed waste subject to RCRA land disposal restrictions are specified in WAC 173-303-140, "Land Disposal Restrictions," which incorporates 40 CFR 268 by reference.

The management and disposal of PCB wastes are governed by the *Toxic Substances Control Act of 1976* (TSCA; 15 USC 2601, et seq.) and regulations at 40 CFR 761, "Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." The TSCA regulations contain specific provisions for PCB waste, including PCB waste that contains a radioactive component. PCBs also are considered underlying hazardous constituents under the RCRA Land Disposal Program and thus, could be subject to WAC 173-303 and 40 CFR 268 requirements.

Removal and disposal of asbestos and ACM are regulated under the *Clean Air Act* (40 CFR 61, Subpart M). These regulations provide for special precautions to minimize environmental releases or exposure to personnel of airborne emissions of asbestos fibers during work activities.

[1] Worker safety and health standards are not environmental standards *per se* and, therefore, are not potential ARARs. Instead, compliance with applicable safety and health regulations is required external to the CERCLA ARAR process. A discussion of the safety and health requirements is included in this appendix, however, as a result of the nature and importance of these standards.

Waste that is determined to be LLW that meets the Environmental Restoration Disposal Facility (ERDF)[2] waste acceptance criteria would preferentially be disposed at the ERDF, because the ERDF is an engineered facility that provides a high degree of protection to human health and the environment, and previous EE/CAs for other Hanford Site work have shown that this disposal option is more cost effective than disposal at other permitted sites. Construction of the ERDF was authorized through a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Record of Decision (ROD) (*Declaration of the Interim Record of Decision for the Environmental Restoration Disposal Facility* [EPA/ROD/R10-95/100]). The ERDF is designed to meet minimum technological requirements for a landfill, including standards for a double liner, leachate collection system, leak detection, monitoring, and final cover. Alternate potential disposal locations may be considered when the removal action occurs, if a suitable and cost-effective location is identified. Any potential alternate disposal location will be evaluated for appropriate performance standards to ensure that it is adequately protective of human health and the environment.

Waste designated as dangerous or mixed waste would be treated as appropriate to meet land disposal restrictions and the ERDF waste acceptance criteria, and disposed at the ERDF. Applicable packaging and pre-transportation requirements for dangerous or mixed waste generated by the removal action would be identified and implemented before movement of any waste.

Some of the aqueous waste determined to be LLW or designated as dangerous or mixed waste would be transported to the 200 Area Effluent Treatment Facility (ETF) for treatment and disposal. ETF is an RCRA-permitted unit authorized to treat aqueous waste streams generated on the Hanford Site and dispose of these streams at the designated State-Approved Land Disposal Site (SALDS) in accordance with applicable requirements.

Waste designated as nonliquid PCB remediation waste likely would be disposed at the ERDF, depending on whether it meets the waste acceptance criteria. PCB waste that does not meet the ERDF waste acceptance criteria would be retained at a PCB storage area meeting the substantive requirements for TSCA storage and would be later transported for disposal at an appropriate disposal facility.

Asbestos and ACM would be removed, packaged as appropriate, and disposed at the ERDF.

Alternatives 2, 3, and 4 can be performed in compliance with the waste management ARARs. Waste streams will be evaluated, designated, and managed in compliance with the ARAR requirements. Before disposal, waste will be managed in a protective manner to prevent releases to the environment or unnecessary personnel exposure.

A1.2 Standards Controlling Emissions to the Environment

The proposed removal action Alternatives 2, 3, and 4 have the potential to generate radioactive and airborne emissions.

