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Page 1 of 1

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1	/	Cog. Mgr. R. A. Carlson	R A Carlson	3/19/93	H6-03						
1	/	QA T. L. Bennington	[signature]	4/2/93	H4-16						
1	/	Safety K. A. Smith	[signature] for KA Smith	4-2-93	N1-06						
1	|	Env. L. P. Diediker	[signature] for LPD	4/5/93	T1-60						
1	|	ERSS N. R. Kerr	[signature]	4/2/93	N1-75						
1	|	RRSA J. J. Zimmer	[signature]	4/2/93	N1-83						

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7. Abstract

This document provides a safety assessment of the potential hazards associated with the operation of the Prototype Isolation Surface Barrier (Project W-263).

9. Impact Level 3 ESQ

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CONTENTS (cont)

FIGURES

APPENDIXES

SAFETY ASSESSMENT FOR THE HANFORD PROTOTYPE ISOLATION SURFACE BARRIER

1.0 INTRODUCTION

1.1 PURPOSE

The Westinghouse Hanford Company (WHC) is planning to operate a Prototype Isolation Surface Barrier (Project W-263), hereafter referred to as the Barrier, over the 216-B-57 crib located in the 200-BP-1 Operable Unit in the 200 East Area. This activity will support a comprehensive accelerated remedial action that has been initiated in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1990).

This document provides a safety assessment of the potential hazards associated with the operation of the Barrier and the recommended controls to minimize the consequences of any hazards. The assessment provides a record of the safety analysis and review provided for the W-263 Conceptual Design. The Barrier project is currently in the definitive design stage. The design life of the Barrier is 1,000 years.

The Barrier will consist of a fine-soil layer overlying other layers of coarser materials such as sands, gravels, or fractured basalt riprap (Figure 1). The fine-soil layer will act as a medium in which moisture will be stored until the processes of evaporation and transpiration can recycle any excess water back to the atmosphere. The fine-soil also provides the medium for establishing plants that are necessary for transpiration to take place. The coarser materials placed directly below the fine-soil layer create a capillary break that inhibits the downward percolation of water through the Barrier. The placement of silt loam directly over the underlying coarser materials also will create a favorable environment for containing the biological cycles in the upper portion of the Barrier, thereby reducing biointrusion into the lower layers. The coarser materials will help to deter inadvertent human intruders from digging deeper into the Barrier profile. Low-permeability asphalt concrete layers below the fractured basalt will be used to divert any percolating water that travels beyond the capillary break to a recharge water collection system.

1.2 SCOPE

The scope of this safety assessment will address the potential safety issues resulting from any upset or accident conditions and occupational hazards caused by radioactive and hazardous materials during Barrier operational activities. The safety and health issues to be considered during site preparation and barrier construction will be addressed in site specific work procedures (i.e., the Job Safety Analysis, Radiation Work Permit, and the Hazardous Waste Operations Permit). Specific construction hazards and recommendations for hazard control that were identified during this assessment are compiled in Appendix B.

The prototype Barrier is scheduled to remain in place for a minimum of three years. During that three year period, assessment activities will be conducted to evaluate performance of the Barrier. Destructive testing or

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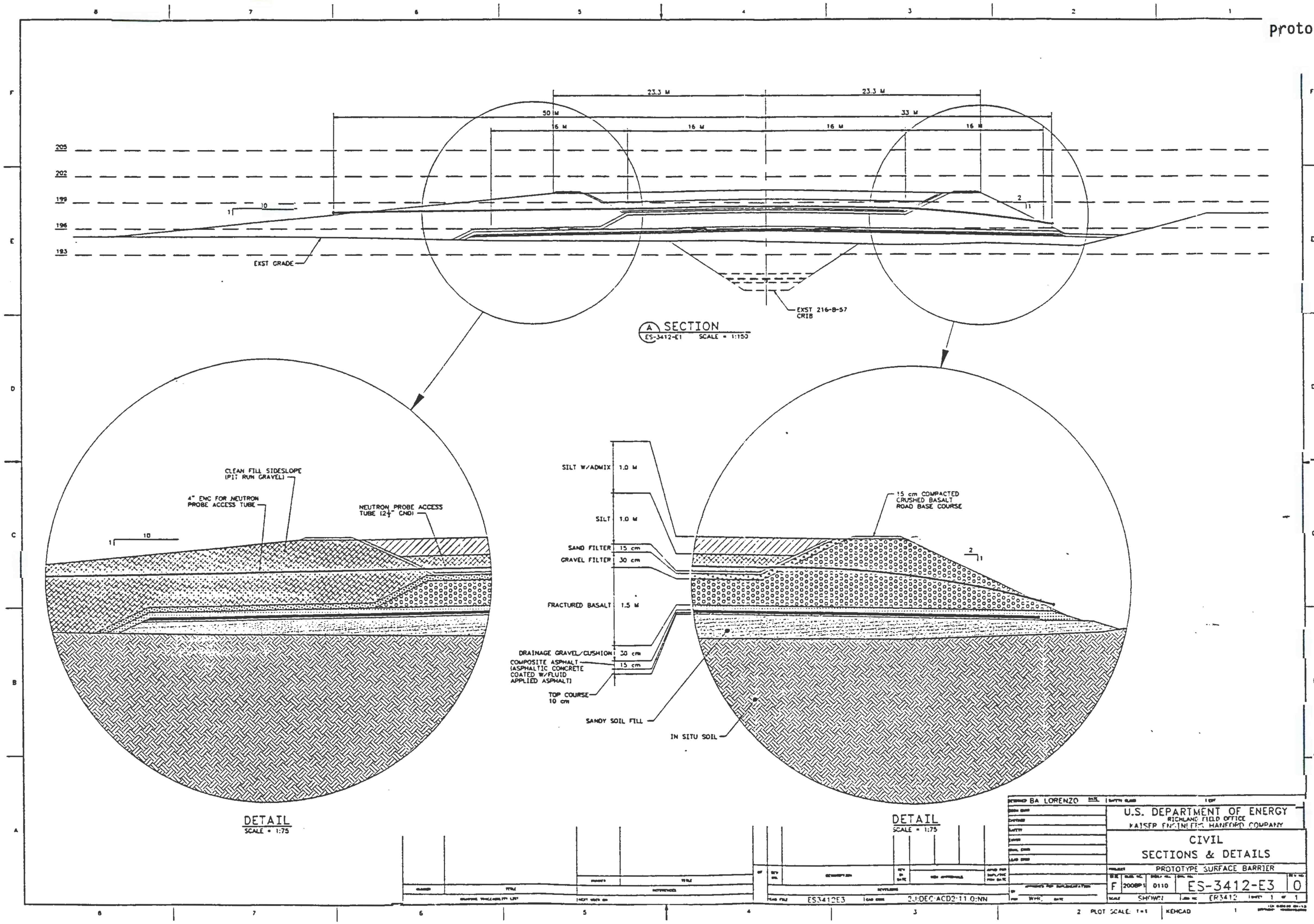
Figure 1.
Prototype Isolation Surface Barrier.



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intrusive investigations (e.g., coring, drilling, or trenching) are not included in the operational plan. If future plans include destructive tests, additional safety analyses will be required.

At the conclusion of the performance assessment phase, the Barrier may remain, in place, for an undetermined time period.

