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DOE/RL-96-73
Revision 1

324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Areas Closure Plan



United States
Department of Energy
Richland, Washington

Approved for Public Release

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**STATE ENVIRONMENTAL POLICY ACT
ENVIRONMENTAL CHECKLIST**

FOR

**HANFORD FACILITY,
324 BUILDING RADIOCHEMICAL ENGINEERING CELLS,
HIGH-LEVEL VAULT, LOW-LEVEL VAULT, AND ASSOCIATED AREAS CLOSURE
PLAN**

March 1998

**WASHINGTON ADMINISTRATIVE CODE
ENVIRONMENTAL CHECKLIST FORMS
[WAC 197-11-960]**

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1 A. BACKGROUND

2 1. Name of project, if applicable:

3
4
5 Closure of the 324 Building Radiochemical Engineering Cells (REC), High-Level Vault (HLV), Low-Level
6 Vault (LLV), and Associated Areas, 300 Area, Hanford Site.

7
8 2. Name of applicants:

9
10 U.S. Department of Energy, Richland Operations Office (DOE-RL).

11
12 3. Address and phone number of applicants and contact persons:

13
14 U.S. Department of Energy
15 Richland Operations Office
16 P.O. Box 550
17 Richland, Washington 99352.

18
19 Contact Persons:

20
21 J. E. Rasmussen, Division Director
22 Office of Environmental Assurance,
23 Permits, and Policy Division
24 (509) 376-5541.

25
26 4. Date checklist prepared:

27
28
29 March 1998

30
31 5. Agency requesting the checklist:

32 Washington State Department of Ecology
33 Kennewick Office
34 1315 West 4th Avenue
35 Kennewick, Washington 99336

36
37 6. Proposed timing or schedule: (including phasing, if applicable):

38
39 This SEPA Environmental Checklist is being submitted to support closure of units within the 324 Building.
40 A schedule for closure activities is proposed as part of the closure plan.

41
42 7. Do you have any plans for future additions, expansions, or further
43 activity related to or connected with this proposal? If yes, explain.

44
45 No. There are no plans to expand or increase the capacity of the building or to add structures.

46
47 8. List any environmental information you know about that has been prepared, or will be prepared,
48 directly related to this project.

49
50 This SEPA Environmental Checklist is being submitted to the State of Washington Department of Ecology
51 (Ecology) with the 324 Building REC, HLV, LLV, and Associated Areas Closure Plan, which was prepared
52 in accordance with the Washington State Dangerous Waste Regulations.

53
54 The following documents have been prepared in accordance with DOE National Environmental Policy Act
55 regulations:

Environmental Assessment: Relocation and Storage of Isotopic Heat Sources, Hanford Site, Richland Washington, DOE/EA-1211, U.S. Department of Energy, Richland, WA, (dated June 1997).

Categorical Exclusion for Removal of Material from the Hot Cells and Vaults, 324 Building, Hanford Site, Richland, WA (PNNL Project Number 13802) (dated September 15, 1995).

Memorandum to File: Cleanout and Decontamination of Five Hot Cells in the 324 and 325 Buildings at Hanford in Compliance with the National Environmental Policy Act (dated October 10, 1990).

General information concerning the Hanford Facility environment can be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 8, August 1996. This document is updated periodically by Pacific Northwest National Laboratory (PNNL), and provides current information concerning climate and meteorology; ecology; history and archeology; socioeconomic; land use and noise levels; and geology and hydrology. These baseline data for the Hanford Site and its past activities are useful for evaluating proposed activities and their potential environmental impacts.

- 9. Do you know whether applications are pending for government approvals of other proposals directly affecting property covered by your proposal?

No applications to government agencies are known to be pending. However, the 324 Building lies within *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* operable units (OU) 300-FF-2 and 300-FF-5 as designated by the *Hanford Federal Facility Agreement and Consent Order*. These operable units are scheduled to be remediated under CERCLA using the remedial investigation and feasibility study process.

- 10. List any government approvals or permits that will be needed for your project, if known.

Ecology is the lead agency authorized to approve the closure plan for the 324 REC/HLV pursuant to the requirements of the WAC 173-303 and 40 Code of Federal Regulations (CFR) Part 265.

Additional permits (e.g., stormwater) applicable to all facilities on the Hanford Site have been prepared.

- 11. Give a brief, complete description of the project, including the uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your project. You do not need to repeat those answers on this page.

The DOE-RL proposes closure of a non-permitted treatment, storage, and/or disposal (TSD) unit housed within the 324 Building. The closure unit boundary was developed using the data quality objective process. The areas of the building requiring closure activities include: all the cells in the REC the REC airlock, the pipe trench, the HLV, the LLV, the trucklock, the cask handling area, the HLV sample room (room 145), the Engineering Development Lab-146, and the galleries.

After the waste inventory has been removed, clean closure of the REC, the HLV and LLV, the piping, and the other areas will be accomplished by decontaminating using a method specified in the Alternative Treatment Standards for Hazardous Debris rule (40 CFR 268.45) and demonstrating that these components meet the closure performance standard. For metal surfaces and concrete the closure performance standard is a 'clean debris surface', as defined in 40 CFR 268.45. Decontamination of the REC units will involve cleaning the interior surfaces. Decontamination of the HLV and LLV will include removal of the tanks and cleaning all metal and concrete surfaces to the performance standard of a 'clean debris surface'. Piping that has transported dangerous waste to or from an area within the closure boundary will be identified. The Identified piping will be decontaminated using a chemical extraction method specified in the Alternative Treatment Standards for Hazardous Debris. The accessible piping will be removed. (If it is not possible to remove all piping, the remaining piping will be immobilized by using a sealing or encapsulation technology specified in

the Alternative Treatment Standards for Hazardous Debris Rule. This piping will be removed and disposed during final decommissioning activities for the 324 Building.) Integrity assessments will be performed on the piping and liners to determine if there was possible escape of contaminants to the environment. Provided that the liners and piping integrity assessments indicate no release of dangerous waste to the environment, the soils and groundwater will not be included in this closure. If it is not possible to demonstrate that there has been no release of dangerous waste to the soils, then soils investigations and remediation will be necessary and will be scheduled and coordinated with the CERCLA Operable Unit, identifying the contaminants of concern and specifying the RCRA ARAR. This situation would also trigger continued monitoring and care.

Closure of the 324 Building closure areas will be performed in accordance with the Ecology-approved closure plan.

12. **Location of the project.** Give sufficient information for a person to understand the precise location of your project, including a street address, if any, and section, township, and range, if known. If the project occurs over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The 324 Building is located near the corner of Locust Street and the George Washington Way Extension north of the city of Richland, in the 300 Area of the Hanford Site.

TO BE COMPLETED BY APPLICANT

**EVALUATIONS FOR
AGENCY USE ONLY**

B. ENVIRONMENTAL ELEMENTS

1. Earth

- a. **General description of the site- Flat, rolling, hilly, steep slopes, mountainous, other.**
The site is essentially flat.
- b. **What is the steepest slope on the site (approximate percent slope)?**
Approximately 2 percent.
- c. **What general types of soils are found on the site? (for example, clay, sandy gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.**
Soil types consist mainly of eolian and fluvial sands and gravel. More detailed information concerning specific soil classifications can be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Revision 8, August 1996. Farming is not permitted on the Hanford Facility.
- d. **Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.**
No.

- 1 e. Describe the purpose, type, and approximate quantities of
2 any filling or grading proposed. Indicate source of fill.

3
4 No filling or grading is required.

- 5
6 f. Could erosion occur as a result of clearing, construction, or
7 use? If so, generally describe.

8
9 No.

- 10
11 g. About what percent of the site will be covered with
12 impervious surfaces after project construction (for example,
13 asphalt or buildings)?

14
15 Not applicable. No construction would occur.

- 16
17 h. Proposed measures to reduce or control erosion, or other
18 impacts to the earth, if any:

19
20 Not applicable. Earth would not be disturbed.

21
22 **2. Air**

- 23
24 a. What types of emissions to the air would result from the
25 proposal (i.e., dust, automobile, odors, industrial wood
26 smoke) during construction and when the project is
27 completed? If any, generally describe and give approximate
28 quantities, if known.

29
30 Minor amounts of exhaust would be generated by vehicles used
31 by personnel to gain access to the 324 Building.

32
33 An airborne release could occur as a result of upset conditions
34 internally or externally. Such a release would not exceed
35 immediately dangerous to life and health concentrations outside
36 the immediate area of the spill/release because of the small
37 quantity of material that is available for release.

- 38
39 b. Are there any off-site sources of emissions or odors that may
40 affect your project? If so, generally describe.

41
42 No.

- 43
44 c. Measures to reduce or control emissions or other impacts to
45 the air, if any?

46
47 Good engineering practices would be followed, and actions
48 would comply with onsite procedures designed to protect worker
49 safety and health, and the environment. Administrative control
50 practices and high-efficiency particulate air filters would limit air
51 emissions as well as protect worker health.
52

1 3. Water

2 a. Surface

- 3
4
5 1) Is there any surface water body in or in the immediate
6 vicinity of the site (including year-round and seasonal
7 streams, saltwater, lakes, ponds, wetlands)? If yes,
8 describe type and provide names. If appropriate, state
9 what stream or river it flows into.

10
11 The Columbia River is in the vicinity of the 324 Building.
12 However, the 324 Building is a nonland-based facility as
13 defined in WAC 173-303-282(3)(i). The
14 WAC 173-303-282(6)(c)(i)(B)(I) requires nonland-based
15 facilities be located at least 152 meters from any perennial
16 water body. The WAC 173-303-282(6)(d)(i) requires
17 nonland-based facilities be located at least 152 meters
18 from any wetlands, designated critical habitats, habitats
19 designated by the Washington Department of Wildlife as
20 habitat essential to the maintenance or recovery of any
21 state listed threatened or endangered wildlife species,
22 natural areas that are acquired or voluntarily registered or
23 dedicated by the owner, or state or federally designated
24 wildlife refuges, preserves, or bald eagle protection areas.
25 The 324 Building is over 152 meters from any of these
26 areas.
27

- 28
29 2) Will the project require any work over, in, or adjacent
30 to (within 200 feet) the described waters? If yes,
31 please describe and attach available plans.

32 No.

- 33
34 3) Estimate the amount of fill and dredge material that
35 would be placed in or removed from surface water or
36 wetlands and indicate the area of the site that would
37 be affected. Indicate the source of fill material.

38
39 None.

- 40
41 4) Will the proposal require surface water withdrawals
42 or diversions? Give general description, purpose, and
43 approximate quantities if known.

44
45 No.

- 46
47 5) Does the proposal lie within a 100-year floodplain? If
48 so, note location on the site plan.

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50 No.
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- 6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground

- 1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

If the 324 Building areas cannot be clean closed in accordance with the closure plan, postclosure groundwater monitoring might be required.

- 2) Describe waste materials that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None.

c. Water Run-off (including storm water)

- 1) Describe the source of run-off (including storm water) and methods of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other wastes? If so, describe.

The Hanford Facility receives only 15.2 to 17.8 centimeters of annual precipitation. Precipitation runs off the existing buildings and seeps into the soil on and near the buildings. This precipitation does not reach the groundwater or surface waters. Precipitation would not come in contact with any of the liquid mixed waste treated and/or stored.

- 2) Could waste materials enter ground or surface waters? If so, generally describe.

Engineering controls during closure activities, such as inspecting the liners for breaches before using decontamination solutions, etc., will prevent dangerous wastes from entering the groundwater.

d. Proposed measures to reduce or control surface, ground, and run-off water impacts, if any:

Measures would include inspecting for breaches or cracks, and sealing any found, before using decontamination solutions.

4. Plants

a. Check the types of vegetation found onsite.

- deciduous tree
- evergreen tree
- shrubs
- grass
- pasture
- crop or grain
- wet soil plants
- water plants
- other types of vegetation

The most common vegetation community in the 300 Area is the sagebrush/cheatgrass or Sandberg's bluegrass. Native vegetation in the immediate vicinity of the 324 Building has been eradicated. Vegetation consists primarily of cultivated ornamentals.

b. What kind and amount of vegetation will be removed or altered?

None.

c. List threatened or endangered species known to be on or near the site.

None. Additional information on the Hanford Facility environment can be found in the environmental document referred to in the answer to Checklist Question A.8.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Not applicable.

5. Animals

a. Underline any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds,
other: _____

mammals: deer, bear, elk, beaver,
other:Small mammals

fish: bass, salmon, trout, herring,
shellfish, other: _____

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Raptors (burrowing owls; ferruginous, redtail, and Swainson's hawks) rarely are seen in the 300 Area. Small passerines (sparrows, finches) are present in the general vicinity of the 324 Building. Mule deer, rabbits, and coyotes occasionally are seen in the general area.

- b. List any threatened or endangered species known to be on or near the site.

Two federal and state listed threatened or endangered species have been identified on the 1,450 square kilometer Hanford Site along the Columbia River; the bald eagle and peregrine falcon. In addition, the state listed white pelican, sandhill crane, and ferruginous hawk also occur on or migrate through the Hanford Site. Of these five species, none is likely to use the shrub-steppe habitat of the 300 Area.

- c. Is the site part of a migration route? If so, explain.

The Hanford Facility is part of the broad Pacific flyway.

- d. Proposed measures to preserve or enhance wildlife, if any:

None.

6. Energy and Natural Resources

- a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will be used for lighting and other cleanup operations.

- b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

- c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None.

7. Environmental Health

- a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Possible environmental health hazards to workers could arise from activities at the 324 Building. The hazard could come from exposure to radioactive, dangerous, and/or mixed waste.

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Stringent administrative controls and engineered barriers will be employed to minimize the probability of even a minor incident and/or accident. A chemical spill, release, fire, or explosion could occur only as a result of a simultaneous breakdown in multiple barriers or a catastrophic natural forces event.

- 1) Describe special emergency services that might be required.

Hanford Facility security, fire response, and ambulance services are on call at all times in the event of an onsite emergency. Hanford Facility emergency services personnel are specially trained to manage a variety of circumstances involving chemical and/or mixed waste constituents and situations.

- 2) Proposed measures to reduce or control environmental health hazards, if any:

All personnel are trained to follow proper procedures during the treatment and storage operations to minimize potential exposure. The 324 Building has systems for ventilation, radiation monitoring, fire protection, and alarm capability. The heating, ventilation, and air conditioning system maintains a negative air pressure in the 324 Building.

Chemical and radiological safety hazards would be mitigated by preventing direct contact with the residual chemical constituents; high-efficiency particulate air filtration of all offgas streams; and protective clothing, appropriate training, and respiratory protection used by onsite personnel as necessary.

b. Noise

- 1) What type of noise exists in the area which may affect your project (for example: traffic, equipment, operation, other)?

None.

- 2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

None.

- 3) Proposed measures to reduce or control noise impacts, if any:

None.

1 8. Land and Shoreline Use
23 a. What is the current use of the site and adjacent properties?
4

5 In 1996, the 324 Building began transition from its historic
6 programmatic mission of waste technology research to a
7 deactivation and stabilization mission. Waste treatability studies
8 are being completed, or will be completed within the initial phase
9 of deactivation. Upon completion of deactivation the building
10 will be in a radiologically and industrially safe condition, suitable
11 for a surveillance and maintenance phase before final
12 decontamination and decommissioning. Future land use
13 associated with the Hanford Site's 300 Area, which includes the
14 324 Building and surrounding vicinity, will be addressed when
15 considering options of future land use for the entire Hanford
16 Facility.

17
18 The Hanford Facility is a single RCRA facility identified by the
19 U.S. Environmental Protection Agency (EPA)/State Identification
20 Number WA7890008967 that consists of over 60 TSD units
21 conducting dangerous waste management activities. These TSD
22 units are included in the *Hanford Facility Dangerous Waste Part*
23 *A Permit Application*. The Hanford Facility consists of all
24 contiguous land, and structures, other appurtenances, and
25 improvements on the land, used for recycling, reusing,
26 reclaiming, transferring, storing, treating, or disposing of
27 dangerous waste, which, for the purposes of the RCRA, are
28 owned by the U.S. Government and operated by the DOE-RL,
29 excluding land owned by Washington State.