A1.3 Radiological Air Emissions

Clean Air Act (42 USC 7401 et seq.) and the *Washington Clean Air Act* (Revised Code of Washington [RCW] 70.94) require regulation of radioactive air pollutants. Implementing regulations found in 40 CFR 61.92 sets limits for radionuclide emissions, which cannot exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr. This requirement

[2] 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 facilities can be treated as one for purposes of CERCLA response actions.

would be applicable to any aspects of the removal action with the potential to emit radionuclides to unrestricted areas. Verification of compliance with this standard is required by the state implementing regulation at *Washington Administrative Code* (WAC) 173-480-070. Radioactive air emissions are to be controlled through the use of best available radionuclide control technology (BARCT), or as low as reasonably achievable control technology (ALARACT) where economically and technologically feasible [WAC 246-247-040(3) and -040(4), "Radiation Protection—Air Emissions," "General Standards," and associated definitions]. To address the substantive aspect of these potential requirements, best or reasonably achieved control technology could be addressed by ensuring that applicable emission control technologies (those successfully operated in similar applications) would be used when economically and technologically feasible (i.e., based on cost/benefit). If it is determined that substantive requirements for control of radioactive airborne emissions must be applied to site activities once ARARs are finalized, then controls will be administered as appropriate using the best methods from among those that are reasonable and effective.

A1.4 Criteria/Toxic Air Emissions

General Regulations for Air Pollution Sources (WAC 173-400) and *Controls for New Sources of Toxic Air Pollutants* (WAC 173-460) establish limits on emissions of criteria/toxic air pollutants. The primary source of emissions resulting from this removal action will be fugitive particulate matter. In accordance with WAC 173-400-040(3) and (8), reasonable precautions must be taken to: (1) prevent the release of air contaminants associated with fugitive emissions resulting from demolition, materials handling, or other operations; and (2) prevent fugitive dust from becoming airborne.

The use of treatment technologies that would result in emissions of toxic air pollutants that would be subject to the substantive applicable requirements of WAC 173-460 are not anticipated to be a part of this removal action.

Treatment of some waste encountered during the removal action may be required to meet the ERDF waste acceptance criteria. In most cases, the type of treatment anticipated would consist of solidification/ stabilization techniques, such as macroencapsulation or grouting, and would not result in the emission of toxic air pollutants. If more aggressive treatment is required that would result in the emission of regulated air pollutants above *de minimis* emission values found in WAC 173-460-150, the substantive requirements of WAC 173-400-113(2) and WAC 173-460-060 would be evaluated to determine applicability and satisfied if determined to be ARAR.

Emissions to the air will be minimized during implementation of the removal action through use of standard industry practices, such as the application of water sprays and fixatives. These techniques are considered reasonable precautions to control fugitive emissions as required by WAC 173-400-040(3) and (8).

The alternatives are expected to comply with the ARARs in Tables A-1 and A-2.

Table A-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Removal Action

Citation	ARAR or TBC	Requirement	Rationale for Consideration
***Clean Air Act of 1977*, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"**			
40 CFR 61.92, "Standard"	ARAR	This regulation sets limits for radionuclide emissions, which cannot exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr or greater.	The 105-KE Reactor contains radioactive constituents. Potential emissions from work under the NTCRA would be performed in accordance with the substantive provisions of this standard.
40 CFR 61.145, "Standard for Demolition and Renovation" Specific subsections: • 40 CFR 61.145(a)(1) and (2) • 40 CFR 61.145(c) • 40 CFR 61.150, "Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations"	ARAR	These standards apply to demolition activities, including the removal of RACM. The standards of 40 CFR 61.145(a)(1) and (2) are used to determine when the requirements of 40 CFR 61.145(c) apply to demolition activities. The standards of 40 CFR 61.150 are used to control asbestos emissions during collection, processing, packaging, and transport of any asbestos-containing waste material.	The 105-KE Reactor contains asbestos. The substantive provisions of 40 CFR 61.145(c) would be followed for the demolition activities with RACM under this removal action. The substantive provisions of 40 CFR 61.150 would be met during activities that involve collection, processing, packaging, and transport of asbestos-containing waste material under the NTCRA.
Archaeological and Historic Preservation Act of 1976			
National Archaeological and Historic Preservation Act of 1976, 16 USC 469aa-mm 40 CFR 6.301(c), "Applicant Requirements"	ARAR	These laws apply to activities that could cause the loss of any archaeological or historic data. This act mandates preservation of the data and does not require protection of the actual site.	Based on past identification of archeological and historic sites at the Hanford Site, the substantive requirements of this Act would be applicable to actions under the NTCRA that might disturb these sites. In accordance with these requirements, archaeological and historical data will be preserved as appropriate before or during the work. This requirement is location-specific.