1.3 SUMMARY OF COMMITMENTS

This safety assessment concludes that Barrier operational activities are within the limits of a nonnuclear, general use, hazard classification (WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*). Therefore, no additional safety analyses are required or recommended provided the scope of operations does not change (see Sections 1.2 and 1.3). This is consistent with the requirements in the *Safety Analysis and Review System* (DOE 1986).

The required safety functions are limiting destructive testing (i.e., drilling, coring, or other intrusive activities) and controlling water from simulation tests. One operational safety limit (OSL) and two prudent actions are recommended to assure any activities (during the barrier construction and operational phase) do not impact project site worker safety and result in any adverse consequences to the worker, the public, or the environment. These controls are discussed in Section 4.0.

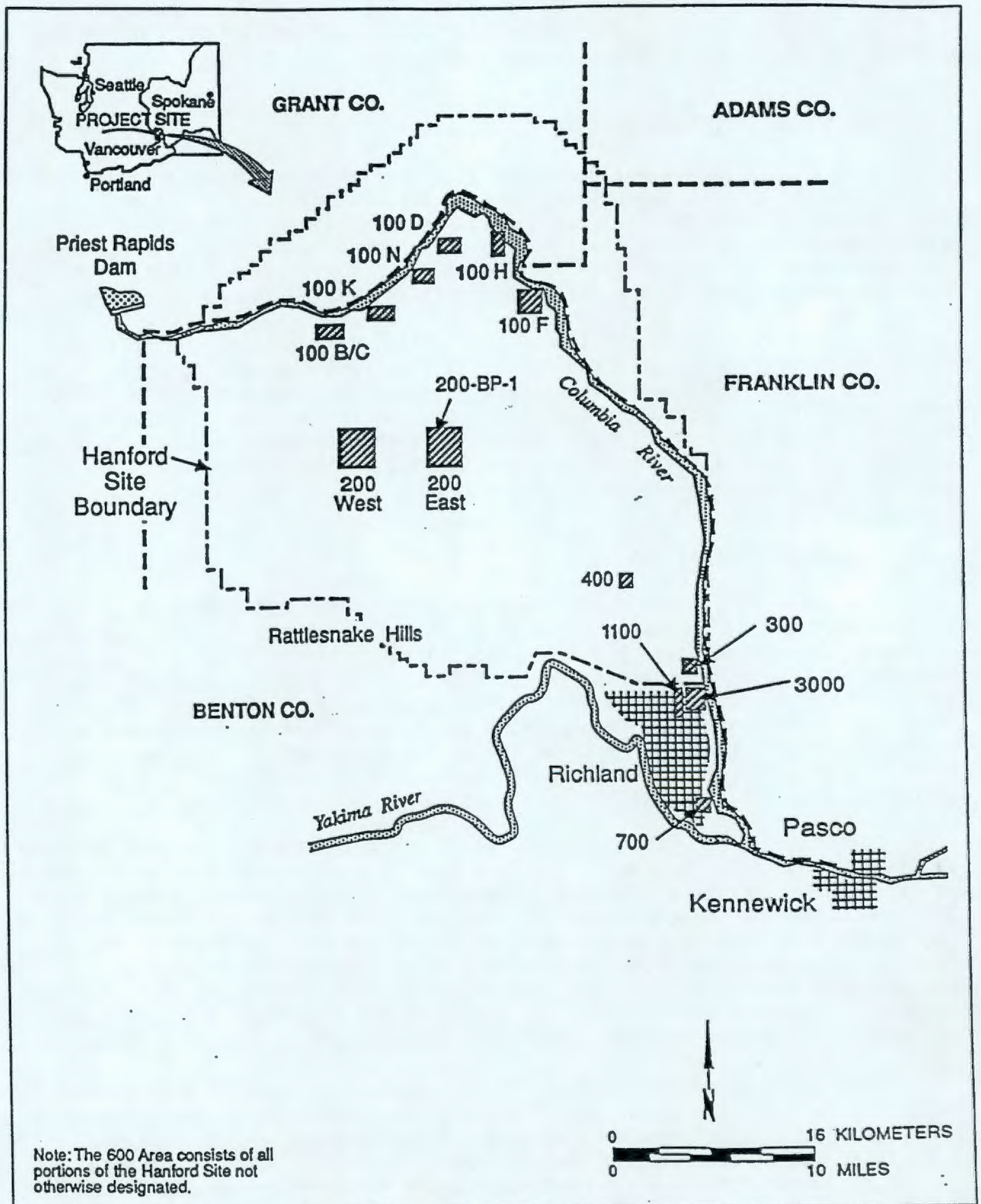
1.4 PROCESS AND OPERATIONS

The Barrier location is the northern edge of the 200 East Area, as shown in Figures 2 and 3. The Barrier is to be installed at the 200-BP-1 Operable Unit over the contaminated 216-B-57 crib. The Barrier will allow in-situ disposal of the waste contained in the crib by effectively preventing plant, animal, human, hydraulic, and wind intrusion for up to 1,000 years (the first three years of testing may require some maintenance activities) without maintenance. The prototype will be tested for a minimum of three years to demonstrate its effectiveness and, if successful, the design will be used to stabilize the remaining nine cribs at the 200-BP-1 Operable Unit.

During operation, the Barrier will be subjected to testing that includes simulating precipitation events that are three times greater than normal and at rates that simulate a 1,000-year storm event. The water penetrating the Barrier to the impermeable asphaltic concrete layer will be collected above the impermeable layer and measured to determine the effectiveness of the Barrier. Any water collected should be free of radioactive or hazardous contaminants because it will have percolated through or run off over clean materials. Because water should not penetrate the impermeable layer, none is available to mobilize residual subsurface contaminants in the crib media.

Test operations will continue for at least three years. During this time, the Barrier will be inspected and routine monitoring and maintenance activities may be performed as required. The monitoring and maintenance activities may include erosion damage repair, reseeding, gas monitoring, groundwater monitoring and frequent monitoring for radioactive contamination. In addition, the Barrier will be checked for anomalous settling and abnormal vegetative or animal disruption.

Figure 2. Hanford Site Map.