30
31 b. Has the site been used for agriculture? If so, describe.
32

33 No portion of the Hanford Facility has been used for agricultural
34 purposes since 1944.

35
36 c. Describe any structures on the site.
37

38 The 324 Building, located in the 300 Area, is a steel and
39 reinforced concrete structure. Numerous buildings surround the
40 324 Building as a result of the developed 300 Area.

41
42 d. Will any structures be demolished? If so, what?
43

44 No.

45
46 e. What is the current zoning classification of the site?
47

48 The Hanford Site is zoned by Benton County as an Unclassified
49 Use (U) district.

50
51 f. What is the current comprehensive plan designation of the
52 site?
53

54 The 1985 Benton County Comprehensive Land Use Plan
55 designates the Hanford Site as the "Hanford Reservation". Under

1 this designation, land on the Hanford Site may be used for
 2 "activities nuclear in nature." Nonnuclear activities are
 3 authorized if and when DOE approval for such activities is
 4 obtained".

- 5
 6 g. If applicable, what is the current shoreline master program
 7 designation of the site?

8
 9 Not applicable.

- 10
 11 h. Has any part of the site been classified as an
 12 "environmentally sensitive" area? If so, specify.

13
 14 No.

- 15
 16 i. Approximately how many people would reside or work in the
 17 completed project?

18
 19 None.

- 20
 21 j. Approximately how many people would the completed
 22 project displace?

23
 24 None.

- 25
 26 k. Proposed measures to avoid or reduce displacement impacts,
 27 if any:

28
 29 None.

- 30
 31 l. Proposed measures to ensure the proposal is compatible with
 32 existing and projected land uses and plans, if any:

33
 34 Not applicable. (Refer to Checklist Question B.8.f)

35
 36 9. Housing

- 37
 38 a. Approximately how many units would be provided, if any?
 39 Indicate whether high, middle, or low-income housing.

40
 41 None.

- 42
 43 b. Approximately how many units, if any, would be eliminated?
 44 Indicate whether high, middle, or low-income housing.

45
 46 None.

- 47
 48 c. Proposed measures to reduce or control housing impacts, if
 49 any:

50
 51 None.
 52

10. Aesthetics

- 1
2
3 a. What is the tallest height of any proposed structure(s), not
4 including antennas; what is the principal exterior building
5 material(s) proposed?
6

7 No new structures are being proposed. The unit is located in an
8 existing building, which is approximately 14 meters high.
9

- 10 b. What views in the immediate vicinity would be altered or
11 obstructed?
12

13 None.
14

- 15 c. Proposed measures to reduce or control aesthetic impacts, if
16 any:
17

18 None.
19

20 11. Light and Glare

- 21 a. What type of light or glare will the proposal produce? What
22 time of day would it mainly occur?
23

24 None.
25

- 26 b. Could light or glare from the finished project be a safety
27 hazard or interfere with views?
28

29 No.
30

- 31 c. What existing off-site sources of light or glare may affect your
32 proposal?
33

34 None.
35

- 36 d. Proposed measures to reduce or control light and glare
37 impacts, if any:
38

39 None.
40

41 12. Recreation

- 42 a. What designated and informal recreational opportunities are
43 in the immediate vicinity?
44

45 None.
46

- 47 b. Would the proposed project displace any existing recreational
48 uses? If so, describe.
49

50 No.
51
52

1 c. **Proposed measures to reduce or control impacts on**
2 **recreation, including recreation opportunities to be provided**
3 **by the project or applicant, if any?**

4
5 None.

6
7 **13. Historic and Cultural Preservation**

8
9 a. **Are there any places or objects listed on, or proposed for,**
10 **national, state, or local preservation registers known to be on**
11 **or next to the site? If so, generally describe.**

12
13 No places or objects listed on, or proposed for, national, state, or
14 local preservation registers are known to be on or next to the
15 324 Building.

16
17 b. **Generally describe any landmarks or evidence of historic,**
18 **archaeological, scientific, or cultural importance known to be**
19 **on or next to the site.**

20
21 There are no known archaeological, historical, or Native
22 American religious sites in the 324 Building area.

23
24 c. **Proposed measures to reduce or control impacts, if any:**

25
26 None.

27
28
29 **14. Transportation**

30 a. **Identify public streets and highways serving the site, and**
31 **describe proposed access to the existing street system. Show**
32 **on site plans, if any.**

33
34 Not applicable.

35
36 b. **Is site currently served by public transit? If not, what is the**
37 **approximate distance to the nearest transit stop?**

38
39 No. The distance to the nearest public transit stop is
40 approximately 113 meters located near the entrance to the
41 300 Area.

42
43 c. **How many parking spaces would the completed project have?**
44 **How many would the project eliminate?**

45
46 Not applicable.

47
48 d. **Will the project require any new roads or streets, or**
49 **improvements to existing roads or streets, not including**
50 **driveways? If so, generally describe (indicate whether public**
51 **or private).**

52
53 No.

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e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day are generated by the completed project? If known, indicate when peak volumes occur.

No additional vehicular traffic will be required.

g. Proposed measures to reduce or control transportation impacts, if any:

None.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No. Existing services are adequate.

b. Proposed measures to reduce or control direct impacts on public services, if any:

None.

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other:

Electricity, telephone, sewer, water, and refuse collection are available at the 324 Building.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

All utilities for the 324 Building are currently available. No new utility services would be required.

1 SIGNATURES

2 The above answers are true and complete to the best of my knowledge. We understand that the lead agency is
3 relying on them to make its decision.
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6
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8

9
10 *J. E. Rasmussen*
11 *J. E. Rasmussen*
12 J. E. Rasmussen, Division Director
13 Office of Environmental Assurance,
14 Permits, and Policy Division
15 U.S. Department of Energy
16 Richland Operations Office
17
18

3/30/98
Date

19
20 *William D. Adair*
21 *William D. Adair*
22 W. D. Adair, Director
23 Environmental Protection
24 Responsible Party for
25 Fluor Daniel Hanford, Inc.

3/30/98
Date

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DOE/RL-96-73

Revision 1

UC-630

324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Areas Closure Plan

Date Published
March 1998



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Department of Energy**

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3 324 Building Radiochemical Engineering Cells, High-Level Vault,
4 Low-Level Vault, and Associated Areas Closure Plan
5
6

7 FOREWARD
8

9 The Hanford site is owned by the U.S. government and operated by the U.S. Department
10 of Energy, Richland Operations Office. Dangerous and mixed waste (containing both
11 radioactive and dangerous components) are produced and managed on the Hanford site. The
12 dangerous waste is regulated in accordance with the *Resource Conservation and Recovery Act*
13 *of 1976* and the *State of Washington Hazardous Waste Management Act of 1976* (as administered
14 through the Washington State Department of Ecology *Dangerous Waste Regulations*,
15 Washington Administrative Code 173-303). The radioactive component of mixed waste is
16 interpreted by the U.S. Department of Energy to be regulated under the *Atomic Energy Act*
17 *of 1954*; the nonradioactive dangerous component of mixed waste is interpreted to be regulated
18 under the *Resource Conservation and Recovery Act of 1976* and Washington Administrative
19 Code 173-303.
20

21 For purposes of the *Resource Conservation and Recovery Act of 1976* and the
22 Washington State Department of Ecology *Dangerous Waste Regulations*, the Hanford site is
23 considered to be a single facility. The single dangerous waste permit identification number
24 issued to the Hanford site by the U.S. Environmental Protection Agency and the Washington
25 State Department of Ecology is U.S. Environmental Protection Agency/State Identification
26 Number WA7890008967.
27

28 The areas within the 324 Building, covered by this closure plan, are not covered by a
29 *Resource Conservation and Recovery Act of 1976* Part A, Form 3, Dangerous Waste Permit
30 Application. However, the areas are being closed pursuant to the requirements for *Resource*
31 *Conservation and Recovery Act of 1976* closure for interim status treatment, storage, and
32 disposal (TSD) units as documented in the *Hanford Federal Facility Agreement and Consent*
33 *Order* (Ecology, et al., 1996) as milestones (Milestones M-89-00 and M-20-55). Information
34 provided in this closure plan is current as of March 1998.
35

36 Previous submittals of this closure plan include the initial submittal "324 Building REC
37 and HLV Closure Plan," submitted in 1995 (PNL-10890) and "The 324 Building Radiochemical
38 Engineering Cells and High-Level Vault Closure Plan," revision 0 of this document, submitted in
39 1997. This document represents the second revision of the original 1995 submittal.

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ACRONYM LIST

1		
2		
3	ALARA	as low as reasonably achievable
4	ARAR	applicable or relevant and appropriate requirement
5	ATS	alternative treatment standards
6		
7	BCCP	B-Cell Cleanout Project
8	BNWL	Battelle-Northwest Laboratories
9	BWHC	B&W Hanford Company
10	BWR	boiling water reactor
11		
12	CERCLA	Comprehensive Environmental Response, Compensation, and Liability
13		Act
14	CCTV	closed-circuit television
15	CFR	Code of Federal Regulations
16	COC	constituent of concern
17		
18	D&D	decontamination and decommissioning
19	DOE	U.S. Department of Energy
20	DOE-RL	U.S. Department of Energy, Richland Operations Office
21		
22	Ecology	Washington State Department of Ecology
23	EDL	Engineering Development Laboratory
24	EM-40	DOE Office of Environmental Restoration
25	EM-60	DOE Office of Nuclear Material and Facility Stabilization
26	EPA	U.S. Environmental Protection Agency
27	EPRI	Electric Power Research Institute
28	EQL	estimated quantitation limit
29		
30	FDH	Fluor Daniel Hanford, Inc.
31	FR	Federal Register
32	FRG	Federal Republic of Germany
33		
34	HEPA	high-efficiency particulate air
35	HLLW	high-level liquid waste
36	HLV	high-level vault
37	HLV/LLV	high-level vault/low-level vault
38	HLW	high-level waste
39	HNF	Hanford Nuclear Facility (document identifier)
40	HQ	headquarters (DOE)
41	HVAC	heating, ventilation, and air conditioning
42		
43	IC	ion chromatography
44	ICP	inductively coupled plasma
45	ICP/AES	inductively coupled plasma/atomic emission spectroscopy
46	ICP/MS	inductively coupled plasma/mass spectroscopy

1		
2	LDR	land disposal restrictions
3	LLV	low-level vault
4	LLW	low-level waste
5		
6	MSDS	material safety data sheet
7	MTCA	Model Toxic Control Act
8	MW	mixed waste
9		
10	ND	not detected
11	NDE	nondestructive examination
12	NWVP	Nuclear Waste Vitrification Project
13		
14	PHMC	Project Hanford Management Contract
15	PMP	project management plan
16	PNL	Pacific Northwest Laboratory
17	PNNL	Pacific Northwest National Laboratory
18		
19	PUREX	plutonium-uranium extraction
20	PWR	pressured water reactor
21		
22	R&D	research and development
23	RCRA	Research Conservation and Recovery Act of 1976
24	REC	radiochemical engineering cells
25	RLFCM	radioactive liquid-fed ceramic melter
26	RPD	relative percent difference
27		
28	S&M	surveillance and maintenance
29	SCW	special case waste
30	SMF	Shielded Materials Facility
31	SNF	spent nuclear fuel
32		
33	TC	toxicity characteristic
34	TCLP	toxicity characteristics leaching procedure
35	TPD	Transition Projects Division
36	Tri-Party	
37	Agreement	Hanford Federal Facility Agreement and Consent Order
38	TRU	transuranic (waste)
39	TSD	treatment, storage, and/or disposal
40		
41	WAC	Washington Administrative Code
42	WDOH	Washington Department of Health
43	WSEP	Waste Solidification Engineering Prototype
44	WTEL	Waste Technology Engineering Laboratory
45		
46	ZVDP	Zeolite Vitrification Demonstration Project

1		
2	Bq/g	becquerels per gram
3	Bq/L	becquerels per liter
4	Ci	Curie
5	°	degree Celsius
6	d/m-ml	disintegrations per minute per milliliter
7	g/ml	grams per milliliter
8	m ³	cubic meters
9	R/hr	roentgen per hour
10	µg/g	microgram per gram
11	µg/L	microgram per liter
12	µg/ml	microgram per milliliter

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1.0 INTRODUCTION AND OVERVIEW

The Hanford Site, located adjacent to and north of Richland, Washington, is operated by the U.S. Department of Energy, Richland Operations Office (RL) (Figure 1-1). The 324 Building is located in the 300 Area of the Hanford Site (Figure 1-2). The 324 Building was constructed in the 1960s to support materials and chemical process research and development activities ranging from laboratory/bench-scale studies to full engineering-scale pilot plant demonstrations. In the mid-1990s, it was determined that dangerous waste and waste residues were being stored for greater than 90 days in the 324 Building Radiochemical Engineering Cells (REC) and the High-Level Vault/Low-Level Vault (HLV/LLV) tanks [these areas are not *Resource Conservation and Recovery Act of 1976 (RCRA)* permitted portions of the 324 Building].

Through the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-89 (Ecology, et al., 1996), agreement was reached to close the nonpermitted RCRA unit in the 324 Building. This closure plan, managed under TPA Milestone M-20-55, addresses the identified building areas targeted by the Tri-Party Agreement and provides commitments to achieve the highest degree of compliance practicable, given the special technical difficulties of managing mixed waste that contains high-activity radioactive materials and the physical limitations of working remotely in the areas within the subject closure unit.

This closure plan is divided into nine chapters. Chapter 1.0 provides the introduction, historical perspective, 324 Building history and current mission, and the regulatory basis and strategy for managing the closure unit. Chapters 2.0, 3.0, 4.0, and 5.0 discuss the detailed facility description, process information, waste characteristics, and groundwater monitoring, respectively. Chapter 6.0 deals with the closure strategy and performance standard, including the closure activities for the B-Cell, D-Cell, HLV, LLV, piping and miscellaneous associated building areas. Chapter 7.0 addresses the closure activities identified in Chapter 6.0, and also adds information on closure activities for the soil directly beneath the unit, regulated material removed during closure, and the schedule for closure. Chapter 8.0 provides surveillance, monitoring and postclosure information and Chapter 9.0 provides a list of references used throughout the document.

1.1 Hanford Site and 300 Area Overview

The Hanford Site lies within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State. The Hanford Site occupies an area of approximately 1,450 square kilometers located adjacent to and north of Richland, Washington. The Hanford Site has restricted public access and provides a buffer for the smaller areas (including reactors, chemical separation facilities, and special nuclear material facilities) onsite that historically were used for production of nuclear materials and waste storage and disposal. About 6 percent of the land area has been disturbed and is actively used. One of the major operational areas includes the 300 Area, which is located just north of Richland. The 300 Area covers 4.3 square kilometers. The 324 Building lies within the boundary of the 300 Area.