Table A-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Removal Action

Citation	ARAR or TBC	Requirement	Rationale for Consideration
National Historic Preservation Act of 1966			
National Historic Preservation Act of 1966, 16 USC 470, Section 106 36 CFR 800, "Protection of Historic Properties" 40 CFR 6.301(b), "Applicant Requirements" Executive Order 11593, *Protection and Enhancement of the Cultural Environment* 36 CFR 65, "National Historic Landmarks Program" 36 CFR 60, "National Register of Historic Places"	ARAR	The *National Historic Preservation Act of 1966* requires that historic properties are appropriately considered in planning federal initiatives and actions. These laws also require federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation, and mitigation processes, and consultation with interested parties.	Based on past identification of cultural and historic sites at Hanford, these types of sites could be encountered during the NTCRA. The substantive requirements of this Act would be applicable to actions that might disturb these types of sites. This requirement is location-specific.
Native American Graves Protection and Repatriation Act of 1990			
Native American Graves Protection and Repatriation Act of 1990, 25 USC 3001, et seq. 43 CFR 10, "Native American Graves Protection and Repatriation Regulations"	ARAR	These provisions establish federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Based on Hanford Site history, these types of sites could be encountered during the NTCRA. Substantive requirements of this act would be applicable if remains and sacred objects are found during removal action. Native American Tribal consultation would be initiated in the event of discovery. This requirement is location-specific.
Endangered Species Act of 1973* and *Migratory Bird Treaty Act of 1918			
Endangered Species Act of 1973, 16 USC 1531 et seq, subsection 16 USC 1536(c) 50 CFR 402, "Interagency Cooperation—Endangered Species Act of 1971, as amended" 40 CFR 6.302(h), "Responsible Official Requirements"	ARAR	These laws and implementing regulations prohibit actions by federal agencies that are likely to jeopardize the continued existence of listed threatened or endangered species or result in the destruction or adverse modification of critical habitat or removal of protected migratory birds, their young, or their eggs.	The NTCRA will be implemented at the Hanford Site in locations where such species could be encountered during the NTCRA. Substantive requirements of this act would be applicable if threatened or endangered species are identified in areas where the removal action will occur. If the NTCRA is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource in accordance with substantive requirements of these laws and regulations.

Table A-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Removal Action

Citation	ARAR or TBC	Requirement	Rationale for Consideration
Migratory Bird Treaty Act of 1918, 16 USC 703, et seq.	ARAR	These laws and implementing regulations make it unlawful at any time (unless and except as permitted by regulations) by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof, included in the terms of the individual conventions between the United States and Great Britain, the United Mexican States, the Government of Japan, and the Union of Soviet Socialist Republics.	The NTCRA will be implemented at the Hanford Site in locations where such species could be encountered during the NTCRA. Substantive requirements of this act would be applicable if threatened or endangered species are identified in areas where the removal action will occur. If the NTCRA is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource in accordance with substantive requirements of these laws and regulations. Mitigation measures will be taken to deter nesting by migratory birds on, around, or within the structures undergoing dismantlement and demolition, and to identify and protect occupied nests. This requirement is location-specific.
Protection of Stratospheric Ozone, 40 CFR 82			
40 CFR 82.156 “Required Practices” 40 CFR 82.158 “Standards for Recycling and Recovery Equipment” 40 CFR 82.161 “Technician Certification”	ARAR	The provisions of 40 CFR 82.156 specify standards for evacuation of refrigerant from appliances to a recovery or recycling machine prior to disposal. The procedures and processes of 40 CFR 82.158 apply to recycling and recovery of ODS. 40 CFR 82.161 requires appropriate certification for workers who recover or recycle ODS.	The 105-KE Reactor facilities could include appliances. Appliances identified for disposal may include ODS that would be managed in accordance with the applicable substantive requirements and work practices. These requirements are action-specific.