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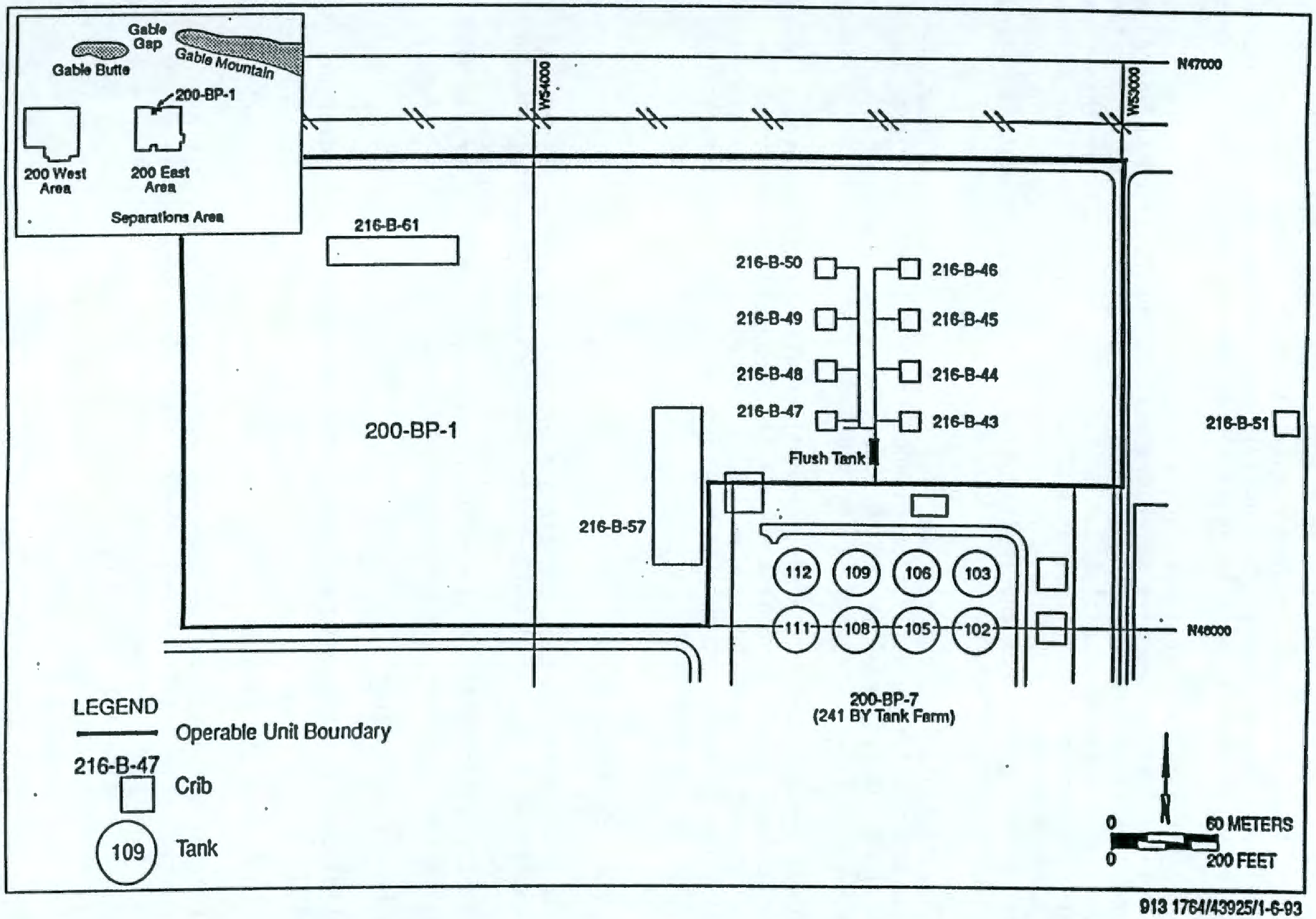

Figure 3. The 200-BP-1 Operable Unit.

1.5 HAZARDS AND RISKS

The Barrier is constructed of nonradioactive materials over sites that include underground radioactive material. No hazardous chemicals are known to be present in the crib (see Section 2.2.1). The industrial health and safety issues are real, but could endanger only those individuals involved in the three year testing and operational activities. Neither workers in proximal facilities or the public will be at risk from Barrier operations.

The Barrier and operational activities meet nonnuclear criteria (WHC-CM-4-46). No radioactive materials will be incorporated or introduced into the Barrier structure during the operational period. The only potential safety issue related to radiological or hazardous materials are those that could result from accidental releases at the 241-BY Tank Farm, the adjacent waste management facility. These issues can be minimized by following existing safety procedures and implementing logical and prudent safeguards against occupational injury.

Hazard classification computations (Appendix A) indicate that the testing, and monitoring activities planned for the Barrier project constitute a general use hazard level (WHC-CM-4-46). The operational, potential, and dismissed hazards are assessed in Section 3.0.

Westinghouse Hanford Company procedures will be implemented to ensure that occupational safety needs are provided. Specific instructions in controlling occupational hazards will be provided in the Job Safety Analysis, the Radiation Work Permit, and the Hazardous Waste Operations Permit that will be written for this project.

1.5.1 Physical Hazards

Barrier operation does not contain or create physical hazards other than those routinely encountered and accepted by the general public. The principal physical hazards are related to vehicular traffic at the project site. Sufficient traffic control and warning devices must be incorporated into the safety program to reduce the risk of injury.

1.5.2 Explosion Hazards

Explosion hazards are not expected to be present during Barrier operation.

1.5.3 Environmental Hazards

Careful attention to engineering specifications and verification of as-built configurations will be required to limit environmental impacts. The potential for inducing remobilization and migration of contaminants during performance testing and compaction/dust control can be eliminated by a functioning recharge water collection system and prudent water application practices during compaction activities.

1.5.4 Construction Related Hazards

Construction related hazards will be addressed in a separate hazards analysis document. Construction activities will primarily involve the use of earth-moving vehicles, road graders, and front end loaders. This equipment will be used to complete land surveys; clear the project site; construct roads, barricades, parking and pipeline facilities; construct a recharge water collection system; build the stratified Barrier; and decommission raw material quarry operations. The construction specifications for completing these activities will be compiled in a work package by the Hanford architect and engineering contractor. Additional observations and recommendations related to construction safety are provided in Appendix B.

1.5.5 Hazards Caused by Other Nearby Facilities

Because of the proximity of the 216-B-57 crib to the 261-BY Tank Farm, prudent action would require observance of selective Tank Farm Safety Practices. Interactive discussions between Tank Farm and Barrier Safety/Project personnel would be helpful in identifying training requirements, personnel protective equipment, and emergency response coordination activities.

1.6 REVIEW AND AUTHORIZATION

The hazard assessment indicates that the Barrier project is a nonnuclear, general use category activity (WHC-CM-4-46). Therefore, no additional safety analyses to assess risk from radioactive or hazardous materials are required or recommended.

2.0 RELEVANT BACKGROUND DATA

2.1 OPERATIONAL EQUIPMENT AND ACTIVITIES

2.1.1 Performance Assessment

The work plan for conducting performance assessment (PA) activities has not been finalized. Preliminary reports indicate that PA activities will consist of experiments to evaluate fluid infiltration, bioturbation, and erosion resistance. Of these, the activity that presents the greatest potential for a safety impact is the infiltration study. No intrusive investigations (e.g., coring, drilling, or trenching) will be conducted during the PA evaluation.

In the infiltration study, a quantity of simulated precipitation will be applied at the top of the completed Barrier. In one test, approximately three times the annual average precipitation will be applied. In a second test, the statistical 1,000-year storm will be simulated. The Barrier will not permit transmission of fluids below the asphalt layer by design. Any water discharged from the Barrier either by run-off or outflow will be collected in the recharge water collection system.

Even if the Barrier only performed at 70% efficiency, no more water than what presently reaches the uncovered crib would be added to the subsurface below the Barrier. If the infiltration study measures unusually low Barrier efficiency, the PA will be concluded and a corrective action initiated to minimize the risk of environmental insult.

2.1.2 Operation

After the initial PA study is concluded, the Barrier will be maintained in place. As long as the Barrier meets design requirements, there is little likelihood that it will be removed.

Operational care activities will include surveillance and monitoring of the Barrier and any associated equipment. During this time, the project site will be visually inspected and routine monitoring and/or maintenance activities will be performed.

An operations work plan has not been completed. However, specific activities are expected (during the three year test phase) to include erosion-damage repair, reseeding, monitoring for potential gaseous emissions, groundwater monitoring, evaluation of animal intrusion and frequent monitoring for any radioactive contamination. Any activities necessary to maintain access control will also be implemented. At a minimum, personnel will ascend the Barrier and traverse the top to inspect the structure for indications of unusual vegetative or animal disruption, abnormal erosion, accelerated settlings or malfunctions of the recharge water collection system.