1
2 The Hanford Site is owned by the U.S. government and operated by the U.S. Department
3 of Energy, Richland Operations Office (RL) in conjunction with its contractors. The Hanford
4 Site missions are to safely clean up and manage the site's legacy wastes, and to develop and
5 deploy science and technology, as noted in DOE/RL-96-92, *Hanford Strategic Plan*. Dangerous
6 waste and mixed waste (containing both dangerous and radioactive components) are produced
7 and managed on the Hanford Site. Waste components are regulated in accordance with the
8 *Resource Conservation and Recovery Act of 1976* (RCRA), *The Hazardous and Solid Waste*
9 *Amendments of 1984*, and or the *State of Washington Hazardous Waste Management Act of 1976*
10 (as administered through the Washington State Department of Ecology (Ecology) *Dangerous*
11 *Waste Regulations*, Washington Administrative Code (WAC) 173-303; or the *Atomic Energy Act*
12 *of 1954*). Throughout this closure plan, 'mixed waste' refers to waste containing both dangerous
13 and radioactive components. Radioactive waste and the radioactive component of mixed waste
14 are interpreted by the U.S. Department of Energy to be regulated under the *Atomic Energy Act of*
15 *1954*; dangerous waste and the nonradioactive dangerous waste component of mixed waste are
16 interpreted to be regulated under the RCRA and WAC 173-303.
17

18 For the purposes of RCRA, the Hanford Site is considered a single facility encompassing a
19 number of waste management units. The U.S. Environmental Protection Agency (EPA) and
20 Ecology have issued a single dangerous waste permit identification number (EPA/State
21 Identification Number WA890008967) to the Hanford Site. All waste management activities
22 carried out under the assigned identification number are considered to be 'onsite' as defined in
23 WAC 173-303.
24

25 **1.2 324 Building**

26
27 A history and description of the building are provided in the following sections.
28

29 **1.2.1 324 Building Description**

30
31 The 324 Building is a substantial concrete and steel structure. The 324 Building is divided
32 into four integrated-but-separate primary work areas: the Engineering Development
33 Laboratory-102 (nonradioactive) or EDL-102, the Engineering Development Laboratory-146
34 (radioactive) or EDL-146, the radiochemical engineering cells (REC), and the Shielded Materials
35 Facility (SMF). Additional facilities in the 324 Building include development laboratories,
36 maintenance shops, and service areas. Within the 324 Building are controlled experimentation
37 areas referred to as 'hot-cells' with radiation shielding provided by thick concrete walls. To
38 protect against releases of radioactive material from the hot cells to the environment, integral
39 metal liners with sumps (i.e., without drains) were installed in the cells and tank vaults.
40 Confinement of radioactive particulate matter within the shielded cells is provided by a directed
41 air flow through high-efficiency particulate air (HEPA) filter ventilation system (Chapter 2.0
42 provides a detailed facility description).
43

1 **1.2.2 324 Building History**

2
3 The 324 Building (and associated support facilities), known as the Waste Technology
4 Engineering Laboratory (WTEL), was constructed from 1964 to 1966 in the 300 Area
5 (Figure 1-2). Based on photographs and a report on unconfined underground radioactive waste
6 in the 300 Area (Paas 1955) the 324 Building was constructed over a site that was used for
7 burying dry low-level waste beginning in 1943 (Figure 1-3). Total activity of buried material
8 was not reported. Before construction of new facilities in this area in late 1951, the buried
9 material was moved to a location approximately 200 meters to the north of the previous burial
10 ground.

11
12 The 324 Building was designed and constructed to allow for a high degree of versatility in
13 completing complex and varied experimentation on highly radioactive wastes to develop
14 approaches for waste treatment and storage activities. The 324 Building was designed as a single
15 integrated facility for orderly progression of nonradioactive and/or radioactive development
16 studies from laboratory or bench-scale to full engineering-scale pilot plant demonstrations. The
17 facility houses radiochemical and radiometallurgical hot cells and laboratories. The facility
18 supported several RL related initiatives for highly radioactive chemical processing and
19 metallurgical engineering studies. As a result of residues and internal facility spills during the
20 conduct of these activities, the facility contains areas with significant fixed and dispersible mixed
21 waste contamination.

22
23 In November 1996, the 324 Building was transferred from the Pacific Northwest National
24 Laboratory (PNNL) to the 300 Area Stabilization Project, B&W Hanford Company (BWHC), to
25 begin the transition from its historic programmatic mission of waste technology research to a
26 deactivation and stabilization mission. Nonradioactive and radioactive waste treatability studies
27 ongoing at the time of transition are being completed, or will be completed, within the initial
28 phase of deactivation. These activities are conducted by PNNL under a tenant-landlord
29 agreement with BWHC in the cold side (nonradioactive) laboratories, in the 324 Building C-Cell
30 and in EDL-146.

31
32 **1.3 Closure Requirement History**

33
34 Closure requirement history is described in two parts: closure regulatory basis and
35 compliance agreements.

36
37 **1.3.1 Closure Regulatory Basis**

38
39 In April 1993, Ecology and the EPA were notified that RL had determined that the REC
40 B-Cell and the high-level vault (HLV) within the 324 Building were being used to manage or
41 store mixed waste (DOE-RL, 1997). This unit was not permitted under RCRA; therefore, these
42 activities were not in compliance with RCRA regulations.

1 In January 1995, Ecology conducted a Dangerous Waste Compliance Inspection of the
2 324 Building (Ecology, 1995a). The inspection included the nonpermitted 'storage facility'
3 containing mixed waste. The inspection was required to support resolution of a dispute resulting
4 from TPA negotiations. The goals of the inspection included: (1) documenting the current
5 regulatory compliance status of 324 Building using a checklist inspection technique,
6 (2) documenting the permit status by assessing all potentially applicable Hanford Site permit
7 applications, (3) establishing when RL/PNNL first became aware of their compliance deficiency
8 and documented actions taken to notify Ecology or the EPA and to correct or mitigate the
9 deficiencies, and (4) allowing EPA an opportunity to obtain information to support the dispute
10 resolution and to gather information to support potential joint compliance actions that may
11 require EPA's regulatory authority over the Land Disposal Restriction (LDR) regulations
12 (40CFR268).

13
14 Negotiations for resolution of the noncompliant RCRA issues were conducted among
15 Ecology, EPA, and RL using the Tri-Party Agreement dispute resolution process. On February 7,
16 1995, the Tri-Party Agreement Dispute Resolution Committee agreed to the following:
17 (1) Ecology would issue a Voluntary Compliance letter (Ecology, 1995b), to document the areas
18 of noncompliance associated with the 324 Building REC and HLV and (2) RL, Ecology, and
19 PNNL would negotiate Tri-Party Agreement milestones to close the noncompliant TSD Unit. It
20 was agreed that the Tri-Party Agreement milestones would be sufficient to satisfy regulatory
21 enforcement for the areas of noncompliance.

22
23 The 1995 Voluntary Compliance letter (Ecology, 1995b) noted the following violations:

- 24
- 25 • Failure to ship waste offsite within 90 days of accumulating 208 liters or more
 - 26
 - 27 • Failure to store mixed waste in containers or tanks per WAC 173-303-200(1)(b)
 - 28
 - 29 • Failure to meet tank requirements per WAC 173-303-640(2) and (6)
 - 30
 - 31 • Failure to apply for interim status and failure to meet interim status facility standards
 - 32 per WAC 173-303-400
 - 33
 - 34 • Failure to prepare LDR notifications for shipments of mixed waste offsite per
 - 35 WAC 173-303-140(2)(a) and 40CFR268.7(a)(1).
 - 36
 - 37 • With Ecology's approval, RL and PNNL initiated efforts to operate the 324 Building
 - 38 REC and HLV in compliance with interim status RCRA standards and to clean out the
 - 39 REC.
 - 40

1 **1.3.2 Compliance Agreements**

2
3 Because of radiation, storage, and shipment concerns, it would not be possible to
4 immediately remove the mixed waste material from the units. Radiation levels within these units
5 are estimated to range between 1 R/hr to $> 10^6$ R/hr. Ecology and RL agreed that PNNL would
6 continue managing the waste in the REC and HLV in a manner appropriate for the radiological
7 risks posed by the waste.

8
9 Based on the nonpermitted activities and the special radiological considerations, the
10 following Tri-Party Agreement Milestones signed July 28, 1995 (Appendix 1A) were established
11 to address these issues and complete closure of the nonpermitted mixed waste units in the 324
12 Building REC and HLV:

- 13
14 • Milestone M-89-01 identified the HLV tanks that contained liquid mixed waste as
15 tanks 104, 105, 107, and directed RL to remove the mixed waste, flush, and drain these
16 tanks. This milestone was completed in October 1996.
- 17
18 • Milestone M-89-02, due May 1999, requires removal of B-Cell mixed waste and
19 excess equipment. The actions required under this milestone have been incorporated
20 into this closure plan (Chapter 7.0).
- 21
22 • Milestone M-89-03 required compliance with interim status facility standards for the
23 nonpermitted 324 Building areas. Because of the high radiation fields associated with
24 mixed waste stored in the REC and HLV, alternative compliance measures for some
25 interim status requirements were employed. This milestone was completed in March
26 1995.
- 27
28 • Milestone M-89-04 required RL to identify mixed waste management alternatives.
29 This milestone was completed in June 1995.
- 30
31 • Milestone M-20-55 required the submittal of a closure plan for the previously
32 identified unpermitted TSD unit in the 324 Building. This milestone was satisfied with
33 the initial submittal of this closure plan to Ecology in December 1995. The closure
34 plan subsequently was modified and resubmitted in May 1997. This current revision of
35 the document is submitted to resolve comments and issues with the initial and
36 subsequent closure plan, to reflect the change in building mission and management,
37 and to provide better integration of closure activities with building stabilization and
38 decontamination activities and with the *Comprehensive Environmental Response,*
39 *Compensation and Liability Act (CERCLA) of 1980* remedial actions for the 300 Area
40 operable units.

41
42 Meetings were held during 1996, among all the parties involved, that resulted in the
43 *January 1997 Summary of Agreements Reached During the Data Quality Objectives Process:*

1 324 Building (Ecology and DOE-RL 1997). This agreement defined the boundaries of the
2 nonpermitted RCRA closure unit, those components requiring action and no action (refer to
3 Figure 1.4, and Chapter 2.0, Section 2.1) and sampling and analysis information of rinsates from
4 the HLV after completion of inventory removal.
5

6 1.4 324 Building Deactivation Project

7
8 While specified areas (Chapter 2.0, Section 2.2) of the 324 Building are undergoing
9 closure, the entire building will be undergoing deactivation. The mission of the 324 Building
10 Deactivation Project is to accomplish a safe and cost-effective deactivation using innovative
11 techniques that will mitigate all facility risk to low-cost, stable conditions requiring minimal
12 surveillance and maintenance. The 324 Building Deactivation Project is to establish a passively
13 safe and environmentally secure configuration, and to preserve that configuration for a minimum
14 10 years or longer (post-deactivation pending final disposition). The post-deactivation
15 surveillance and maintenance period will be used to predict future maintenance requirements and
16 represents the reasonable time span needed to define, authorize, and initiate the follow-on
17 decontamination and decommissioning (D&D) activities.
18

19 The deactivation project removes, reduces, and/or stabilizes dangerous waste and mixed
20 waste within the 324 Building. Completing these activities reduces potential hazards to
21 personnel, the public, and the environment and allows for a reduced level of surveillance during
22 the extended surveillance period following deactivation. When fully deactivated, the work areas
23 will be unoccupied, empty, and locked. The work areas will contain no active systems or utilities
24 except for surveillance lighting and any necessary monitoring instrumentation.
25

26 In November 1996, planning began for deactivating the 324 Building. The objective of the
27 deactivation planning was to identify the activities needed to establish a passively safe,
28 environmentally secure configuration and ensure that the configuration could be retained after
29 deactivation. This effort culminated in the *324/327 Project Management Plan for the 324/327*
30 *Facilities Stabilization Project* (HNF-IP-1289). This project management plan (PMP) presents
31 the deactivation approach to be used for the two facilities and the supporting cost, schedule, and
32 scope baselines. This PMP was prepared based on lessons learned from previous deactivation
33 project PMP and with guidance provided in DOE Order 4700.1, *Project Management System*,
34 and the Tri-Party Agreement, Section 8.0, "Facility Decommissioning Process."
35

36 Key technical objectives for the 324 Building Deactivation Project are as follows:

- 37
- 38 • Closure activities will be completed to meet Tri-Party Agreement commitments
39 (Chapter 2.0, Section 2.2).
- 40
- 41 • Facility configuration will be established such that active systems are not required for
42 safety and environmental confinement.
43

- Deactivation will be performed in a way that will result in a redesignation of the 324 Building as a radiological facility in accordance with the criteria and guidelines provided in DOE-STD-1027, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports."

1.5 Closure Plan and Deactivation Plan Integration

This closure plan is for an unpermitted RCRA unit, and as such, will not be incorporated into the Hanford Site RCRA Permit (Ecology 1994). Management of closure will be based on agreements made between the RL and Ecology, as described in this closure plan and documented in the Administrative Record. The closure driver for the 324 Building is the Tri-Party Agreement Milestone M-20-55. General requirements for RCRA closure are discussed in the Tri-Party Agreement. These requirements (Section 5.3 of the Tri-Party Agreement) state that 'all [treatment, storage and/or disposal] TSD units that undergo closure, irrespective of permit status, shall be closed pursuant to the authorized State Dangerous Waste Program in accordance with WAC 173-303-610.

Previous submittals of this closure plan include the initial submittal "324 building REC an HLV closure Plan," submitted in 1995 (PNL-10890) and "The 324 Building Radiochemical engineering Cells and High-Level Vault Closure Plan," Revision 0 of this document, submitted in 1997.

The purpose of this revised closure plan is to lay out a path forward for closure of the nonpermitted TSD identified areas within the 324 Building. These areas are discussed in Chapter 2.0, Section 2.1. As a part of the overall 324 Building deactivation and compliance agreement activities, there currently are ongoing and planned projects, including activities associated with: (1) waste removal under the M-89 Tri-Party Agreement Milestone, (2) completion of activities to meet closure requirements (3) removal of residual radioactive contamination, waste, and equipment, (4) deactivation projects as defined in the project management plan (HNF-IP-1289), and (5) completion of activities to meet building endpoint criteria.

The strategy for 324 Building cleanout and ultimate closure of those areas covered by this closure plan (Chapter 2.0, Section 2.2) includes the coordination of the facility deactivation activities and the final closure of the areas and equipment (and associated piping/systems) within the closure boundary. The deactivation activities described below are provided for information only. This is depicted in Figure 1-4 and described by the following:

- Research and Development Activities -- This item (shown in Figure 1-4) was the previous mission of the facility managed by PNNL.
- Building Deactivation -- The 324 Deactivation Project (shown in Figure 1-4) covers the deactivation and minimum safe activities within the 324 and adjacent buildings. In

1 addition, subprojects are performing closure activities in response to existing Tri-Party
2 Agreement Milestones (B-Cell cleanout and the HLV/LLV tank closures). This project
3 will remove and/or reduce human health and environmental hazards associated with
4 the current condition of the 324 Building. This project will place the building in the
5 lowest radiological classification possible for surveillance and maintenance pending
6 reuse or final decommissioning and decontamination.

- 7
- 8 • Deactivation Projects -- The Deactivation Projects are managed through several
9 subprojects (Figure 1-4) based on areas and facility systems. These projects include
10 324 Minimum Safe, B-Cell Cleanout Project, Cesium Removal Project, A-Cell
11 Cleanout Project, Radiochemical Engineering Complex Deactivation, Shielded
12 Material Facility Deactivation, 324 Laboratory and Experimental Area Deactivation,
13 324 Heating, Ventilation, and Air Conditioning (HVAC), 324 Waste Streams and
14 Utilities, and various nonnuclear support areas.

15

16 The following projects (as shown in Figure 1-4), when completed, will meet the mission
17 requirements and objectives described in Section 1.4, including the physical and administrative
18 closure of the REC/HLV/LLV and associated areas:

- 19
- 20 • Residual Contamination/Waste/Equipment Removal -- Efforts are under way to clean
21 out both regulated and nonregulated waste from the 324/327 Buildings in support of
22 the mission objectives and for waste classified as "Special Case Waste" under Tri-
23 Party Agreement M-92.
 - 24
 - 25 • Waste Removal Under Milestone M-89 (M-89-00,01,02) -- Efforts are under way to
26 clean out both regulated and nonregulated waste from the 324 Building in support of
27 the mission objectives and the Tri-Party Agreement Milestones involving areas within
28 the closure unit boundary (TPA-M-89-00,01,02; refer to Chapter 3.0, Section 3.3 and
29 Chapter 7.0).
 - 30
 - 31 • Deactivation Endpoints -- The endpoint method for the 324 Building deactivation will
32 follow the guidance published in DOE/EM-0318, *Facility Deactivation, Methods and*
33 *Practice Handbook, Emphasizing End Points Implementation*. Deactivation endpoint
34 criteria and activities, when complete, will meet the deactivation mission objectives.

35

36 If deactivation or closure plan activities are not completed in a manner that allows
37 closeout/acceptance of endpoints, additional activities will be conducted following a
38 reevaluation of endpoint closure strategy and feasibility (e.g., economic, as low as
39 reasonably achievable (ALARA) exposure rates, etc.).

40

41 Completion and verification of the 324 Building endpoints, by both DOE Office of
42 Nuclear Material and Facility Stabilization (EM-60) and associated Contractor, and
43 DOE Office of Environmental Restoration (EM-40) and associated Contractor, are
44 required to complete the facility transition phase and initiate the surveillance and
45 maintenance phase of the decommissioning process.