Table A-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Removal Action

Citation	ARAR or TBC	Requirement	Rationale for Consideration
***Toxic Substances Control Act of 1976* (TSCA); 40 CFR 761, "Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"**			
40 CFR 761.50(b)1, 2, 3, 4, and 7, "Applicability," "PCB Waste" 40 CFR 761.50(c), "Applicability," "Storage for Disposal" "Disposal Requirements," 40 CFR 761.60(a), "Disposal Requirements" "PCB liquids" 40 CFR 761.60 (b), "Disposal Requirements" "PCB Articles" 40 CFR 761.60 (c), "Disposal Requirements" "PCB Containers" 40 CFR 761.61, "PCB Remediation Waste" 40 CFR 761.62, "PCB Bulk Product Waste" 40 CFR 761.79, "Decontamination Standards and Procedures"	ARAR	These regulations apply to the storage and disposal of PCB wastes, including liquid PCB wastes, PCB items, PCB remediation waste, PCB bulk product wastes, and PCB/ radioactive wastes at concentrations equal to or greater than 50 ppm. These regulations also provide options for decontamination of materials contaminated with PCBs.	The 105-KE Reactor could include various forms of PCB wastes, including, but not limited to, PCB items, PCB liquids, and PCB articles, and/or containers that would be managed in accordance with the substantive requirements of these standards if encountered and or generated during the NTCRA.

Source:

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"

40 CFR 82, "Protection of Stratospheric Ozone"

40 CFR 141, "National Primary Drinking Water Standards"

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"

CFR = *Code of Federal Regulations*
NTCRA = non time-critical removal action
ODS = ozone depleting substances
ppm = parts per million
RACM = regulated asbestos-containing material
TBC = to-be-considered

Table A-2. Identification of Potential State Applicable or Relevant and Appropriate Requirements for the Removal Action

ARAR Citation	ARAR	Requirement	Rationale for Consideration
Regulations Pursuant to the *Resource Conservation and Recovery Act of 1976* and Implemented Through WAC 173-303, "Dangerous Waste Regulations"			
"Identifying Solid Waste," WAC 173-303-016	ARAR	This regulation applies for determining which materials are and are not solid waste. This determination is used to establish which wastes are subject to the designation procedures of WAC 173-303-070(3).	Solid wastes will be generated during the decommissioning of the 105-KE Reactor during the NTCRA. Substantive requirements of these regulations would be applicable because they define how to determine which materials are subject to the designation regulations. Specifically, materials that are generated for removal from the CERCLA site during the removal action would be evaluated using the procedures for identifying solid waste to ensure proper management. This requirement is action-specific.
"Designation of Dangerous Waste," WAC 173-303-070(3)	ARAR	This regulation applies for the evaluation of solid wastes to determine if such wastes are designated as dangerous or mixed waste. Solid wastes that are designated as dangerous or mixed wastes are subject to management and disposal standards of WAC 173-303.	There is potential for generating solid wastes that would be designated as dangerous or mixed waste. Substantive requirements of these regulations would be applicable to solid wastes generated or encountered during the NTCRA. Solid waste generated for removal from the CERCLA site during this removal action would be evaluated using the dangerous waste designation procedures to ensure proper management. This requirement is action-specific.
"Excluded Categories of Waste," WAC 173-303-071	ARAR	This regulation lists waste categories that are excluded from management in accordance with the requirements of WAC 173-303.	There is potential for generating materials during the decommissioning of the 105-KE Reactor that would qualify for management under the substantive provisions of these regulations, which would be used as appropriate during the NTCRA. This requirement is action-specific.
"Conditional Exclusion of Special Wastes," WAC 173-303-073	ARAR	This regulation provides for management of wastes that pose a relatively low hazard to human health and the environment. The standards provide for management of special wastes with a low level of protection that is intermediate between dangerous and nondangerous solid wastes.	There is a potential for generating materials that would qualify for management under the substantive provisions of these regulations, which would be used as appropriate during the NTCRA. This requirement is action-specific.