None of the activities expected to occur during the operations period entail unusual hazards or risks to project site personnel. The risk to inspection personnel would be equal to or less than that presently incurred by personnel who inspect the stabilized crib at the present time.

2.2 INTRINSIC HAZARDS

2.2.1 Barrier Materials

No hazardous substances will be emplaced in the Barrier. The Barrier is composed mostly of natural materials: clean sandy soil, commercially available 5/8 inch crushed basalt, 30 cm (12 in.) minus and 25 cm (10 in.) minus basalt, fine to medium sand silt from the McGee Ranch, and pea gravel. These constituents pose no known hazard.

The radioactivity in the soils near the McGee Ranch are described in Hanford Site Environmental Reports. The most recent report (PNL 1990) indicated that the distribution of radionuclides in the McGee Ranch soils are similar to other offsite locations. The radionuclides represent a very small inventory. The dose received from exposure to McGee Range soils is much less than that received from routine exposure to onsite Hanford Site soils.

2.2.2 Gas Emissions

During past monitoring and sampling activities, gas concentrations in and around the 216-B-57 crib and the 200-BP-1 Operable Unit have been routinely measured. To date, no anomalous gas emissions have been detected. Emissions of toxic chemical or radiological gases are not expected to occur as a result of the proposed activities. Measurements collected during the PA will be analyzed to verify that gas emissions do not present a health hazard.

2.2.3 Radiological Hazards

The surface of the 200-BP-1 Operable Unit was contaminated by fallout from other activities. The contaminated soil has been gathered, placed on top of the contaminated cribs, and covered with a .4 m (1.5 ft) to .6 m (2 ft) thick layer of uncontaminated soil. Further discussion of the stabilization activities are provided in the *UN-216-E-17, Interim Stabilization Final Report* (Hayward 1992).

Radiological surveys at the 200-BP-1 Operable Unit indicate that the radiation levels above the crib are currently nondetectable or at background levels. Subsurface contamination is largely restricted to depths in excess of 1 m (3 to 5 ft). After the Barrier is completed, more than 5 m (16 ft) of earthen material will isolate the workers from the subsurface contamination. There is little likelihood that Barrier operations personnel will ever come into direct contact with radioactive materials in the crib. Monitoring for radioactive contamination will be required at the frequency identified in the site specific RWP.

2.2.4 Radiological Materials in Crib 216-B-57

The radiological inventory of the contaminated crib has been described in the *Safety Assessment for 200-BP-1 Task 4* (Kerr 1992). A summary of the material inventory has been compiled and printed in Appendix C. As long as the stabilization layer over the crib is not breached, project site workers will not be brought into contact with the materials beneath.

The *Phase 1 Remedial Investigation for 200-BP-1 Operable Unit* (DOE-RL 1993) included data describing the distribution of radionuclides in the subsurface at the 216-B-57 crib. The data shows that the maximum detected concentrations of radionuclides of potential concern lie at depths of 8 m (27 ft) to 10 m (34 ft) below the stabilization cover. Near surface contamination is restricted to the 0.6 m (2 ft) to 3 m (10 feet) interval below the stabilization cover. Radiological surveys and sampling performed after the stabilization cover was emplaced verified that the level of radioactivity at the surface was less than the acceptable limits in WHC-CM-7-5, *Environmental Compliance Manual*.

2.3 NATURAL PHENOMENA

Each of the hazards presented by natural phenomenon are described as it affects the function of the Barrier throughout its design life and the safety of the project site workers.

2.3.1 Seismic

The Barrier is not designed to maintain a shielding, confinement, or containment safety function during an earthquake. Performance expectations for Barrier stability and structural integrity will be defined in the PA.

2.3.2 Thunderstorms

Thunderstorms occur at an average frequency of about two per month in the summer. The 200 Area Fire Department reports that over the last five years, several fires have been initiated by lightning near the 200-BP-1 Operable Unit. Even if a fire were to strip the vegetation from the Barrier, the rain probably would not damage or penetrate the Barrier. Performance assessment testing will have evaluated a section of the denuded Barrier for verification of its ability to withstand three times the average annual maximum precipitation or 1,000-year storm.

2.3.3 Other Natural Phenomena

Although dust devils abound in the Hanford Site area, tornadoes are seldom experienced west of the Rocky Mountains or in the Pacific Northwest. The probability of a tornado occurring at the Hanford Site is so small that they are considered incredible.

High winds are experienced at the Hanford Site. Very high winds frequently result in dust storms lifting loose earth and sand, often from recently worked soil on nearby farms. Because radioactive deposits in this area have been stabilized with a 0.4 m (1.5 ft) to 0.6 m (2 ft) thick layer of crushed rock, even extreme winds would not affect the job site. The Barrier is designed to withstand high winds during its life. The mixture of pea gravel with the silt stabilizes the exposed surface that is further stabilized with vegetation. Workers are not subjected to hazards other than decreased visibility and discomfort.

Flooding is not a hazard at the 200 East Area. Tidal waves, tsunamis, and seiches are prevented from reaching the Hanford Site by the Cascade Mountain Range. The greatest flood postulated for this region requires total and complete failure of Grand Coulee Dam with subsequent failure of each downstream dam as the wave front collides with it. The *Final Environmental Impact Statement - Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington* (DOE 1987) has analyzed the effect of flooding and concluded that this event does not threaten the 200 East Area.

2.4 POTENTIAL ENERGIES

The hazards from energy sources only involve vehicular and pedestrian traffic. The approach and exit from the Barrier site will be planned to avoid intersections and blind corners, graded to prevent disturbing underlying soil surfaces, marked to indicate the approved access route, and watered down to minimize dust. The quantity of water applied to control dust will be minimized so that flooding, which could mobilize subsurface contaminants, will not occur.

2.5 SITE CHARACTERISTICS

The Hanford Site is located in the south-central part of Washington State. The Hanford Site is approximately 256 km (170 mi) southeast of Seattle and 188 km (125 mi) southwest of Spokane (Figure 2). The 200-BP-1 Operable Unit is located in the approximate center of the Hanford Site, along the northern boundary of the 200 East Area fence (Figure 3). The 216-B-57 crib is located northwest of the 241-BY Tank Farm. The following subsections summarize the site information provided in DOE-RL 1990 and DOE-RL 1993. Climatic information has been updated using data supplied in February 1993 by Hanford Meteorological Station personnel.

2.5.1 Topography

The 200-BP-1 Operable Unit is approximately 198 m (650 ft) above mean sea level on a terrace called the 200 Areas Plateau. The terrace decreases in elevation to the north, northwest, and east towards the Columbia River. The terrace escarpment is steep, with elevation changes between 15 m (50 ft) and 18 m (60 ft).

2.5.2 Geology

The vadose zone beneath the 200-BP-1 Operable Unit consists of interlayered sandy gravel, gravelly sand, and silty-sandy gravel of the Hanford Formation. The Ringold Formation, which ordinarily lies beneath the Hanford Formation in the 200 East Area, has been removed by pre-Hanford Formation erosion. The water lies within Hanford Formation sediments at approximately 121 m (400 ft) above mean sea level.

2.5.3 Meteorology

Prevailing wind directions are from the northwest in all months. Secondary wind directions are indicated as southwesterly winds. Northwest winds occur most often in the winter and summer. Southwesterly winds are associated with spring and summer months. The average summer wind is approximately 15 km/h (10 mi/h) and the average winter winds are approximately 10 km/h (7 mi/h). High winds are usually associated with the dust storms experienced in the region.