- 1
- 2 • Closure Plan criteria -- The closure plan criteria and closeout requirements are
- 3 established in Chapters 6.0, 7.0, and 8.0 of this closure plan. If closure plan activities
- 4 are not completed in a manner that allows closeout/acceptance of closure criteria,
- 5 additional activities will be conducted following reevaluation.
- 6
- 7 • Demonstrate no releases of dangerous waste to the environment -- The demonstration
- 8 criteria is covered in Chapters 6.0 and 7.0. If this criteria is met, certification activities
- 9 will be completed and the unit will be closed (Clean Closed). If clean closure cannot
- 10 be demonstrated, surveillance and maintenance activities will be performed consistent
- 11 with criteria established in Chapter 8.0.
- 12

13 **1.6 Roles and Responsibilities**

14

15 From 1965 until 1996, PNNL managed operations of the 324 Building. In

16 November 1996, oversight responsibility for the 324 Building was transferred from PNNL to the

17 FDH team, the integrating contractor under the Project Hanford Management Contract (PHMC).

18 Since November 1996, the building has been operated by BWHC, a major subcontractor to

19 FDH, responsible for facility transition projects.

20

21 The management organization for the 324 closure activities represents a partnership

22 between four principle project organizations. The four project organizations and their associated

23 summary responsibilities are described in the following paragraphs.

24

- 25 • DOE-HQ -- The Office of Nuclear Material and Facility Stabilization (EM-60) is
- 26 primarily responsible for policy and budget decisions affecting the project. Summary
- 27 responsibilities for the EM-60 project manager are as follows:
- 28
- 29 - Act as the point of contact for matrixed HQ support organizations
- 30
- 31 - Act as the final decision authority when project management team decisionmaking
- 32 deadlocks occur
- 33
- 34 - Participate in quarterly progress reviews
- 35
- 36 - Review project scope, cost and schedule objectives
- 37
- 38 - Approve HQ milestones and project funding
- 39
- 40 - Act as the liaison for HQ organizations and establish proactive communication paths
- 41 to enhance timely decisions
- 42
- 43 - Keep HQ management informed of project status and obtain direction as necessary.

- 1
2 • RL -- The Transition Projects Division (TPD) has field responsibility for the project.
3 The RL project manager is the project interface at RL for DOE-HQ, FDH, and RL
4 matrixed organizations.
5

6 The RL project manager's primary role is oversight rather than daily management of
7 the project. Matrixed support is provided to the RL project manager from the other RL
8 organizations. Summary responsibilities of the RL project manager are as follows:
9

- 10 - Provide project direction
11
12 - Coordinate and approve overall project documentation and control baselines
13
14 - Monitor and review project activities
15
16 - Ensure compliance with applicable DOE orders and regulatory requirements
17
18 - Provide policy guidance and direction to FDH
19
20 - Maintain a proactive single point of contact for matrix support organizations, federal
21 and state regulatory agencies, and other external stakeholders
22
23 - Coordinate approval of project documentation in RL.
24
- 25 • FDH -- The FDH provides project integration across the Hanford Site. The Facility
26 Stabilization Project organization within the FDH has responsibility for integration and
27 performance monitoring for the 324 Building Deactivation Project. The FDH project
28 manager's primary role is oversight rather than daily management of the project. Day-
29 to-day project management responsibilities are assigned to the facility transition
30 subcontractor. The following are summary responsibilities for the project manager:
31
- 32 - Provide integration interface with other onsite contractors to ensure project
33 objectives are not jeopardized because of competing interests/needs
34
35 - Provide management guidance and direction to the facility transition subcontractor
36
37 - Monitor and review project activities and baselines (cost, schedule, scope)
38
39 - Coordinate approval of project documentation within the PHMC integrating
40 contractor
41
42 - Oversee worker health and safety programs
43
44 - Facilitate resolution of policy issues.
45

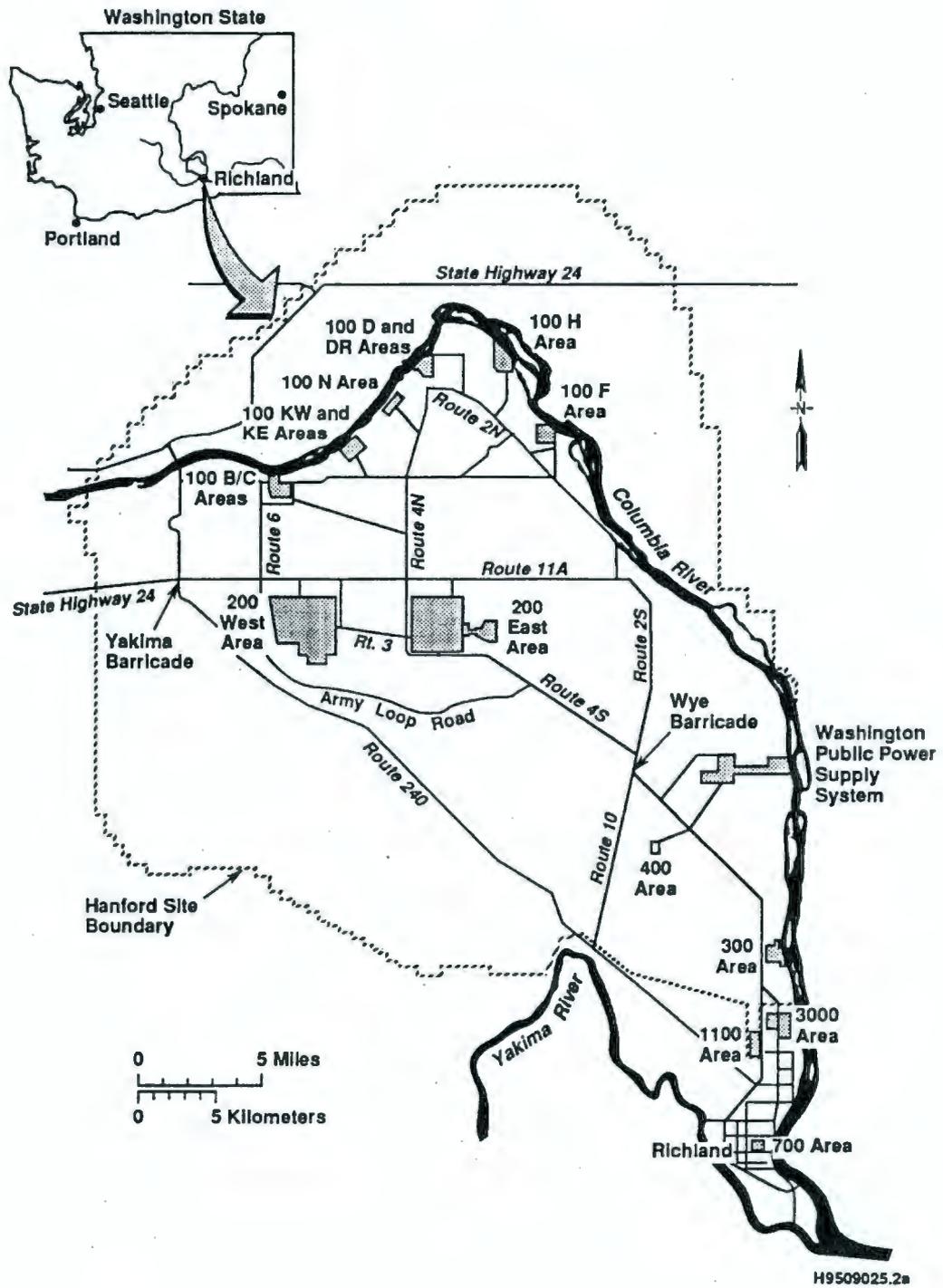
- 1 • Facility Transition Subcontractor -- The facility transition subcontractor is responsible
2 for supporting the FDH and RL project offices with day-to-day technical management,
3 coordination, control, and reporting of project activities. The following are summary
4 responsibilities for the facility transition subcontractors project manager:
5
 - 6 - Develop an integrated plan to accomplish the project objectives in a cost effective
7 manner using demonstrated innovative technology where appropriate.
 - 8
 - 9 - Implement worker health and safety programs.
 - 10
 - 11 - Define and administer the technical, cost, and schedule requirements for the project.
 - 12
 - 13 - Develop the FDH PMP for DOE approval.
 - 14
 - 15 - Prepare safety analysis reports, environmental analyses, and regulatory analyses and
16 permits needed for project implementation.
 - 17
 - 18 - Manage and control project baselines, as well as the timely identification and
19 communication of real and potential problems to the FDH and RL project managers.
 - 20
 - 21 - Develop proposed corrective actions.
 - 22
 - 23 - Implement corrective actions, as required and directed by the FDH project manager.
 - 24
 - 25 - Provide the FDH project office a clear and concise narrative report of project status
26 regarding established project baselines.
 - 27
 - 28 - Perform S&M and deactivation work.
 - 29
 - 30 - Establish and use an effective review process.
 - 31
 - 32 - Establish and use an effective work control process to achieve project objects.
 - 33

34 **1.7 Summary**

35
36 All areas of the 324 Building were considered when defining the boundary for the
37 nonpermitted RCRA TSD closure unit (Ecology 1997). This closure plan only addresses TSD
38 activities that have occurred within the closure boundary. The closure plan outlines the path
39 forward for clean closure. However, where clean closure is not possible, closure surveillance and
40 maintenance activities will be implemented according to Chapter 8.0 of this closure plan.
41

1

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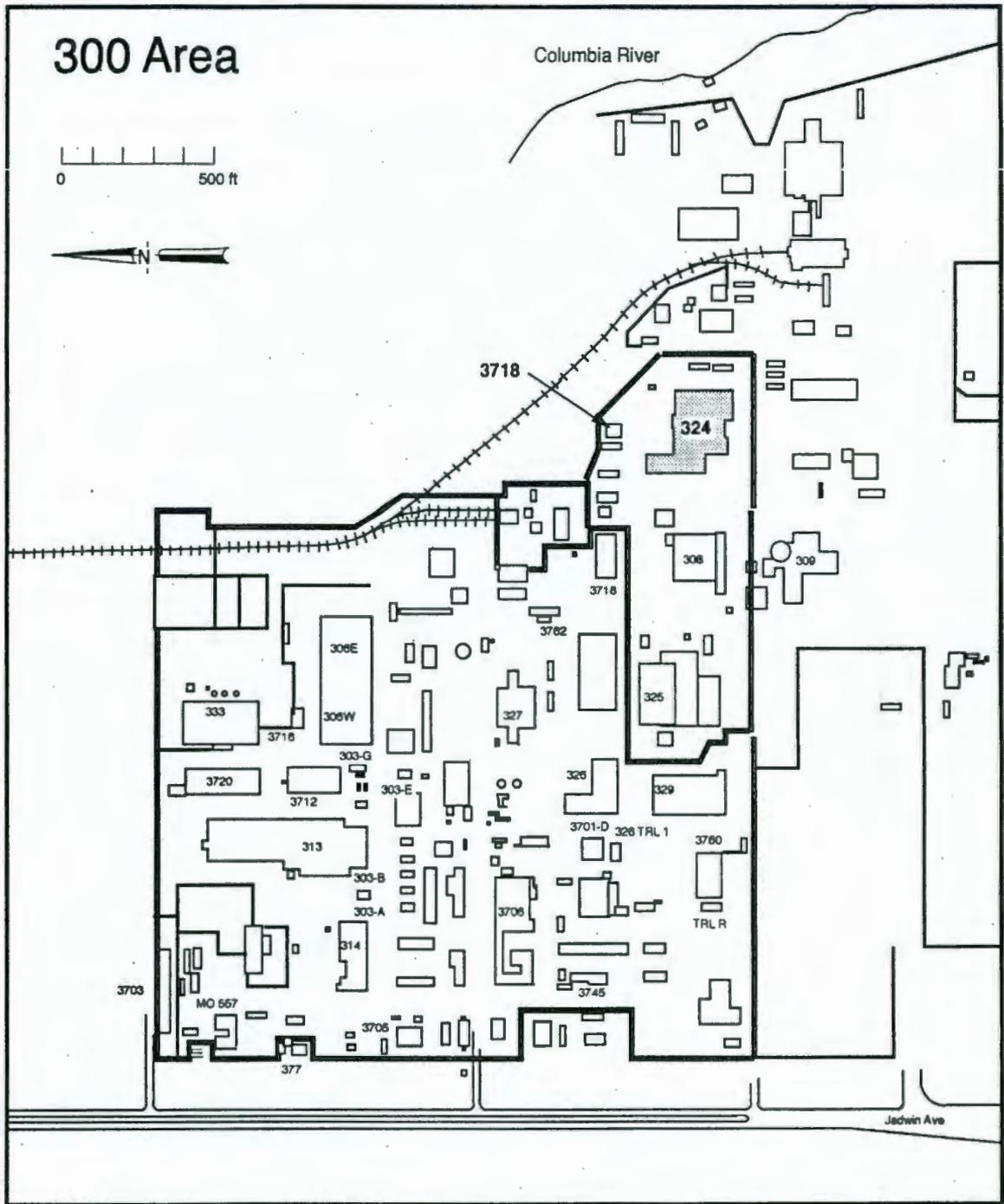


1

2

3

Figure 1-1. Hanford Site.



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2
3

Figure 1-2. 300 Area and Location of 324 Building.

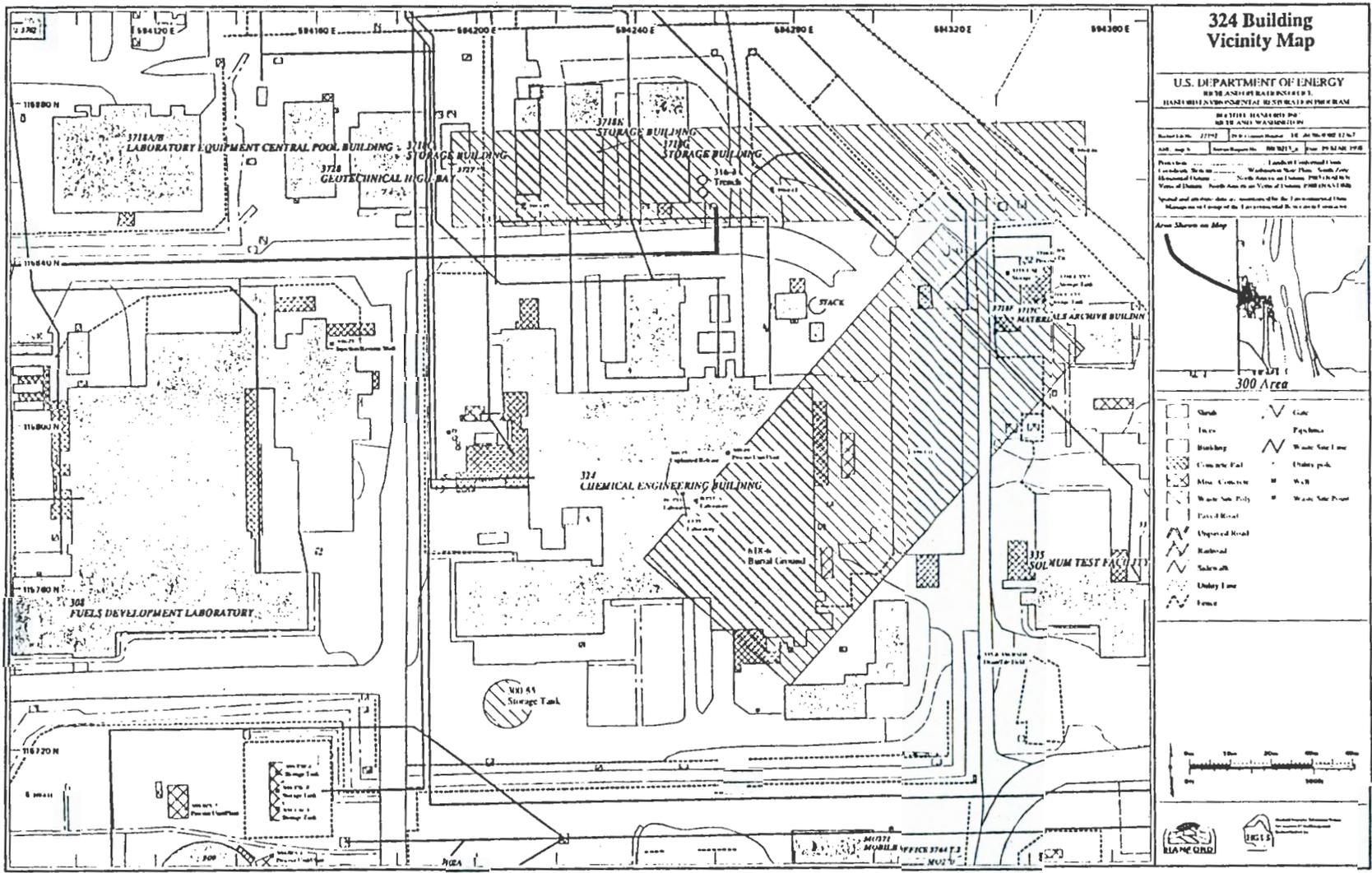


Figure 1-3. 324 Building Construction Site.