Table A-2. Identification of Potential State Applicable or Relevant and Appropriate Requirements for the Removal Action

ARAR Citation	ARAR	Requirement	Rationale for Consideration
"Requirements for Universal Waste," WAC 173-303-077	ARAR	This regulation provides alternate reduced standards for certain solid wastes (i.e., batteries, mercury-containing equipment, and lamps) as described in WAC 173-303-573.	There is potential for generating materials that would qualify for management under the substantive provisions of these regulations, which would be used as appropriate during the NTCRA. This requirement is action-specific.
"Land Disposal Restrictions," WAC 173-303-140(4)	ARAR	This regulation establishes State standards for land disposal of dangerous waste and incorporates by reference the federal land disposal restrictions of 40 CFR 268 that are applicable to solid waste designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	There is potential for generating solid wastes that would be designated as dangerous or mixed waste and require further treatment prior to land disposal. The substantive requirements of this regulation are potentially applicable to dangerous and/or mixed wastes that are generated or encountered during the removal action. Specifically, dangerous and/or mixed waste generated and removed from the CERCLA site would be evaluated for determination of applicable land disposal restrictions at the point of waste generation. This requirement is action-specific.
"Requirements for Generators of Dangerous Waste," WAC 173-303-170(3)	ARAR	This regulation establishes standards for the temporary management of wastes that are designated as dangerous or mixed waste.	There may be waste generated during the NTCRA that needs to be temporarily accumulated or stored under the NTCRA. Substantive requirements of these regulations would be used for management of materials generated and/or encountered during the NTCRA. WAC 173-303-170(3) includes by reference the substantive provisions of both the satellite accumulation standards of WAC 173-303-200 and the standards for management in containers under WAC 173-303-630 and tanks under -640. This requirement is action-specific.
"Solid Waste Management, Recovery, and Recycling Act of 1969," RCW 70.95 "Minimum Functional Standards for Solid Waste Handling" WAC 173-304 Specifications Section: WAC 173-350-300(2)		Establishes requirements for the management of solid waste.	Substantive requirements of these regulations would be applicable to the temporary onsite management of solid waste that will be generated during implementation of the selected remedy.

Table A-2. Identification of Potential State Applicable or Relevant and Appropriate Requirements for the Removal Action

ARAR Citation	ARAR	Requirement	Rationale for Consideration
General Regulations for Air Pollution Sources, WAC 173-400 and WAC 173-460			
Washington Clean Air Act of 1967, RCW 70.94and 43.21A General Regulations for Air Pollution, WAC 173-400 Specific subsection: WAC 173-400-040(3) WAC 173-400-040(8)	ARAR	These laws and regulations require all sources of air contaminants to meet standards for visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons or property, sulfur dioxide, concealment and masking, and fugitive dust. Requires use of RACT.	There is potential for fugitive emissions during decommissioning of the 105-KE Reactor under the NTCRA. Substantive requirements of the general standards for control of fugitive emissions would be applied as appropriate to minimize the generation of fugitive dust that occurs during decommissioning or other activities. These requirements are action-specific.
General Regulations for Air Pollution, WAC 173-400 Specific subsection: WAC 173-400-113	ARAR	This regulation applies to new and modified sources and requires controls to minimize the releases of associated criteria and toxic air emissions. Emissions are to be minimized through application of BACT.	It is unlikely that the substantive provisions in this regulation would be triggered during the NTCRA. However, substantive requirements of this regulation would be applicable to removal actions performed at the site if a treatment technology that emits regulated air emissions is necessary during the implementation of the removal action. This requirement is action-specific.
Controls for New Sources of TAP, WAC 173-460 Specific subsections: WAC 173-460-060 WAC 173-460-150	ARAR	These regulations apply for determination of de minimis emission values and for establishment of control technology as appropriate for new or modified toxic air pollutant sources likely to increase toxic air pollutant emissions. Requires T-BACT and demonstration that emissions of TAP will not endanger human health or safety.	It is not expected that work done under the NTCRA will trigger standards for T-BACT. However, substantive requirements of these regulations would be applicable to removal actions performed at the site, if a treatment technology that emits toxic air emissions is necessary during the implementation of the NTCRA. These requirements are action-specific.
Radiation Protection—Air Emissions, WAC 246-247			
"Radiation Protection—Air Emissions," "Standards," WAC 246-247-040(3) WAC 246-247-040(4)	ARAR	These regulations require all new construction and significant modifications of emissions units to utilize BARCT and require all existing emission units and nonsignificant modifications to utilize ALARCT in controlling emissions to the environment.	Substantive requirements of this standard would be applicable because fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from activities, such as demolition of structures, excavation of contaminated soils, and operation of exhausters and vacuums, performed during the removal action. This standard exists to ensure compliance with emission standards. These requirements are action-specific.