2.5.4 Temperature and Humidity

The average relative humidity is 54% with average ranges between 35 and 75%. The average monthly temperatures range from a low of -1.6°C in January to a high of 24.4°C in July.

2.5.5 Precipitation

The annual average precipitation at the Hanford Meteorological Station is 16 cm (6.3 in.). Annual rainfall is from 7 cm (3 in.) to 28 cm (11 in.) with most of the precipitation occurring in the winter months. The record snowfall for 1992 to 1993 exceeded 134 cm (53 in.). During the largest single storm (1992 to 1993), 31 cm (12.4 in.) of snow accumulation occurred.

2.5.6 Demography

Approximately 110 people live within 15 km (10 mi) of the 200 Areas. There are no residents within a 1.5-km (1-mi) radius of the 200-BP-1 Operable Unit. The city of Richland is approximately 27 km (18 mi) south. The working population for all shifts in the 200 Area is approximately 2,400. The site boundaries are approximately 10 km (7 mi) northwest of the Columbia River and 9 km (6 mi) south of Highway 240.

2.5.7 Nearby Facilities

The 200-BP-57 crib is located approximately 100 m (330 ft) northwest of the 216-BY Tank Farm. The BY Tank Farm has been designated as a low hazard operation; however, this determination is under review for upgrade (Becker 1990). Because of potential unreviewed safety questions, no operations take place within the Tank Farm that could aggravate the existing situation. Therefore, Barrier operational personnel will not be subjected to additional hazards because of their proximity to the 216-BY Tank Farm.

3.0 HAZARD ASSESSMENT

3.1 SUMMARY OF POTENTIAL HAZARDS

There are a number of hazards that have such a low probability of occurrence that they are termed incredible or have such low importance that they need not be considered true hazards. The following is a list of those potential hazards: (1) further spread of contamination by liquids bearing radioactivity or toxic chemicals; (2) release of radioactive or toxic gases; (3) tornadoes; (4) floods; (5) use of soils from the McGee Ranch; and (6) Barrier testing, which is discussed in Section 3.2.

The only potential hazard to workers is direct contact or exposure to radioactive materials in the 200-BP-1 cribs. As long as the stabilization covers over the cribs are not breached or removed, this hazard will have no affect on Barrier project site personnel.

3.2 NEGLIGIBLE HAZARDS

The cribs containing radioactive chemicals are covered with permeable earth fill and are exposed to rain that slowly drives the contamination deeper. Layers of asphaltic concrete in the Barrier will isolate the crib from any more water percolation, either natural or intentional. When the Barrier is complete, incidental water will seldom (if ever) reach the asphalt. Thus, liquids bearing radioactivity or toxics will no longer migrate from the crib.

When the Barrier is finished, it will be subjected to testing that includes simulating precipitation at a rate comparable to the 1,000-year maximum storm and at a total of three times the average annual rainfall. The water penetrating the Barrier to the asphalt layer will be collected and measured to determine the effectiveness of the Barrier. Any water collected should not be contaminated because it will have only run over or through clean materials. Because the water is collected above the asphalt, it should not penetrate the asphalt nor be available to mobilize subsurface contaminants.

Any gases currently generated within the crib pass upwards through the soil and are dissipated in the atmosphere. During characterization sampling, the project site and groundwater well bores are monitored for toxic gas emission. To date, no gases have been detected. When the Barrier is finished, any gases (if present) will be detained longer getting around or through the Barrier. This will result in greater decay of any radioactive gases that may be present. Any gas production that currently originates by chemical reaction will be reduced by the dryer conditions prevailing beneath the completed Barrier.

As stated in Section 2.3.3 above, tornadoes and floods are not considered as credible events based upon their probabilities.

3.3 HEALTH AND SAFETY HAZARDS TO PROJECT SITE WORKERS OR PUBLIC

There are no credible hazards to project site workers or the public as a result of Barrier operational activities.

3.4 ENVIRONMENTAL HAZARDS

Barrier operation is not expected to degrade the environment. On the contrary, the Barrier is expected to reduce the threat from materials in the crib through migration or direct contact. The impact of Barrier operations on the environment should be addressed in separate National Environmental Protection Agency documentation.

3.5 CONTROLLING OF SIGNIFICANT HAZARDS

There are no hazards that may be controlling or significant. The hazards mostly affect the construction crew engaged in building the Barrier. The greatest of these involves collisions between moving equipment and other equipment, buildings, and pedestrians. This hazard is faced by construction crews on a daily basis whether at the Hanford Site or, for example, landscaping a condominium complex. At the Hanford Site, it is more likely that safety procedures will have been prepared and will be enforced.

4.0 OPERATIONAL SAFETY LIMIT AND PRUDENT ACTIONS

The controls in this section are necessary to ensure the basis for this safety assessment. There is one control provided in the form of an OSL. An OSL is an auditable limit established within Westinghouse Hanford Company for the safe operation of a nonreactor nuclear facility or activity. The U.S. Department of Energy, Richland Field Office has a policy that at least one acceptable limit be established to assure the facility is operated or activity is performed safely and within the bounds of the safety assessment. One OSL is implemented that applies to the operational phase of the Barrier.

These controls should be incorporated into the appropriate lower tier documentation and verified by line management through the readiness review process as required by WHC-CM-7-7 (EII 1.13)

4.1 OPERATIONAL SAFETY LIMIT

<u>OPERATIONAL SAFETY LIMIT 1</u>

1.1 TITLE: Limiting Intrusive Activities and Control of Water from Simulation Tests.

1.2 APPLICABILITY: This limit applies to destructive testing (i.e., drilling, coring, or other intrusive activities) or collection of fluid run-off from simulation tests.

1.3 OBJECTIVE: To reduce the potential for intrusion into the crib from drilling, coring, or any water simulation tests.

1.4 REQUIREMENTS:

1. No coring, drilling, or any other intrusive activity, including destructive testing of the prototype surface barrier, will be conducted.

2. All fluid used for water simulation tests shall be limited to the quantities described in the work plan with the run-off being collected and measured for contamination.

1.5 SURVEILLANCE:

1. Work requests addressing any intrusive activities in or around the barrier shall be reviewed by Safety Assurance.

2. The responsible operating organization shall review the water simulation activities weekly to verify the quantities of water being used are consistent with those quantities defined in the work plan. The results of the weekly surveillance shall be documented in the field log.

1.6 RECOVERY: Noncompliance with the requirements:

1. Once a determination has been made that the operating organization is out of compliance with the requirements of this OSL, operations shall immediately cease. The approval of Safety Assurance will be required for restart of operations.

2. The operating organization shall be required to determine if there are any impacts to the Barrier integrity as a result of any intrusive activities or addition of quantities of water that exceed the limits for the simulation tests as identified in the work plan.

3. The OSL violation shall be documented as an unusual occurrence report.

Noncompliance with the surveillance requirements:

1. The surveillance shall be performed immediately.

2. If the surveillance determines noncompliance with the requirements, then initiate recovery actions as identified in Section 1.6, "Noncompliance with the requirements."

3. Failure to implement a surveillance requirement shall be documented as an off-normal occurrence.

1.7 AUDIT REPORT: The field log shall be audited weekly to verify the responsible operating organization is in compliance with the requirement and surveillance. The results of the audit shall be documented in the field log.

1.8 BASIS: The limits are provided as a means to reduce the potential for disturbing the contaminants in the crib and controlling the quantities of water to eliminate any transmission of fluids below the asphalt layer of the barrier.