F1-3

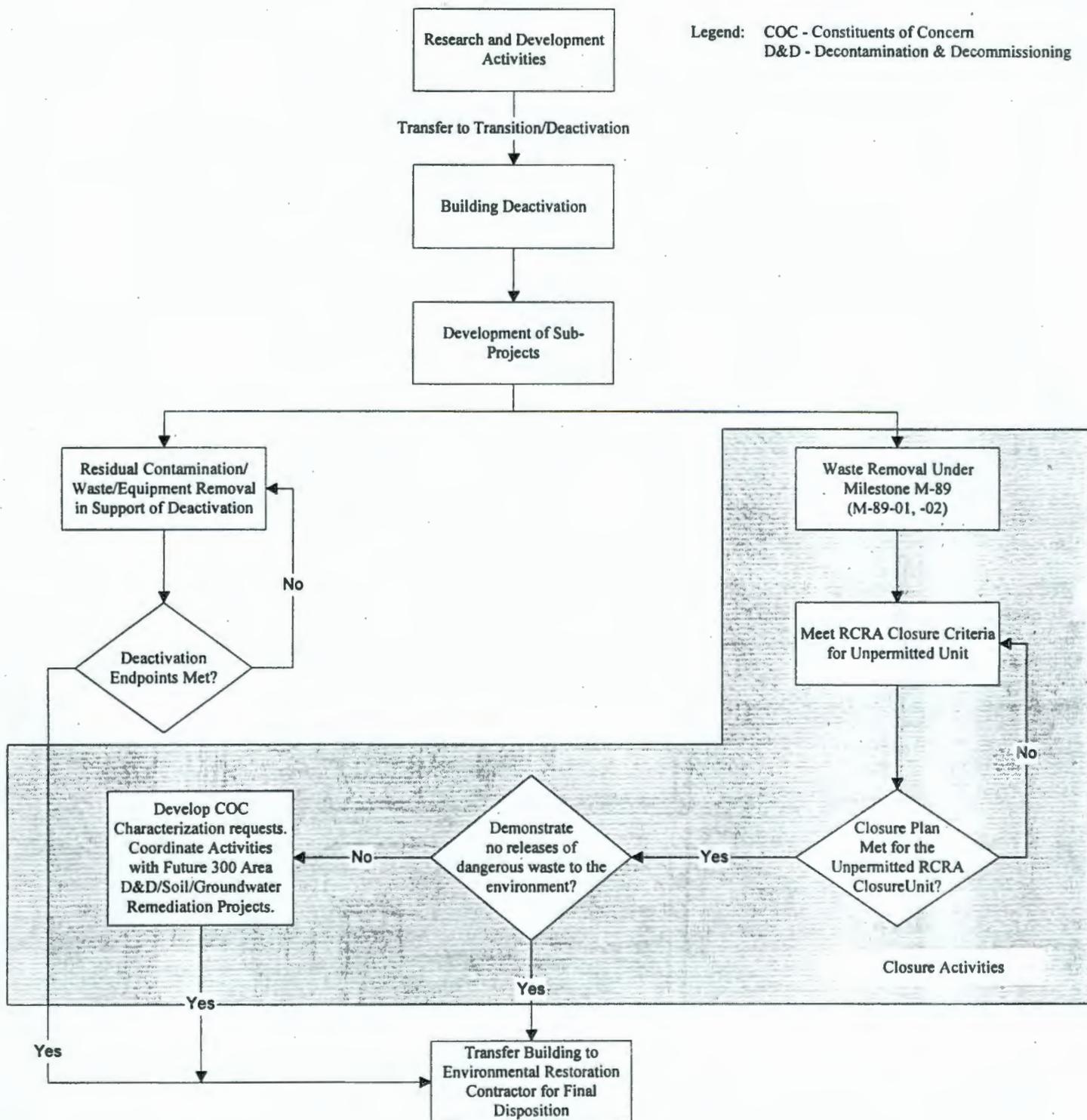


Figure 1-4. Deactivation/Closure Plan Integration.

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2.0 FACILITY DESCRIPTION

The 324 Building was designed to provide office and laboratory space for scientific and engineering staff who conduct multi-disciplinary research in areas of waste characterization and immobilization, waste remediation and cleanup development, biomass research, spent fuel characterization, tritium development, and cesium chloride encapsulation. Because the 324 Building housed research and development activities, the work being conducted changed as programs were concluded and other programs started.

2.1 General Facility Description

Construction of the 324 Building began in 1964 and was completed in 1965. The 324 Building is a substantial concrete and steel structure. The building has a partial basement and first, second, and partial third floors surrounding the engineering hot cell complex. Accessible floor areas total 9,450 square meters. The foundation structure is poured-in-place steel reinforced concrete.

Typically life expectancy criteria for construction and materials is 20 years, however this is a minimum requirement which is consistently exceeded. Although this time period has expired, and no robust non-destructive examination data for the building structure and materials is available, it is believed that the structure and materials are sound. Daily surveillances of the visible areas would note visible defects or flaws in the structure or equipment.

The roof of the facility is a parapeted, slightly sloped steel deck covered with concrete, gravel finished, Class II, 20 year, built-up roof. The roof is inspected at 5-year intervals. A major reroofing project was completed in late summer of 1995, and is expected to last 20 years. The last roof inspection was performed on August 29, 1997, and was found to meet requirements.

The 324 Building and its components are depicted in Figures 2-1 through 2-6. The 324 Building is divided into four, integrated-but-separate primary work areas: EDL-101 and -102, the EDL-146, the REC, and the SMF. The total floor area is about 6,164 square meters. Maximum overall building dimensions are: 62.5 x 71.6 x 13.7-meters-high. The radiation shielding of the hot cell walls is provided by the thick concrete (1.37 meters normal-density; 1.22 meters high-density). Both the REC and SMF cells provide protection from radiation sources of up to 10^6 R/hr.

The EDL-101 and -102 rooms have been used to perform bench-to-prototype scale engineering studies of waste immobilization processes with nonradioactive materials, depleted uranium, and thorium. EDL-101 also was used to develop sodium and lithium cleaning processes in support of development of the Fast Flux Test Facility. EDL-101 consists of a single room (originally designed as a cold (i.e., nonradioactive) crafts shop to support activities in EDL-102). EDL-102 consists of 16 adjacent 15 x 6.7 x 3.5-meters-high modules with complete

1 crane coverage, and the EDL tank room. The modules were designed to allow combination into
2 eight, two-story modules 6.7-meters-high for large-scale studies. The tank room contained four
3 small tanks, and was designed to allow preparation of feed materials for waste immobilization
4 studies.

5
6 The EDL-146 (Figure 2-3) contained unshielded or mildly shielded gloveboxes for studies
7 with extremely toxic materials, tracer level fission products, and/or plutonium. Located within
8 EDL-146 is the sampling room (Room 145), which contains sampling equipment for the HLV
9 and LLV tanks.

10
11 The REC provided for studies of almost any type of chemical or mechanical process with
12 radiation levels of up to 10^6 R/hr. The REC consists of four operating cells surrounding a
13 common air lock cell. The airlock functions primarily as a transition zone and ventilation barrier
14 for movement of shielded material between external areas and the four processing cells. The
15 HEPA ventilation system is designed for contamination confinement by managing air flow from
16 non-contaminated areas into increasingly more contaminated areas and the exhaust through
17 double sets of HEPA filters

18
19 All of the cells and the airlock are equipped with overhead crane service, lead glass
20 windows that are oil filled to facilitate viewing, and master-slave manipulators to aid remote
21 operation and maintenance of in-cell equipment. The manipulators have a weight limit of about
22 11.3 kilograms at full extension but do not permit precise manipulation of materials or waste. In
23 C-Cell and D-Cell, the manipulators limited reach does not allow most of the floor to be
24 accessed. In B-Cell and A-Cell, the manipulators do not reach to the floor.

25
26 A-Cell is a 10-meter-high cell that was used most recently for storage and characterization
27 of vitrified waste in canisters. A-Cell was used most recently to temporarily store 34 high heat
28 and high radiation vitrified isotopic sources (refer to Chapter 3.0).

29
30 B-Cell is a 10-meter-high cell that was used primarily to demonstrate several engineering
31 scale prototypes of waste immobilization processes (refer to Chapter 3.0). B-Cell contained
32 process equipment designed and installed in rack configurations. The racks 'plugged' into the
33 cell walls through specially designed penetrations. The plugs allowed service connections to be
34 made on the 'cold' side of the cell in the service galleries surrounding the hot cells.

35
36 The C- and D-Cells are shorter process cells, capable of handling equipment up to 3.35
37 meters high, and are operated entirely by direct viewing and master-slave manipulators with
38 assistance from remotely operated overhead cranes. Typical processes studied in these cells are
39 dissolution and separation of fuel element compounds by high-temperature gases or liquid salt
40 melts, de-jacketing of fuel elements, remote equipment development, and determination of
41 physical properties of highly radioactive materials or equipment.

42
43 The SMF includes the fabrication cell, the airlock cell, and the feed preparation cell.
44 Complete containment of radioactive materials, alpha, beta, and gamma, are provided for remote

1 research and fabrication studies on metallic and ceramic fuel materials with radiation levels also
2 on the order of 10^6 R/hr.

3
4 The cask handling area is the central hub for control of radioactive material movements
5 within the regulated areas of the building. This area is centrally located adjacent to the REC and
6 their operating galleries, the SMF cells and their galleries, EDL-146, and the regulated
7 (manipulator repair) shop (Room 147). A trucklock provides for shipping and receiving.
8 Material transfers between the functional areas are routed through the cask handling area. The
9 cask handling area is serviced by a 27.2-metric-ton, direct current-powered crane equipped with
10 an auxiliary hoist with a 4.5-metric-ton capacity. Facilities exist for load-in and load-out of large
11 quantities of radioactive materials to any cell or to the shielded vault area through equipment in
12 the trucklock and cask handling areas.

13
14 A wet storage basin was centrally positioned in the cask handling area for underwater
15 storage of radioactive materials, fuel elements, and the unloading of fuel casks. Shielded transfer
16 of highly radioactive materials from the wet basin to either cell complex was provided by
17 remotely operated, mechanical transfer conveyors. The wet basin has been decommissioned,
18 filled with sand, and covered with concrete.

19
20 Two shielded vaults (the HLV and LLV), containing stainless steel tanks ranging from
21 1,700 liters to 18,500 liters, were provided for temporary segregation and hold-up of radioactive
22 liquid feedstocks for, or waste from, chemical processing and/or cleaning operations in the hot
23 cells.

24
25 The four REC hot cells (A-Cell, B-Cell, C-Cell, and D-Cell) surround the REC airlock
26 cell, located at the junction of the T-shaped complex. The two SMF hot cells are adjacent to the
27 SMF airlock cell, located at the junction of the L-shaped complex. The airlocks function
28 primarily as a transition zone and ventilation barrier for movement of radioactive materials in
29 shielded packages between the unshielded areas and the shielded hot cells.

30
31 The remainder of the 324 Building consists of offices, lunchroom, change rooms, and
32 ancillary laboratory spaces. These areas are used to provide administrative support, development
33 laboratories, maintenance shops, and common facility service and support areas.

34 35 **2.2 Closure Unit Boundary Agreement**

36
37 The closure boundary was developed using the data quality objective process to assess how
38 much and what type of data are needed to allow decisions on closure to be made. This section
39 discusses the overall closure boundary and the agreements made on the various components
40 within the closure boundary (Table 2-1). Section 2.3 discusses in detail the as-is condition,
41 relevant construction and operational data, and specific closure unit components. For
42 completeness and to ensure that all areas of the 324 Building were considered for closure
43 requirements detailed record searches and reviews were conducted. Section 2.3 provides data on

1 areas within the closure boundary. Other areas within the 324 Building are outside the scope of
2 this closure plan.

3
4 The closure unit boundary includes all the cells in the REC and the REC airlock, the HLV,
5 the pipe trench that contains piping interconnecting the HLV tanks to the REC Cells, the LLV,
6 the trucklock, the cask handling area, the sample room (Room 145), the EDL-146, and the
7 galleries. Figures 2-2 through 2-5 identify the closure unit boundaries.

8
9 Within this boundary, only the following portions require closure actions: (1) the B-Cell;
10 (2) two portions of the D-Cell, including the adsorbed waste mineral oil container storage area
11 and the HLV liquid treatment process equipment; (3) the airlock; (4) the pipe trench; (5) HLV;
12 (6) LLV; (7) HLV sample room (Room 145); (8) EDL-146; (9) the operating galleries (including
13 Room 18); and (10) the piping system. The strategy and activities required for closure of these
14 portions of the 324 Building are detailed in Chapters 6.0 and 7.0, respectively. Section 2.3
15 provides a general physical description of the portions of the 324 Building that are included in
16 the closure boundary.

17
18 Additionally, Ecology and RL have agreed (Ecology and DOE-RL 1997) that the
19 ventilation system is not included in the closure and that the system will remain operational
20 under Washington State Department of Health (WDOH) direction and compliance requirements,
21 as appropriate, until the ventilation system is no longer needed to support deactivation and
22 closure activities. The 324 Building deactivation PMP currently has draft endpoints established
23 to shutdown the ventilation system.

24 25 **2.3 Closure Unit Descriptions**

26
27 The following sections provide a detailed description of the portions of the 324 Building
28 that are included in the closure boundary, provide construction and operational details, and
29 identify the closure unit components.

30 31 **2.3.1 Radiochemical Engineering Cells**

32
33 The REC (Figures 2-1 through 2-5 and 2-7) consists of four hot cells (A, B, C, and D), a
34 central airlock, and a pipe trench. The cells and airlock are joined to form a T-shaped structure.
35 D-Cell is located above the C-Cell on the south side. C-Cell/D-Cell, the airlock, and the A-Cell
36 form the top of the T-shape. B-Cell connects to the airlock to form the bottom of the T-shape.
37 The walls are constructed of 1.2-meter-thick, high-density concrete or 1.4-meter-thick, normal-
38 density concrete. This concrete is used as containment and radiation shielding.

39
40 The hot cells in the REC complex provide for process engineering and testing of highly
41 radioactive materials. The airlock functions primarily as a transition zone and ventilation barrier
42 for the transfer of highly radioactive material in shielded overpacks between the unshielded cask
43 handling area and the four shielded hot cells.

1
2 The larger A-Cell and B-Cell function as general purpose processing cells and were
3 operated using remote equipment from the operating galleries. A semi-remote maintenance
4 technique grouped process equipment into racks that 'plug' into the cell walls, and allow access
5 to service connections on the 'cold' side for contact maintenance. Certain in-cell items are
6 remotely operated and maintained using direct viewing through lead glass-oil filled windows
7 supplemented by closed-circuit television and manipulators. Process connections also are made
8 on the 'cold' side in a shielded pipe trench by semi-remote means. Process connections included
9 general services such as electrical, compressed air, instrumentation, etc., and piping connections
10 to the HLV and LLV tanks. As mentioned previously, these tanks held process feed solutions,
11 interim product, and process waste solutions.

12
13 Operations in the REC are performed remotely, so that remote experiments could be
14 performed in-cell. Each cell is equipped with remote/mechanical manipulators; remotely
15 operated cranes; remote viewing equipment; and 1.2-meter-thick leaded glass viewing windows
16 filled with mineral oil, which acts as an optical clarifier.