Table A-2. Identification of Potential State Applicable or Relevant and Appropriate Requirements for the Removal Action

ARAR Citation	ARAR	Requirement	Rationale for Consideration
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075 Specific subsections: WAC 246-247-075(1) WAC 246-247-075(2) WAC 246-247-075 (3) WAC 246-247-075(4) WAC 246-247-075(8)	ARAR	These regulations establish the monitoring, testing, and quality assurance requirements for radioactive air emissions from major sources. These regulations also include requirements for continuous sampling and provide for periodic sampling (grab samples) in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. These regulations also provide for the waste site owner or operator to use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures, as approved by the lead agency. These regulations also establish requirements to monitor nonpoint and fugitive emissions of radioactive material.	Substantive requirements of this standard would be applicable because fugitive and nonpoint source emissions of radionuclides to the ambient air may result from activities, such as demolition and excavation of radioactively contaminated soils and operation of exhausters and vacuums, performed during the removal action. These requirements are action-specific.
"General Standards for Maximum Permissible Emissions," WAC 173-480-050(1)	ARAR	This regulation establishes general standards for all radionuclide emission units and requires emission units to meet WAC 246-247 (use every reasonable effort to maintain radioactive materials in effluents to unrestricted areas) ALARA. The regulation indicates that control equipment of sites operating under ALARA shall be defined as RACT and as ALARACT.	Fugitive and diffuse emissions due to demolition and excavation and related activities would be minimized by meeting WAC 246-247. This requirement is action-specific.
"Emission Monitoring and Compliance Procedures," WAC 173-480-070(2)	ARAR	This regulation applies for determining compliance with the radionuclide emission standard. Compliance with the public dose standard is determined by calculating exposure at the point of maximum annual air concentration in a location in which any member of the public may be located in an unrestricted area.	The potential for radionuclide emissions from some activities under the NTCRA such as fugitive and diffuse emissions during fugitive and diffuse emissions during demolition and excavation and related activities would be performed in compliance with the public dose standard during the NTCRA. This requirement is action-specific.

Table A-2. Identification of Potential State Applicable or Relevant and Appropriate Requirements for the Removal Action

ARAR Citation	ARAR	Requirement	Rationale for Consideration
Source:			
40 CFR 268, "Land Disposal Restrictions"			
WAC 173-303, "Dangerous Waste Regulations"			
WAC 173-400, "General Regulations for Air Pollution Sources"			
WAC 173-460, "Controls for New Sources of Toxic Air Pollutants"			
WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides"			
WAC 246-247, "Radiation Protection—Air Emissions"			
ALARA = as low as reasonably achievable			
BACT = best available control technology			
RACT = reasonably available control technology			
T-BACT = best available control technology for regulated emissions of toxic air pollutants			
TAP = toxic air pollutants			

A2. References

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