The following recommended prudent actions are management commitments to as low as reasonably achievable principles and should be implemented through the appropriate work procedures.

4.2 PRUDENT ACTIONS

Function 1- Interaction between Barrier project site workers.

Prudent Action 1 - Because of the proximity to the 241-BY Tank Farm, interaction between Barrier project site workers and Tank Farm personnel is recommended to ensure that the level of protection and training used by Barrier workers is compatible with Tank Farm Operational Safety guidelines.

Function 2- Monitoring of stabilization material during construction activities.

Prudent Action 2 - Observers with authority to temporarily suspend activities should be present during all operations to ensure that the existing stabilization material is not disturbed to the extent it threatens to expose radioactive material. Suspected sites of penetration should be immediately isolated; project site workers should be kept away, and surveyed by a health physics technician to determine if they have been exposed to radioactive material and to what extent the contamination has spread. A recovery plan should be prepared by the contracting agency and approved by the Operable Unit Manager and WHC Health and Safety. The plan should specify, in addition to recovery actions, procedures that would prevent future occurrences.

5.0 REFERENCES

Becker, D. L., 1990, *Nonstabilized Single-Shell Tank Hazard Identification and Evaluation*, WHC-SD-WM-SAR-022, Westinghouse Hanford Company, Richland, Washington.

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PNL, 1990, *Hanford Site Environmental Report for Calendar Year 1989*, PNL-7346, Pacific Northwest Laboratory, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance Manual*, Westinghouse Hanford Company, Richland, Washington.

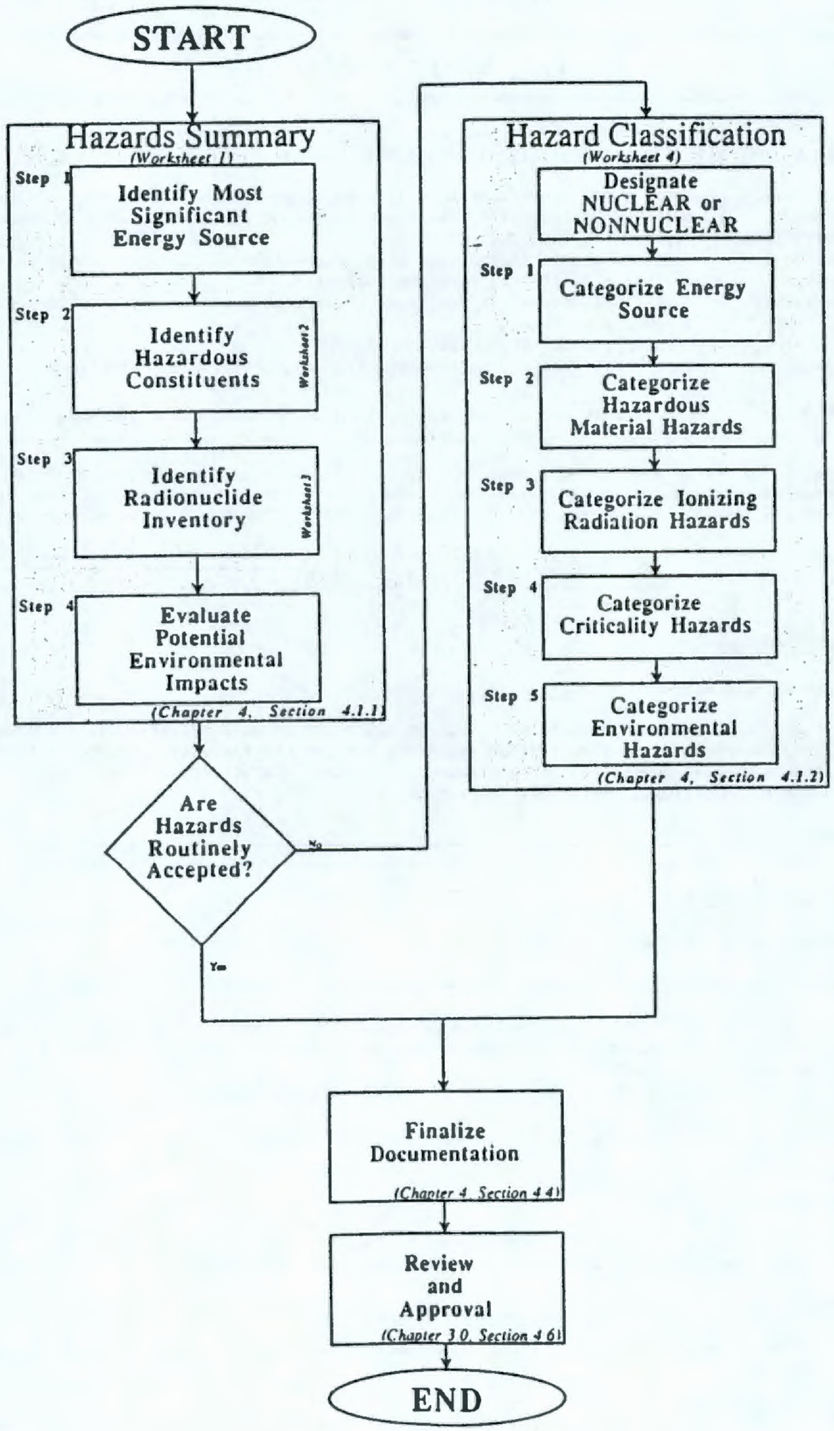
WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual*, Westinghouse Hanford Company, Richland, Washington.
EII 1.13, "Environmental Readiness Review."

APPENDIX A

HAZARD CLASSIFICATION WORKSHEET

9312931682

Figure 4-1. Simplified Hazard Classification Method.



9 3 1 2 9 3 2 1 6 8 3

Figure 4-2. Worksheet 1.

Worksheet 1

HAZARDS SUMMARY

STEP 1
Energy Source Hazards - Circle the most significant energy hazards

	Electrical:	capacitors, transformers, batteries, exposed conductors, high-voltage sources
°	Motion:	pulleys, belts, gears, shears, pinch points, vehicles, mass in motion
°	Gravity-Mass:	falling, falling objects
	Pressure:	confined gases, explosives, chemical reactions, stressed mechanical systems
°	Chemical:	corrosive materials, reactive materials
	Heat/Fire:	electrical, steam, flames, solar, chemical reactions, combustible materials, flammable materials
	Cold:	cryogenic materials, walk-in freezers
	Radiant:	laser, ultraviolet, infared sources, magnetic fields, RF fields
	Others:	

☒ There are no energy sources of a magnitude capable of seriously injuring several facility occupants or causing injuries outside the facility. Injury may occur to a limited number of individuals within the facility due to the types of hazards associated with office work, shop activities, etc.

Comment: Items with an ° indicate a potential hazard for workers at the barricade site.

STEP 2
Hazardous Material Inventory

☐ Worksheet HC.2 attached.

☒ There are no hazardous materials of a type or magnitude capable of seriously exposing several facility occupants or causing serious exposures outside the facility, Hazardous materials are limited to typical quantities of maintenance, cleaning, and structural materials routinely encountered in offices, residences, workshops, etc.

Comment:

STEP 3
Ionizing Radiation Hazards

☐ Worksheet HC.3 attached.