17
18 The remote viewing system consists of a portable video camera equipped with a zoom lens
19 and the ability to record video images. The camera system is hardened for high radiation
20 environment. Cameras in some areas can also provide color images. The video coverage and
21 camera movement in the cells are accomplished using the overhead cranes located in the cells.
22

23 **2.3.1.1 A-Cell Description**

24
25 REC A-Cell (Room 136) is located adjacent to and north of the REC airlock (Room 135).
26 Access into A-Cell is through a swinging shield door located in the airlock on the north wall.
27 Penetrations into A-Cell include ventilation ducts, manipulator sleeves, and electrical cables.
28 Two leaded-glass, oil-filled shielding windows provide visual access into the cell. Associated
29 with each window is a pair of remote/mechanical manipulators that provide remote handling
30 access into the A-Cell. The cell has a 9.1-metric-ton remote-operated bridge crane.
31

32 A-Cell (Figures 2-3 and 2-7) is 2.8 meters long, 6.4 meters wide, and 10 meters high. The
33 floor of the cell is located at the first floor level. The floor is lined with 0.32-centimeter stainless
34 steel plate that is welded at the seams. Under the floor plate is a 15-centimeter-thick slab of
35 concrete, and under the concrete floor is a crawlspace and packed native soil. Waste transfer
36 piping (from the pipe trench to the HLV tanks) is embedded in the concrete floor. Cell access is
37 through a door into the airlock. Walls are constructed of normal-density concrete and other
38 shielding materials (i.e., steel and concrete blocks) to protect personnel from the radiation
39 sources in the cells. Normal services into A-Cell include electricity, water, and compressed air.
40 There are 43 shielded penetrations in the liner to provide for addition of process accessories.
41

42 The following equipment is known to be in the REC A-Cell; all of this equipment is
43 scheduled to be removed.
44

- 1 • 1 electropolishing tank
- 2 • 1 power supply rack
- 3 • 1 canister storage rack (used to contain 34 Federal Republic of Germany canisters)
- 4 • 1 anode grappler
- 5 • 1 407.7-kilogram dumb bell
- 6 • 1 37.7-liter stainless steel 10 gauge container (previously used to store manipulator
- 7 sleeves, plastic, etc., subsequently emptied)
- 8 • Helium leak test fixture on the wall of the cell
- 9 • Canister transport fixture on the cell door.

10
11
12 **2.3.1.1.1 Construction and Operational Detail.** REC A-Cell is constructed of normal-
13 density concrete. The north wall is constructed of 1.37-meter-thick normal-density concrete.
14 East and west walls are constructed of normal-density concrete, varying from 1.37-meters to
15 1.82-meters thick. The south wall is constructed of 1.22-meters-thick normal-density concrete.
16 The interior A-Cell floor is lined with stainless steel. The walls are lined with 0.6-centimeter-
17 thick mild steel plate. The plate is butt-welded and ground to a smooth finish. The stainless
18 steel floor line is seam welded to the mild steel plate, approximately 5.1 centimeters above floor
19 level. The wall liner extends to the height of the crane rails (68.6 centimeters). A 7.6-centimeter
20 band of epoxy resin was applied at the top of the wall liner during construction. REC cell floors
21 are lined with 0.32-centimeter stainless steel. The floors are sloped toward sumps provided with
22 liquid-level indication instrumentation and steam jets for removing accumulated liquid. Under
23 the cells is a solid foundation and a ventilation duct space that houses exhaust ducts carrying air
24 from the cell to the first stage of HEPA filters. The cells are ventilated, and instruments and
25 accessible components are checked daily. Air is drawn through cell wall penetrations and
26 ventilation inlets. Cell pressure is maintained lower than the surrounding galleries to prevent the
27 migration of contamination into the operating gallery. Exhaust air passes through at least two
28 stages of HEPA filtration before exiting through an EPA/WDOH regulated point source emission
29 unit (stack). Alarms and instrumentation are maintained through a periodic preventative
30 maintenance recall system in addition to corrective actions initiated during operator rounds and
31 operations.

32
33 The A-Cell liner was installed at the time of construction of the REC hot-cells. The liner
34 floor is constructed of 0.32-centimeter-thick seam welded stainless steel plate. The walls are
35 lined to the ceiling with mild (carbon) steel that is painted. Mild steel was used rather than
36 stainless because the cell was originally designed to test fission gases (i.e., iodine) that are
37 corrosive to stainless steel. The ceiling is painted concrete. The A-Cell liner has 43 engineered
38 penetrations ranging from 1 meter to 8.5 meters above the floor. The cell was designed and
39 constructed as a primary containment structure for highly radioactive waste (liquid and sludge).
40 There was no integrity assessment documentation available for the original welds, nor was there
41 a periodic nondestructive examination program to determine the integrity of the liners. There has
42 been no indication of corrosion or unplanned penetrations on the cell liner noticed during the
43 recent cell work to remotely remove high heat source vitrified containers.

44

1 **2.3.1.1.2 Closure Unit Components.** As shown in Table 2.1, there are no components
2 within A-Cell requiring closure. Waste piping under A-Cell (in the A-Cell crawl space) will
3 require closure. Access to the crawl space will be evaluated during completion of closure unit
4 activities. Further details for closure activities are provided in Chapter 7.0.
5

6 **2.3.1.2 B-Cell Description**

7

8 B-Cell (Figures 2-2, 2-7, and 2-8) is the largest of the four hot cells, measuring 7.6 meters
9 long, 6.7 meters wide, and 9.3 meters high. The floor of the cell is located at approximately the
10 basement level, 3.05 meters below grade. The floor and the walls are lined up to 8.2 meters high
11 with 0.32-centimeter-stainless steel plate that is welded at the seams. Under the floor liner is a
12 slab of concrete varying from 15.2 to 30.5 centimeters in thickness, and under the concrete is
13 packed native soil. The cell walls are made of 1.5-meter-thick high-density concrete from the
14 floor up to the 0.0 level (cell walls in Room 18), thinning to 1.2-meters-thick from 0.0 level up to
15 the ceiling (0.0 level is the first floor level). The cell is surrounded on three sides by operating
16 galleries on the first and second floors and on two sides by a gallery (Room 18) at the basement
17 level. The east side of the cell adjoins the airlock.
18

19 Numerous cell wall penetration sleeves, stepped for shielding purposes, are used to provide
20 piping and electrical services to in-cell equipment. Penetrations for services, such as
21 manipulators and electrical cables, are not completely sealed, but rather rely on the negative
22 pressure in the cell to prevent escape of contamination. Ventilation inlets initially were designed
23 and installed with low-efficiency filters (dust stops), but those filters admitted particulate matter
24 from the outside, some of which settled to the floor as it entered the slower moving air in the cell.
25 In April 1994, HEPA filters were installed to minimize the amount of dust entering the cell. The
26 HEPA filters remove at least 99.97 percent of 0.3-micron-size particles. Air leaving B-Cell
27 passes through an electrostatic precipitator upstream from a bank of in-cell HEPA filters. The air
28 exhaust passes through two additional banks of HEPA filters before leaving the building.
29

30 Two cranes service the cell and allow material movement between B-Cell and the airlock
31 cell. Three oil-filled lead glass viewing windows are located on the first floor, and two viewing
32 windows are located on the second floor. The first floor windows each have two adjacent
33 remote/mechanical manipulators that allow remote manipulation and maintenance of the in-cell
34 equipment.
35

36 The following equipment is known to be in the REC B-Cell. All of this equipment is
37 scheduled to be removed. This equipment is described in detail in Chapter 3.0, Section 3.3.2:
38

- 39 • Three large equipment racks (1A, 1B, and 2A)
- 40 • Three in-cell process service tanks (Tank 112, Tank 114, and Tank 118)
- 41 • An evaporator tank (Tank 113)
- 42 • An acid fractionator tank (Tank 115)
- 43 • Associated ancillary equipment and piping.

- 1 • Two temporary fuel storage racks
- 2 • Special Case Waste (SCW) and mixed waste storage rack
- 3 • A fuel pin storage container
- 4 • Fuel thimbles used to transport and store spent fuel assemblies
- 5 • 2,265-kilogram steel block
- 6 • Sump trench cover screen
- 7 • West window work tray.

8
9 The two fuel storage racks currently house the light waste reactor (LWR) spent fuel
10 assemblies (located within fuel assembly thimbles) and the fuel pin storage container containing
11 17 intact fuel pins. The fuel storage racks are temporary racks located on either side of the west
12 window of B-Cell. The SCW container rack currently contains the containerized dispersibles. A
13 114-liter fuel pin storage container is used to house approximately 16 rod-equivalent boiling
14 water reactor (BWR) and pressured water reactor (PWR) Spent Nuclear Fuel (SNF) segments,
15 and 21 kilograms of PWR fuel pellet fragments (>7.6 centimeters in length).

16
17 **2.3.1.2.1 Construction and Operational Detail.** B-Cell floor was constructed with a two
18 percent slope from the high point along the west side to the low point on the east side. The cell
19 was designed so that any liquid that reaches the floor flows across the floor to a trench, that runs
20 the length of the east side, which is sloped to a sump in the northeast corner beneath the 2A
21 Rack. Liquid jetted from the B-Cell sump was transferred to the HLV tanks via the pipe trench.
22 The sump jet ceased operating in 1979, and due to inaccessibility, was not replaced. Because of
23 the placement of the 1A, 1B, and 2A Racks, inspection of the status of the collection trench and
24 sump is not possible. However, the cell was designed to have a sump alarm that annunciates if
25 excess liquid accumulates. No documentation was found that the sump alarm was ever turned
26 off or otherwise made inoperable. The sump alarm is designed to function through monitoring
27 pressure differences caused by increases in the liquid level present in the sump. Differential
28 pressure transmitters located in the second floor gallery area are serviced routinely to ensure
29 working order. The alarm is set to indicate the presence of liquid at a pre-set level (typically 2.5
30 centimeters to 5 centimeters of liquid). Therefore, it is possible to have liquid present in the
31 sump below the setpoint of the instrumentation while the alarm is operational.

32
33 The processing activities in B-Cell included some high temperature processing steps that
34 could have allowed some process effluents to be consecutively transported to the relatively cool
35 ceiling and be condensed. Although the down draft design of the in-cell ventilation was expected
36 to minimize this effect, the inlet air ducts in the ceiling did not coincide with the position of the
37 underlying high temperature equipment enough to be totally effective.

38
39 B-Cell is lined with 0.32-centimeter stainless steel. The cell has a solid foundation, is
40 protected from the environment, is ventilated, and the instruments and accessible components are
41 checked daily. Air is drawn through cell wall penetrations and ceiling ventilation inlets. Cell
42 pressure is maintained lower than the surrounding galleries to prevent the migration of
43 contamination. Exhaust air passes through at least two stages of HEPA filtration before exiting
44 through an EPA/WDOH point source emission unit (stack).

1
2 Alarms and instrumentation are maintained through a periodic preventative maintenance
3 recall system in addition to corrective actions initiated during operator rounds and operations.
4 In-cell liquid alarms and instrumentation are designed to function through monitoring pressure
5 differences caused by increases in the liquid level in the sump or vessel.
6

7 The B-Cell liner was installed at the time of construction of the REC hot cells. The liner
8 was constructed with 0.32-centimeter stainless steel plate, seam welded, and covers the floor and
9 8.2 meters up the walls. At the top, the concrete wall was slotted and the liner plate was folded
10 and epoxyed in place in the slot to form a waterproof flashing to prevent liquid from entering
11 behind the liner. The remaining walls and ceiling are painted concrete. The B-Cell liner has 89
12 engineered penetrations located at a minimum height of 1 meter and maximum height of
13 8 meters. The hot cells were designed and constructed as a primary containment structure for
14 highly radioactive waste (liquid and sludge). There was no integrity assessment documentation
15 available for the original welds, nor was a periodic nondestructive examination program for
16 determining the integrity of the liners. In addition, the floor liner could not be inspected because
17 it was covered by the large process racks and dirt/debris.
18

19 It should be noted that as designed, the stainless steel liner ran up the wall to the concrete
20 ledges that hold the crane rails. Angle iron 'flashing' was installed at the junction between the
21 crane rails and the top of the stainless liner. The flashing is sealed and bolted in place. This
22 flashing completes the effective seal of the cell, and prevents decontamination solutions or
23 deluge water from running between the concrete wall and the stainless steel liner.
24

25 **2.3.1.2.2 Closure Unit Components.** The components requiring closure in B-Cell are the
26 stainless steel liner and surrounding concrete (Table 2-1). The excess in-cell equipment and
27 dispersible debris (including all mixed waste) are being removed in accordance with the M-89-02
28 Milestone. B-Cell cleanout is an ongoing project, which is detailed in Chapter 3.0, Section 3.3.2.
29

30 **2.3.1.3 C-Cell Description**

31
32 C-Cell is located directly below D-Cell in the south leg of the REC 'T' (Figures 2-3 and
33 2-7). The floor of the cell is at the first floor building level. The C-Cell is 5.9 meters long,
34 3.7 meters wide, and 4.6 meters high. The floor is lined with 0.32-centimeter-stainless steel plate
35 welded at the seams. Under the floor plate is a 15-centimeter-thick slab of concrete, and under
36 the concrete floor is a crawl space and packed native soil. The cell is adjoined to the north by the
37 airlock. The cell access is provided by a door to the airlock. Shielding walls are constructed of
38 1.2-meter-thick high-density concrete. Normal services into C-Cell include electricity, water,
39 and compressed air.
40

41 C-Cell is adjacent to and south of the REC airlock (Room 135). Access into C-Cell is via
42 the Airlock through two openings. A pass-through is capable of handling articles up to
43 46 centimeters wide and 46 centimeters high. It is equipped with hinged 15-centimeter thick
44 steel and lead shielding doors on the inside and outside surfaces of the cell wall. Larger articles,

1 up to 1.8 meters wide by 2.4 meters high, can be moved through the C-Cell shield door. In
2 addition, articles can be introduced to, but not removed from C-Cell through a small 10.2-
3 centimeter diameter pass-through in the front facing wall. A removable block (0.9 m by 1.2 m) is
4 located in the C-Cell ceiling to allow transfers between C-Cell and D-Cell. C-Cell was designed
5 to be a multipurpose cell for laboratory and engineering scale radiochemical experimentation.
6

7 Two leaded-glass, oil-filled shielding windows provide visual access into the cell.
8 Associated with each window is a pair of remote/mechanical manipulators that provide
9 remote-handling capability in the cell. The C-Cell also is equipped with a 1.8-metric-ton remote-
10 operated bridge crane and a power-assisted robotic manipulator.
11

12 Cell lighting consists of mercury vapor lighting lamps. These fixtures are positioned along
13 the wall above the cell windows.
14

15 The following equipment is known to be in C-Cell:
16

- 17 • Sludge pretreatment system (currently operational)
- 18 • A metal fold down ladder
- 19 • 1.8-metric-ton bridge crane (dedicated to C-Cell)
- 20 • Camera
- 21 • Pneumatic arm
- 22 • Periscope
- 23 • Hand tools
- 24 • A work table.
25

26 **2.3.1.3.1 Construction and Operational Detail.** C-Cell is constructed of concrete. The
27 ceiling is 0.9-meters-thick concrete with one removable block 0.9-meter by 1.2-meter, located on
28 the north side of the cell to allow transfer of equipment from D-Cell. The short east and west
29 walls are normal-density concrete varying in thickness from 1.4 meters to 1.8 meters thick. The
30 north wall is of 1.4-meters-thick normal-density concrete. The south wall is of 1.2-meters-thick
31 high-density concrete. The floor is of 0.61-meter-thick high-density concrete. Process lines are
32 embedded in the concrete floor. The interior C-Cell floor is lined with stainless steel seam
33 welded plate; interior walls also are lined from floor to ceiling with stainless steel seam welded
34 plate. The exterior walls are painted concrete. C-Cell is equipped with one sump located in the
35 southwest corner of the cell. A collection trench runs along the south wall of the cell. The floor
36 of the cell is sloped to the sump. In 1995, the sump was sealed closed by welding a stainless
37 steel plate to the floor. The collection trench is still functional.
38

39 C-Cell has a solid foundation, is protected from the environment, is ventilated, and the
40 instruments and accessible components are checked daily. Air is drawn through cell wall
41 penetrations and ventilation inlets. Cell pressure is maintained lower than the surrounding
42 galleries to prevent the migration of contamination. Exhaust air passes through at least two
43 stages of HEPA filtration before exiting through an EPA/WDOH, regulated point source

1 emission unit (stack). A ventilation crawl space with a packed native dirt floor under the C-Cell
2 floor slab allows routing of the airlock exhaust plenums to the first stage of HEPA filtration.

3
4 In addition, service piping manifolds are located on the east and west walls of the cell. The
5 manifolds consist of flanges or block connectors attached to piping that is embedded in the
6 concrete wall. The piping consists of steam, water, and vacuum lines. Additionally, extra
7 service lines are present that can provide interconnection to other REC Cells for the transfer of
8 solutions. All of these lines, as well as lines servicing D-Cell, are embedded in the concrete
9 walls and floor of the cell.

10
11 Alarms and instrumentation are maintained through a periodic preventative maintenance
12 recall system in addition to corrective actions initiated during operator rounds and operations.

13
14 The C-Cell liner was installed at the time of construction of the REC hot cells. The liner
15 was constructed with 0.32-centimeter-thick stainless steel plate, seam welded, and covers the
16 floor, walls, and ceiling. The ceiling has a 0.9-meter by 1.2-meter removable block to allow
17 transfer of equipment into the cell using the D-Cell crane. The C-Cell liner has 21 engineered
18 penetrations located at a minimum height of 1 meter and maximum height of 4 meters. The hot
19 cells were designed and constructed as a primary containment structure for highly radioactive
20 waste (liquid and sludge). There was no integrity assessment documentation available for the
21 original welds, nor was there a periodic nondestructive examination program to determine the
22 integrity of the liners.

23
24 **2.3.1.3.2 Closure Unit Components.** As shown in Table 2.1, there are no components
25 within C-Cell requiring closure.
26

27 **2.3.1.4 D-Cell Description.**

28
29 D-Cell is located directly above C-Cell in the south end of the REC 'T' (Figures 2-5 and
30 2-7). The floor of the cell is between the first and second floor levels. D-Cell is 6.1 meters long,
31 3.7 meters wide, and 4.9 meters high. The floor is lined with 0.32-centimeter-thick stainless
32 steel, and the walls are lined with mild steel. The cell is adjoined by the airlock and by the
33 second floor service gallery on the south side. There is a door between the cell and the airlock.
34 Walls are constructed of 1.4-meter-thick, normal-density concrete and uses other shielding
35 materials (i.e., steel) to protect personnel from the radiation sources in the cell. Normal services
36 into D-Cell include electricity, water, and compressed air. Services are provided through
37 embedded piping in the east and west walls of the cell. Piping also includes unused service lines
38 that can be used to provide connection to other REC Cells for the transfer of solutions or small
39 process ventilation.
40

41 D-Cell is located adjacent to and south of the REC airlock. D-Cell is situated directly
42 above the C-Cell with a 0.6-meter-thick floor slab in between. A removable block in the floor
43 allows egress to C-Cell below. Access into the D-Cell is through a swinging shield door located
44 in the airlock on the south wall or through a transfer port that provided an airlock for a glovebox

1 originally installed in the D-Cell gallery area. A small 7.6-centimeter pass-through port is
2 available for transfers of materials into or out of the cell. A pass-through penetration that was
3 never used, is present in the west wall of the cell. The penetration is shielded with concrete
4 bricks and covered with a steel access plate on the gallery side of the wall.
5

6 D-Cell is similar to the other REC cells and has two shielding windows, four
7 remote/mechanical manipulators, a remote viewing periscope, and closed-circuit television.
8 D-Cell shares a 4.5-metric-ton adjacent to each remote operated bridge crane with the airlock and
9 A-Cell. D-Cell lighting consists of a mercury vapor lamps installed at each window on the cell
10 interior. D-Cell has a sump in the southwest corner of the cell. There is no documentation of
11 any process upset that resulted in the accumulation of liquids in the sump.
12

13 In addition to the SNF, HLV filters, and ion exchange columns, the following equipment is
14 known to be in D-Cell:
15

- 16 • HLV skids 1 and 2
- 17 • HLV skid spreader bar
- 18 • Two spent fuel storage containers with full length and segmented fuel sections
- 19 • A lead cave containing two balances
- 20 • One cell periscope
- 21 • Mark 42 sample fines
- 22 • One wall-mounted power-assisted robotic manipulator
- 23 • Two 19-liter buckets of nonregulated waste
- 24 • Miscellaneous hand tools, electrical cords, electrical junction box, impact wrench,
25 empty tubing and piping, wire and nylon slings, and lifting hooks
- 26 • One mini-grout container with waste (nonregulated)
- 27 • 38 empty lengths of 4.3-meter-long tubing designed to contain spent fuel rod segments.
28

29 D-Cell is used primarily for engineering development work involving highly radioactive
30 materials and waste. D-Cell currently contains some contaminated process equipment.
31

32 **2.3.1.4.1 Construction and Operational Detail.** D-Cell is constructed of concrete. The
33 short east and west walls are constructed of 1.7-meter-thick normal-density concrete. The west
34 wall has a 'soft plug' area 0.76 meters wide by 0.91 meters high that is shielded with concrete
35 bricks, and covered with a steel access plate on the gallery side. The north wall is constructed of
36 1.1-meter-thick normal-density concrete. The long south wall is constructed of 1.22-meter-thick
37 high-density concrete. The floor is constructed of 0.91-meter-thick high-density concrete. An
38 equipment access hatch 0.91-meters by 1.22-meters is present on the north side of the cell floor.
39 The hatch allows transfer of equipment to C-Cell using the D-Cell crane. The interior D-Cell
40 floor is lined with stainless steel. The D-Cell interior walls are lined from the floor to ceiling
41 with mild (carbon) steel with welded seams. The wall liner is seam welded to the floor liner
42 about 5.08 centimeters above the floor. The mild steel liner is epoxy-sealed to the concrete wall
43 at the crane rail height.
44

1 The floor is sloped towards a sump provided with leak detection, liquid level indication
2 instrumentation, and steam jets for removing accumulated liquid. D-Cell is protected from the
3 environment, is ventilated, and the instruments and accessible components are checked daily.
4 Air is drawn through cell wall penetrations and ventilation inlets. Cell pressure is maintained
5 lower than the surrounding galleries to prevent the migration of contamination. Exhaust air
6 passes through at least two stages of HEPA filtration before exiting through an EPA/WDOH
7 point source emission unit (stack).

8
9 Alarms and instrumentation are maintained through a periodic preventative maintenance
10 recall system, in addition to corrective actions initiated during operator rounds and operations.

11
12 The D-Cell liner was installed at the time of construction of the REC hot-cells. The liner
13 was constructed with 0.32-centimeter-thick stainless steel plate, seam welded, and covers the
14 floor. The walls are lined to the ceiling with mild (carbon) steel welded at the seams. The walls
15 are painted. The ceiling is painted concrete. The D-Cell Liner has 21 engineered penetrations
16 located at a minimum height of 1 meter and maximum height of 4 meters. Although the hot cells
17 were designed and constructed as a primary containment structure for highly radioactive waste
18 (liquid and sludge), there was no integrity assessment documented in evaluation of the original
19 welds, nor was there a periodic nondestructive examination program for determining the integrity
20 of the liners.

21
22 **2.3.1.4.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
23 closure in D-Cell are the removal of the installed equipment associated with the storage and
24 treatment of waste materials from the HLV tanks (Chapter 3.0, Section 3.3.9), followed by visual
25 inspection of the stainless steel liner and surrounding concrete. The removal of this equipment
26 will be performed in accordance with Chapter 7.0, Section 7.1.4. It is anticipated that this
27 equipment will be used to support liquid waste processing of decontamination solutions
28 generated during deactivation activities.

30 **2.3.1.5 Airlock Description**

31
32 The REC airlock is used primarily as a transition area for transfer of material and
33 equipment into and out of the adjoining cells. Cask transfers between the airlock and the cask
34 handling area are performed using a powered cask dolly.

35
36 The airlock is located at the junction of the arms of the REC 'T' (Figure 2-7) and is
37 6.7 meters long, 6.6 meters wide, and 10 meters high. The floor and the walls up to 8.2 meters
38 high are lined with stainless steel plate welded at the seams. The airlock adjoins A-Cell (north),
39 B-Cell (west), and C-Cell/D-Cell (south), and the cask handling area (east). Access to these
40 areas is via large steel doors equipped with interlocks to prevent unintended opening. The
41 airlock is equipped with cranes that facilitate remote installation, maintenance, and operation of
42 equipment. Shielding walls are constructed of 1.4-meter-thick normal-density concrete.

43

1 Access to the REC airlock is through two swinging doors, hung one above the other,
2 sharing a single opening to the cask handling area. The doors are constructed of stepped steel
3 that is at least 0.3 meters thick; the lower door has a 30-centimeter-square lead-glass shielding
4 window. Large pneumatic cylinders provide the driving force to open and close the doors. The
5 doors are not specifically fire-rated. However, because of the thickness and fire resistance, the
6 doors will help limit the spread of fire into adjoining areas.

7
8 One lead-glass, oil-filled shielding window is located in the east wall of the airlock.
9 Associated with the window is a pair of remote/mechanical manipulators that provide remote
10 access into the airlock.

11
12 Penetrations into the airlock include a cask access port, ventilation duct, manipulator
13 sleeves, and electrical cables. These services are not completely sealed but rely on the negative
14 pressure in the airlock to limit escape of contamination. Under normal operating conditions, the
15 pressure differential between the interior and exterior of the airlock creates a constant sweep of
16 air from the cask handling area through the penetrations into the airlock, thereby maintaining
17 contamination control.

18
19 Mercury vapor and incandescent lights are installed in the airlock. The types of portable
20 furnishings stored in the airlock include several large tables and a ladder that leads to the service
21 platform.

22
23 **2.3.1.5.1 Construction and Operational Detail.** The airlock is constructed of concrete.
24 The interior airlock floor is lined with stainless steel. The floor outside the airlock (i.e., the cask
25 handling area floor) is painted concrete. The airlock interior walls are lined from the floor up to
26 8.2 meters with stainless steel. The remainder of the walls and the ceiling are painted concrete.

27
28 The REC airlock also is equipped with the following items:

- 29
- 30 • One, 0.680-metric-ton remote-operated jib crane with a camera mounted on the boom
 - 31 • Two remotely-operated 4.5-metric-ton bridge cranes that also serve A- and D-Cells
 - 32 • A material and equipment transfer system that includes an electric tugger, dollies, and
33 nine sections of track
 - 34 • Several work tables
 - 35 • The pipe trench pump.
- 36

37 The airlock is lined with 0.32-centimeter stainless steel. The floors are sloped toward the
38 pipe trench. The airlock has a solid foundation, is protected from the environment, is ventilated,
39 and the instruments and accessible components are inspected daily. Air is drawn through cell
40 wall penetrations and ventilation inlets. Airlock pressure is maintained lower than the
41 surrounding galleries to prevent the migration of contamination. Exhaust air passes through at
42 least two stages of HEPA filtration before exiting through an EPA/WDOH regulated point source
43 emission unit (stack). A crawl space with a packed native dirt floor located under the concrete
44 floor of the airlock allows routing of the airlock exhaust plenums to the first stage of HEPA
45 filtration. The area is used to provide for chaseways for ventilation supply/exhausts from the hot

1 cells and process and waste transfer lines. No waste management activities have taken place in
2 this area.

3
4 Alarms and instrumentation are maintained through a periodic preventative maintenance
5 recall system in addition to corrective actions initiated during operator rounds and operations.

6
7 The airlock liner was installed at the time of construction of the REC hot-cells. The liner
8 was constructed with 0.32-centimeter stainless steel plate, seam welded, and covers the floor and
9 8.2 meters up the walls. The remaining walls and ceiling are painted concrete. The ceiling is
10 painted concrete. Although the REC was designed and constructed as a primary containment
11 structure for highly radioactive waste (liquid and sludge), there was no integrity assessment
12 documentation evaluating the original welds, nor was there a periodic nondestructive
13 examination program for determining the integrity of the liners. Despite this, there was no
14 indication of corrosion or unplanned penetrations of the airlock liner noticed during the recent
15 cell work to remotely remove high-heat source vitrified containers.

16
17 **2.3.1.5.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
18 closure will be those that isolate piping associated with the HLV/LLV tanks that are beneath the
19 airlock. The removal of equipment and the deactivation of the airlock will be performed in
20 accordance with the 324 Building deactivation plan.

21 22 **2.3.1.6 Pipe Trench**

23
24 The pipe trench was used to make utility, process, and waste handling connections
25 between the cells and the HLV tanks. The pipe trench is located under the floor of the REC
26 airlock just in front of the B-Cell door. The pipe trench is 1.3 meters wide, 6.4 meters long, and
27 varies in depth from approximately 1.8 meters on the north end to 1.6 meters on the south end.
28 Process and waste handling piping runs between the pipe trench and the HLV tanks, LLV tanks,
29 and B-Cell.

30
31 The pipe trench also was designed to collect water used for decontamination in the REC
32 airlock. The pipe trench was equipped with a steam jet that enabled solutions collected in the
33 trench to be transferred to LLV tank 102, but the jet ceased functioning in 1985. Since that time,
34 collected water has been managed by monitoring the pipe trench level, and by curtailing use of
35 water in the airlock if levels reach an administrative control level. Alternatively, a pump has
36 been connected to tubing running into the pipe trench. The outlet for the pump is connected to a
37 line that passes through a shield plug in the airlock into B-Cell.

38
39 The pipe trench can be accessed by removing five 60-centimeter-thick cover blocks using
40 B-Cell's 9.1-metric-ton bridge crane. The pipe trench is used to make process connections for
41 the radioactive liquids being handled by the cells and the vaults. Examples of the connections
42 include transfer lines to and from the vaults, lines to the loadout station, and lines to B-Cell.
43 Also, various utility connections (chemical addition lines, air lines, and steam lines) can be made
44 in the pipe trench. Additional information on the overall piping system is given in Section 2.4.

1
2 **2.3.1.6.1 Construction and Operational Detail.** The pipe trench is lined with 0.32m
3 stainless steel plate. The pipe trench contains approximately 7.6 meters of 12-millimeter pipe,
4 approximately 210 meters of 2.5-centimeter pipe, approximately 46 meters of 5.08-centimeter
5 pipe, and approximately 29 meters of 7.6-centimeter pipe. In the mid 1970's, a triple encased
6 inter-building transfer line (transfer piping with two outer pipe containments) was installed in the
7 pipe trench to transfer spent fuel dissolved in nitric acid to the 325 Building and to return the
8 processed solution to the 324 Building (refer to Chapter 3.0, Section 3.1.2.3).
9

10 **2.3.1.6.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
11 closure will be those that isolate piping associated with the HLV tanks. Note: To determine if
12 additional closure activities are required, the pipe trench liner will be inspected on removal of the
13 piping and drip pans.
14

15 **2.3.1.7 Other Radiochemical Engineering Cell Components**

16
17 Two other components of the REC are closure concerns. These are the pass-through
18 ports and the cubicles.
19

20 **2.3.1.7.1 Pass-through Ports.** Pass-through ports are holes in the hot cell walls (ranging
21 from 10 to 38 centimeters in diameter) that are used to pass items into the hot cells. The smaller
22 ports generally are equipped with 'split plugs', which have shielding on the bottom for half of one
23 plug and on the top half for the other half of the plug. This allows hoses and cords to be placed
24 through the wall into the hot cell. The larger ports generally are equipped with shielding doors
25 and are used to pass objects, such as tools or equipment, into (and possibly out of) the cell.
26 There are no closure components requiring closure associated with the pass-through ports.
27

28 **2.3.1.7.2 Cell Cubicles.** Cell cubicles are located in the walls of A-Cell and B-Cell. The
29 cubicles consist of a 10-centimeter-thick steel shielding door that opens into a small area in the
30 wall. The cubicles do not penetrate the cell walls. The cubicle areas are used for making process
31 connections (e.g., for steam, air, water, chemical addition) into the cells.
32

33 Eight cubicles are associated with A-Cell and B-Cell. Cubicles A-11 and A-12 are
34 located on the first floor of the A-Cell gallery. Cubicles A-21 and A-22 are located on the
35 second floor. Cubicles A-31 and A-32 are located on the third floor. Cubicles B-12 and B-14
36 are located on the first floor B-Cell gallery, west wall (Figure 2-7). As discussed in
37 Section 2.3.3, the only components associated with the eight cubicles requiring closure are those
38 associated with the isolation of the HLV tanks piping.
39

2.3.2 Description of High-Level Vault and Low-Level Vault

Two shielded underground vaults (HLV and LLV) are in the 324 Building (Figures 2-1, 2-6, and 2-9). These vaults are equipped with tanks for temporary storage of liquids. Each vault contains four stainless steel tanks. These tanks have been used as temporary holding tanks for feed solutions, feedstock tanks for process solutions, or collection tanks for effluents from project activities. The HLV and LLV tanks have been used to store mixed waste solutions.