☒ There are no radiological hazards. Radiation sources, if present , are limited to:

- those commercially available to the public and exempt from licensing requirements
- encapsulated or sealed sources meeting the requirements of ANSI standard N542
- instrument check sources
- sources considered nonradioactive based on regulatory guidance

Comment:

STEP 4
Environmental Hazards

☒ Radioactive/hazardous materials are limited to types, forms, and quantities that, if released to the environment would present only negligible damage to the environment

Comment:

☐ Significant damage could occur if the hazardous/radioactive materials were released to the environment.

Comment:

Figure 4-3. Worksheet 2.

Worksheet 2

STEP 2

HAZARDOUS MATERIAL INVENTORY

Hazardous Constituent	Quantity
Hot Applied Sealant	1400g
(Hazardous Only While Molten)	See Appendix C

Figure 4-4. Worksheet 3.

Worksheet 3

STEP 3

RADIONUCLIDE INVENTORY

Radionuclide	Activity	RG Value
Only Small Quantities of Naturally Occurring Isotopes.		

Figure 4-5. Worksheet 4. (sheet 1 of 2)

Worksheet 4

Hazard Classification

NUCLEAR or NONNUCLEAR

☒ NONNUCLEAR ☐ NUCLEAR

STEP 1
Energy Source Hazards

If not controlled, energy source(s) are capable of:

	L	M	H
• severely injuring several facility occupants and/or causing minor injuries outside the facility	☒		
• severely injuring individual outside the facility and/or causing minor injuries offsite		☐	
• severely injuring individuals offsite			☐

STEP 2
Hazardous Materials Hazards

	L	M	H
• serious overexposure to several facility occupants and/or exposures = limits outside the facility	☒		
• serious overexposures outside the facility and/or exposures = limits offsite		☐	
• serious overexposures offsite			☐

STEP 3
Ionizing Radiation Hazards

Unit Release Dose Equivalent (URDE) Table

RG	Column A Inventory	Column B URDE (rem/Ci)	A x B
1		1.0E+2	
2		5.0E-2	
3		5.0E-3	
4		2.0E-7	
5		7.0E-4	
		Total A x B =	

Radiological Hazard Class Value = C = (Total A x B) x (Release Fraction) x (Remoteness Factor)

C = __________.

Radiological Hazard Classification

C	Hazard Class
$C \leq 0.01$	Low
$0.01 < C \leq 100$	Moderate
$C > 100$	High

Figure 4-5. Worksheet 4. (sheet 2 of 2)

Worksheet 4 (cont)

Hazard Classification

	L	M	H
• radiological hazard class value ≤ 0.01	☐		
• radiological hazard class value 0.01 < x ≤ 100		☐	
• radiological hazard class value > 100			☐

or

	L	M	H
Only nondispersible operating conditions exist, that is, (1) nondestructive operations with radioactive materials in solid, grouted, or vitrified form, or (2) storage of radioactive materials in DOT approved shipping containers, metal pipe nipples, or fire-resistant safes.	X☒		

STEP 4

Nuclear Criticality Hazard	L	M	H
> 45% minimum critical mass of fissionable material		☐	

STEP 5

Environmental Hazard	L	M	H
The type, form, and quantity of hazardous/radioactive material is such that, if released to the environment could cause:			
• moderate onsite environmental damage requiring remedial action, but negligible damage offsite	☐		
• major onsite environmental damage, possibly irreparable or non-containable		☐	
• moderate contamination spread offsite requiring site response		☐	
• an uncontained contamination spread offsite, potentially resulting in loss of public resources			☐

Summary of Results

Facility Title ______________________________

Facility Designation ☐ Nuclear ☒ Nonnuclear

Facility Classification ☐ Low ☐ Moderate ☐ High

X☒ General Use

APPENDIX B

POTENTIAL CONSTRUCTION HAZARDS

1.0 GENERAL CONSTRUCTION ACTIVITIES

Construction activities will be completed using standard earth-moving vehicles, excavation equipment, and ancillary heavy equipment (for example, trucks, front-end loaders, and road graders). The construction activities will be described in detail in a construction specification document prepared by the Hanford Site architect and engineering contractor.

The following activities are the major work elements anticipated to be necessary to prepare the project site and construct the Barrier.

- Abandon groundwater monitoring well 299-E33-24
- Survey area and install survey markers
- Construct gravel access roads and parking area
- Place signs and chain barricades
- Clear, grub, and level the project site
- Install raw water pipelines
- Install recharge water collection system and retention basins
- Place asphaltic concrete
- Develop basalt mining operation
- Place fractured basalt bio-intrusion barrier and side slope
- Place and compact crushed rock gravel filter
- Excavate, place, and compact clean soil and gravel
- Excavate, place, and compact sand filter
- Place geotextile separator/cushion over sand filter
- Excavate, blend, and place silt layer
- Place and compact crushed rock erosion barrier
- Decommission basalt mining operation and silt borrow area.

1.1 WELL ABANDONMENT

Abandonment of the groundwater monitoring well does not entail any radiological or chemical hazards. The well will be sealed in place using commercially available grout cement or bentonite. The monitoring well abandonment will be completed according to the procedures contained in WHC-CM-7-7, *Environmental Investigations and Site Characterizations Manual* (EII 6.10), which conforms to the requirements provided in WAC 173-160. Pertinent portions of WHC-CM-7-7, the construction specification document, and recommendations from this analysis will be incorporated in the Job Safety Analysis, the Hazardous Work Permit, and the Radiation Work Permit documents.

1.2 MILITARY ORDINANCE

Small caches of military ordinance have been discovered at the McGee Ranch (see Appendix C). Because earth-moving equipment will be used for excavation, the site should be screened by a qualified munitions auditor before excavation commences. If these precautions are implemented, no remnants of military ordinance are expected to be present in the Barrier material.

1.3 ASPHALT SEALANT

Asphaltic concrete, hot applied sealant, and a perforated polypropylene geotextile are the nonnatural components of the Barrier. No hazards are associated with the geotextile. The asphaltic concrete will be applied by a commercial paver. The concrete will be mixed offsite, hauled to the project site, and applied much like a highway. No hazards are anticipated other than those common to such work.

The hot applied sealant, however, is to be melted onsite and applied again by a commercial paver. The sealant is rated No. 1 (slight) with respect to acute health and fire hazards. The health hazards are related to inhalation of vapors and burns on the skin from contact with hot sealant. The control measures in Section 2.3 should be enforced not only for contractor personnel but for Hanford Site employees in the proximate vicinity.

2.0 HAZARDS

2.1 LIGHTING STRIKES

Lightning would cause the greatest risk to pedestrians and operators of construction equipment not having enclosed cabs. Several prudent actions can be taken to mitigate the threat to individuals at or near the 200-BP-1 Operable Unit.

- Allow nearby parking of personal vehicles, because steel roofed vehicles have been shown to afford the greatest protection from lightning.
- Require that construction buildings and trailers be equipped with lightning rods that are properly grounded.
- Alert supervisors to the potential danger and instruct them to allow project site workers to seek shelter while the storm is still approaching.

2.2 MOTION HAZARDS

The activity will involve earth-moving machinery from which pedestrian traffic and other machinery may be hidden from view. Over the years, prudent safety procedures have been developed and are recognized in the *Washington Administrative Code*; it is both recommended and required they be enforced.

In addition, the entrance and exit from the project site shall be planned to avoid intersections and blind corners; filled and graded to prevent disturbing underlying soil surfaces; marked to indicate the approved access route; and watered down to minimize dust. The quantity of water applied to control dust will be minimized so that flooding, which could mobilize subsurface contaminants, will not occur.

Fire hazards associated with mobile refueling, if used , and the sealant melting kettles can be addressed by the 200 Area Fire Department, provided they are briefed on the activities at each location and the route to each location.

2.3 RADIOLOGICAL HAZARDS

The radiological hazards during operation entail receiving an unnecessary exposure for the buried crib. This event could occur if the 0.5 m (1.5 to 2 ft) stabilization earthen cover is breached. The most probable mechanism for causing such a breach is by severe disruption of the cover by heavy equipment during site preparation. To prevent this situation, an onsite observer should be stationed at the project site during the initial construction activities to ensure the stabilization layer that presently covers the crib is not breached or removed.

2.4 CONTAMINANT MIGRATION

The potential for environmental damage could be initiated by indiscriminate use of compact water during construction. Construction activities for the Barrier will place sandy soil directly on the surface and be shaped and compacted to the required configuration; then, a course of 5/8 in. crushed basalt will be placed and compacted above that. These activities will require water for dust control. No more water should be used than is necessary and should not penetrate the surface more than a few inches.

3.0 COMPLIANCE REQUIREMENTS

The following items are required to maintain compliance with Federal and State laws, requirements, codes, standards, and orders.

1. All contractors involved with Barrier construction shall be required to submit a document detailing the safety procedures that will be implemented during construction. These procedures shall be commensurate with WAC 296-155 (see parts F, M, N, and R). Westinghouse Hanford Company will direct the preparation of these procedures.

2. The construction routing shall be planned, scheduled, prepared, marked, and maintained to promote traffic safety and to prevent disturbing subsurface radioactive material.

3. The existing wells installed within the crib area will be sealed before the Barrier is constructed. Wells shall be abandoned in accordance with WAC 173-160, as discussed in WHC-CM-7-7 (EII 6.10).

3.1 RECOMMENDED CONTROLS AND LIMITS

The controls and limits in this section are intended to keep the activities associated with construction and maintenance of the Barrier within the limits of this safety assessment.

1. Construction buildings and trailers shall be equipped with properly installed and grounded lightning rods.

2. Limits shall be established and enforced for water used for dust

control and compaction so it does not mobilize subsurface contaminants.

3. The 200 Area Fire Department shall be briefed on the activities, combustion potential, and routes to the locations of highest fire potential such as refueling sites, and sealant melting sites. Such areas shall be cleared to an appropriate radius of combustible materials.

4. The following apply if silts from the McGee Ranch are used:

   a. The work area shall be presurveyed for potentially military ordinances or other explosive materials.

   b. If pyrotechnics or ordinances are found, it shall be removed by proper authorities.

   c. All workers at the project site shall be cautioned to the possible existence of explosives, how to report any findings, and to avoid such materials.

5. The control measures for the hot applied sealant specified in the Material Safety Data Sheets shall be enforced. In addition, the melting kettles shall be located downwind of the site and at a prudent distance [for example, at least 457 m (500 yd)], if possible, from existing activities or facilities.

4.0 REFERENCES

WAC 173-160, 1990, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

WAC 296-155, "Washington Industrial Safety and Health Act," *Washington Administrative Code*, as amended.

WHC-CM-7-7, *Environmental Investigations and Site Characterizations*, Westinghouse Hanford Company, Richland, Washington.
EII 6.10, "Abandoning/Decommissioning Ground Water Wells."

APPENDIX C

DISCUSSION OF RADIOLOGICAL INVENTORY IN CRIB 216-B-57

1.0 RADIOLOGICAL INVENTORY IN CRIB 216-B-57

The remedial investigation/feasibility study work plan for the 200-BP-1 Operable Unit includes consideration for crib 216 B-57 (DOE-RL 1990). It was determined that crib contamination in the vadose zone is a residual of chemicals and radionuclides bound and filtered from the discharged liquid wastes. The liquids discharged were the residual liquids from a flocculation or settling process that was performed in the BY storage tanks. Chemicals were added to the BY storage tanks to precipitate radioactive contaminants to the tank bottoms. The process was performed using a cascading sequence. Flocculent was added and settling time was allowed given to progressively precipitate the radioactive contaminants. The effectiveness of the process was not well documented, leaving questions regarding the specific characteristics of the residue retained in the soil column. The work plan includes a conservation reconstruction of postulated liquid discharges to the crib. Table B-1 provides a summary of the postulated discharges.

Table B-1. Summary of the Postulated Discharges.

Total discharges	
Substance (chemicals in kg)	Crib 216-B-57
Ammonia carbonate	1.20 E+04
(radionuclide in Ci decayed to April 1986)	
Cobalt-60	1.50 E-2
Strontium-90	2.01 E+0
Ruthenium-106	6.00 E+0
Cesium-137	2.46 E+2
Plutonium-239	1.10 E-2
Plutonium-240	2.87 E-3
Uranium-238	2.90 E-4
Volume (liters)	8.40 E+7
Year(s)	1968 to 1973
Duration	76 months

1.1 CONCENTRATIONS

The contaminant inventory in the vadose zone is unknown. Simplified and conservative assumptions were made to address the potential bounding concentration of the substances in the vadose zone of the 216-B-57 crib. Westinghouse Hanford Company Environmental Technology developed a worst-case basis that assumes all of the radionuclides discharged during the operation life of the crib (1968 to 1973) are confined in a four feet deep cylindrical zone beneath the crib. Significant amounts of tritiated waste are not expected to be retained in the soil.

Westinghouse Hanford Company Environmental Engineering developed a basis that predicts the fraction of soluble chemicals residing in the soil. Westinghouse Hanford Company Geosciences reviewed the basis and concurred that the radionuclide concentration assumption would be a bounding case and that the fraction derivation would reasonably represent the chemical components that would remain in the soil. The postulated concentrations of the constituents are summarized below in Table B-2.

Table B-2. Postulated Concentrations of Constituents.

Maximum concentrations	
Substance	Crib 216-B-57
Contamination	--
Volume	170 m^3
Chemicals/ppm	--
Ammonia carbonate	1.40 E+1
Radionuclide/uCi/cm^3 Decayed to April 1986	
Cobalt-60	8.65 E-5
Strontium-90	1.18 E-2
Ruthenium-106	3.50 E-7
Cesium-137	1.45 E+0
Plutonium-239	6.23 E-5
Plutonium-240	1.69 E-5
Uranium-238	1.70 E-6

1.2 OTHER CHARACTERISTICS

Ammonium carbonate was evaluated to identify potential hazards. Ammonium Carbonate decomposes on exposure to air with loss of ammonia (NH_3) and carbon dioxide (CO_2) and converting to sodium bicarbonate. The alkaline discharges and drying action following the discharge termination is expected to have liberated the free NH_3 and CO_2. The ammonium carbonate does not represent a hazard to the Barrier construction activities over the 216-B-57 crib.

Other hazardous chemical compounds may exist as a result of discharges into the crib. The complexity of the discharge effluents and limited historical data make identification impossible.

Other hazards involved with the construction of the Barrier are the normal occupational and safety hazards involved with construction and movement of large quantities of soil; i.e., operation of earth-moving machinery, walking-working surfaces proximity awareness, and barricading.

2.0 REFERENCE

DOE-RL 1990, *Remedial Investigation Feasibility Study Work Plan for the 200-BP-1 Operable Unit Hanford Site, Richland, Washington*, Rev. 1, DOE/RL 88-32, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

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