2.3.2.1 High-Level Vault and High-Level Vault Tanks Description

The HLV is a rectangular concrete vault set under the floor of the cask handling area. The HLV is 6.4 meters long, 4.0 meters wide, and 4.4 meters deep, and is oriented in an east/west direction. The west end of the vault (the end closest to the REC cells) has a ledge approximately 1.4 meters high that enlarges the upper level of the HLV to 8.2 meters long.

The HLV contains four stainless steel tanks (104, 105, 106, and 107) (Figures 2-1, 2-6, 2-9, 2-10, 2-11, and 2-12). Tank 104 and Tank 105 are on the lower level, with Tank 104 being the eastern-most tank. Tanks 106 and 107 sit on the ledge, with Tank 107 being the northern-most tank. The smallest tank has a capacity of approximately 1,700 liters and the largest tank has a capacity of approximately 19,000 liters.

Each tank is a cylinder with a flat top and sloped bottom (except for Tank 107, which has a concave bottom) and a stainless-steel cooling jacket, although the cooling system has been deactivated. The HLV tanks are fitted with bubbler tubes with differential pressure transducers for measuring liquid level, specific gravity, and static pressure and with thermocouples for measuring temperature. Instrument readings are logged each normal working day. The tanks also are equipped with high-liquid level and high-temperature alarms, except Tank 106, which does not have an operational high-liquid level alarm. Because the stainless-steel cooling jackets are not being used, air now fills the space between each tank and its jacket. The head space in each tank is operated at slightly negative pressure, is vented through a common ventilation system that pulls air and tank vapors through two banks of HEPA filters located in Room 11, and is discharged to the main 324 Building stack.

When the HLV tanks were installed in 1964, the following design features were included to provide protection against releases of waste to the environment: corrosion-resistant stainless steel tanks and piping; welded pipe connections; tanks with top-entering penetrations only; secondary containment around tanks and piping; and instruments to control the fill level of the tanks and to detect leaks.

2.3.2.1.1 Construction and Operational Detail. The HLV is constructed of concrete and is lined with a welded 0.32-centimeter stainless steel plate over the floor, ledge, and partially up the wall. The plate, which provides secondary containment, covers the floor and extends 1.1 meters up the walls. The stainless steel plate also covers the floor of the ledge and extends 15.2 centimeters up the walls above the ledge. The floor is sloped in the shortest direction

1 toward a trench located along the north wall. The trench, in turn, slopes from both ends of the
2 HLV toward the middle where a 0.6-meter x 0.6-meter x 0.6-meter sump is located. The sump is
3 equipped with a liquid sensing alarm and a steam jet to transfer liquids to Tank 104. The alarm
4 set-point is maintained between 2.5 and 5.1 centimeters of liquid. The liquid-level
5 instrumentation records levels down to zero. (Waste generation and management activities are
6 addressed in more detail in Chapters 3.0 and 4.0.)
7

8 The HLV is covered by concrete 1.8 meters thick. The concrete shields against radiation
9 to minimize exposure to personnel outside of the HLV. The HLV can be accessed from above by
10 removal of the cover blocks, which cover about 40 percent of the vault floor area. Beneath the
11 concrete cover blocks are removable steel plate ventilation barriers.
12

13 There has been no integrity assessment performed for the purpose of complying with
14 WAC 173-303. The presence of high-activity radioactive material made the physical
15 performance of an acceptable assessment unreasonably difficult. However, all of the available
16 data required to assess the integrity of the unit have been evaluated and addressed in this closure
17 document. Design standards, dangerous characteristics of material handled in tanks and cells, the
18 age and history of the tanks in the vaults, and the results of construction testing of the tanks and
19 piping are addressed.
20

21 Secondary containment is provided for all tank systems. The tank systems are housed in
22 concrete vaults lined with seal welded 0.32-centimeter stainless steel plate. Capacities of the
23 lined sections of the vaults are greater than that of the largest tank. The vaults are situated below
24 grade and surrounded by packed native soil, providing a solid foundation. The vault floors are
25 sloped toward a sump provided with leak detection, liquid-level indication instrumentation, and
26 steam jets for removing accumulated liquid. The vaults are housed completely within the
27 confines of the 324 Building so the vaults are protected from run-on and precipitation. The
28 tanks, vaults, and cells are all ventilated to prevent the accumulation of hydrogen produced from
29 the exposure of aqueous liquids to high-level ionizing radiation. Inaccessible ancillary piping is
30 designed with jacketing where piping is imbedded in concrete or secondary containment.
31 Accessible ancillary piping is subject to daily inspection.
32

33 Liquid transfers are accomplished using leak proof steam jets, vacuum transfer, or gravity
34 flow. Transfer stations are supplied with metering equipment and tank volume indicators to
35 prevent overflow. Tanks also are equipped with high-liquid level and high-temperature alarms,
36 except Tank 106. Tank 106 had a high liquid alarm; however, it has failed and has not been
37 repaired because of the high radiation field preventing access. Tank and secondary containment
38 alarms annunciate both visibly and audibly in Room 310 (process control room) and the lobby. In
39 addition, an audible alarm sounds in all galleries and the power operator's office to alert
40 personnel if any monitored alarm point is exceeded.
41

42 Operating procedures requiring the inspection and documentation of tank systems and
43 monitoring instrumentation have existed and evolved since the facility was opened. Currently,
44 operator rounds are performed daily. The operator records instrument readings, inspects
45 equipment for proper function and alignment, and notifies supervision to initiate corrective

1 action in the event of equipment failure or out-of-specification instrument reading. Operators
2 also are directed to look for abnormal conditions (e.g., leaks, fire hazards, plugged drains) and to
3 initiate the appropriate corrective actions.
4

5 Alarms and instrumentation are maintained through a periodic preventative maintenance
6 recall system in addition to corrective actions initiated during operator rounds and operations.
7 Vault liquid alarms and instrumentation are designed to function through monitoring pressure
8 differences caused by increases in the liquid level in the sump or vessel. Differential pressure
9 transmitters located in the second floor gallery area routinely are serviced to ensure transmitters
10 are in working order.
11

12 Tanks 105 and 106 were constructed in the early 1940's for a 200 Areas facility that was
13 never constructed. In 1950, these tanks were transferred to the 300 Area and installed in the
14 321 Building. Tank 104 was constructed in 1954 and installed in the 321 Building as well.
15 These tanks were removed from the 321 Building in 1958. From 1950 through 1958, the
16 321 Building was used for testing Plutonium and Uranium Extraction (PUREX) flow sheet
17 modifications. Modifications of the tanks for use in the 324 Building vaults consisted of
18 removing and patching bottom drains and side penetrations, adding penetrations in the lids for
19 additional piping and instrumentation, and modifying the tank support legs to conform to the
20 pitch of vault floors. The tank support legs are constructed of type 304-L stainless steel, welded
21 in place. Tank 107 was built specifically for the 324 Building. The weld specifications for the
22 tanks are Hanford Standard Specification HWS-4924-S. The radiograph specification is HWS-
23 8227. The radiography and welding specification numbers and references to leak tests were
24 obtained from notes on the as-built drawings. Although test results are unavailable,
25 nonconformance to these standards typically would be noted on the as-built drawings. These
26 drawings were approved by the cognizant engineer at the time of installation. Subsequent to
27 testing, the tanks were accepted and placed into operation.
28

29 The four HLV tanks are interconnected with piping. These tanks are also connected to
30 various other locations in the REC cells, as shown in Table 2-2. Specific design details and
31 ancillary equipment are described in the following sections.
32

33 The HLV tanks have been rinsed, along with their associated piping as described in
34 Chapter 3.0, Section 3.3.9. Dose rates in the HLV have been estimated at 60 R/hr due to residue
35 in the tanks. In 1996, the HLV and LLV tanks were emptied and the HLV tanks were flushed to
36 satisfy Tri-Party Agreement milestone M-89-01.
37

38 **2.3.2.1.1.1 Tank 104.** Tank 104 was built in 1954 and was originally installed in the
39 321 Building. Tank 104 is 2.7 meters in diameter by 2.7 meters high, has a capacity of
40 15,000 liters, and is constructed of 1.27-centimeter-thick Type 304-L stainless steel. The outer
41 cooling water jacket is of 0.48-centimeter Type 304-L stainless steel. Tank 104 rests on
42 18 304-L stainless steel legs arranged in two concentric circles. In 1964, the tank was modified
43 for use in the HLV and moved to its present location. As part of the modification, all of the
44 circumferential and long-seam welds were radiographed to ensure the integrity of the tank.

1 Additionally, the tank was leak tested by filling the tank with water, and the cooling jacket
2 hydrostatically was tested to 138 kilopascals gauge.
3

4 **2.3.2.1.1.2 Tank 105.** Tank 105 was built in 1943, and was installed in the 321 Building
5 around 1950. Tank 105 is 2.9 meters in diameter and 2.7 meters high, and has a design capacity
6 of 19,000 liters. The tank is constructed of 1.27-centimeter-thick type 309 (25Cr-12Ni)
7 Columbium austenitic stabilized stainless steel. The tank also has a 0.48-centimeter-thick outer
8 jacket constructed of Type 18-8 Columbium austenitic stainless steel. Tank 105 rests on
9 18 304-L stainless steel legs arranged in two concentric circles. In a manner similar to Tank 104,
10 Tank 105 was modified for use in the HLV and moved to its present location in 1964. At that
11 time, all of the circumferential-stall and long-seam welds were radiographed; the tank was leak
12 tested by filling the tank with water; and the cooling jacket hydrostatically was tested at
13 137.9 kilopascals gauge.
14

15 **2.3.2.1.1.3 Tank 106.** Tank 106, constructed in 1944, is 1.2 meters in diameter
16 (including the cooling jacket) by 1.5 meters high and has a capacity of 1,700 liters. Tank 106
17 rests on the ledge beside Tank 107 and is supported by three type 304-L stainless steel legs. The
18 tank walls and bottom are made of 0.64-centimeter type 309 (25-12) Columbium austenitic
19 stabilized stainless steel plate; the cooling jacket is made of 0.48-centimeter type 18-8
20 Columbium austenitic stabilized stainless steel; and the roof is made of 0.95-centimeter type 25-
21 12 Columbium austenitic stabilized stainless steel.
22

23 **2.3.2.1.1.4 Tank 107.** Tank 107 is made of 0.64-centimeter-thick type 304-L stainless
24 steel and was subjected to radiography and dye-penetration testing of the welds when built in
25 1963. This tank also has a 0.48-centimeter-thick outer jacket of type 304-L stainless steel. Tank
26 107 is supported by three Type 304-L stainless steel legs and rests on the ledge beside Tank 106.
27 Tank 107 is 1.7 meters in diameter (including the cooling jacket) by 1.8 meters high and has a
28 capacity of 3,600 liters. The tank cooling jacket extends 1.1 meters above the base of the tank.
29 Tank 107 also has an agitator installed through a flange on the top of the tank.
30

31 **2.3.2.1.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
32 closure are the four HLV tanks, the associated piping, the vault liner and potentially the
33 surrounding concrete (in the event of liner breach).
34

35 **2.3.2.2 Low-Level Vault and Low-Level Vault Tanks Description**

36

37 The LLV is a rectangular concrete vault set under the floor of Room 147. Room 147 is
38 used for repair of radioactively contaminated equipment. The vault is 8.7 meters long, 4.0 meters
39 wide, and 5.6 meters deep, and is oriented in a north/south direction. The vault is lined with
40 0.32-centimeter stainless steel plate over the floor and 1.2 meters up the wall. The floor is sloped
41 from both ends to the middle and to the west and has a sump in the middle of the vault along the
42 west wall. The trench slopes from both ends toward the 0.6-meter by 0.6-meter by 0.3-meter
43 sump. The sump is equipped with liquid sensing alarms and a steam jet siphon that discharges
44 liquids to tank 102. The alarm setpoint is set at 2.5 to 5.1 centimeters of liquid.

1
2 The vault is covered by cover blocks (0.6-meter thick concrete) that reveal approximately
3 40 percent of the vault when removed from above. Beneath the cover blocks are removable steel
4 plate ventilation barriers. The LLV is connected via a short tunnel to the HLV near the top of the
5 vaults in the southern interconnecting wall. The vaults share the same air space, which is vented
6 to the low pressure side of the A-frame air filter bank from the HLV.
7

8 The LLV contains four stainless steel tanks (Tanks 101, 102, 103, and 108) (Figures 2-1,
9 2-6, 2-9, and 2-13). All tanks are stainless steel with cooling jackets to enable circumferential
10 heating and cooling of the tanks. The tank tops are flat and the tank bottoms are sloped. Tanks
11 are vented through two HEPA filters located in Room 11 then flow into the main building
12 exhaust.
13

14 The tanks rest on 18 pads placed in two concentric circles about the longitudinal axis of
15 the tank and one in the center.
16

17 **2.3.2.2.1 Construction and Operational Detail.** The four tanks in the LLV were built
18 in 1943, and subsequently were modified in 1963 for use in the LLV. All of the circumferential-
19 stall and long-seam welds were radiographed following modification. Additionally, the tanks
20 were leak tested by filling with water after the modifications were completed. As are the HLV
21 tanks, the LLV tanks are fitted with bubbler tubes with differential pressure transducers for
22 measuring liquid level, specific gravity, and static pressure and with thermocouples for
23 measuring temperature. Instrument readings are logged each normal working day. Tank 102 is
24 equipped with a liquid level alarm; no liquid level alarms are installed on the other tanks.
25

26 Tanks 101, 102, 103, and 108 were constructed in the early 1940s for use in a facility in
27 the 200 Area that was never constructed. In 1950, the tanks were transferred to the 300 Area and
28 installed in the 321 building. These tanks were removed from the 321 Building in 1958. From
29 1950 through 1958, the 321 Building was used for testing PUREX flow sheet modifications.
30

31 Modifications of the tanks for use in the 324 Building vaults consisted of removing and
32 patching bottom drains and side penetrations, adding penetrations in the lids for additional piping
33 and instrumentation, and modifying the tank support legs to conform to the pitch of the vault
34 floors. The tank support legs are composed of type 304-L stainless steel, welded in place.
35

36 The weld specifications for the tanks are Hanford Standard Specification HWS-4924-S.
37 The radiography specification is HWS-8227. The radiography and welding specification
38 numbers and references to leak tests are listed as notes on as-built drawings. Although test
39 results are unavailable, nonconformance to these standards typically would be noted on as-built
40 drawings. These drawings were approved by the cognizant engineer at the time of installation.
41

42 Construction and operational details associated with LLV secondary containment,
43 construction specifications, integrity assessments, liquid transfers, alarms and instrumentation,
44 and routine inspection and maintenance procedures are the same as those described for the HLV
45 in Section 2.3.2.1.1.

1
2 The tanks are interconnected. The tanks also are connected to other locations in the REC
3 cells as shown in Table 2.3.
4

5 **2.3.2.2.1.1 Tank 101.** Tank 101 is 2.0 meters in diameter (including cooling jacket) by
6 4.3 meters high and has a capacity of 12,500 liters. Tank 101 is constructed of 1.3-centimeters-
7 thick Type 309 (25-12) austentic Columbium stainless steel. The outer cooling water jacket is of
8 0.32-centimeter Type 18-8 austentic Columbium stainless steel.
9

10 **2.3.2.2.1.2 Tank 102.** Tank 102 is 2.4 meters in diameter (including cooling jacket) by
11 4.3 meters high and has a capacity of 18,500 liters. Tank 102 is constructed of 1.27 centimeters
12 thick Type 309 (25-12) austentic Columbium stainless steel. The outer cooling water jacket is of
13 0.32 centimeter Type 18-8 austentic Columbium stainless steel.
14

15 **2.3.2.2.1.3 Tank 103.** Tank 103 measures 2.0 meters in diameter (including cooling
16 jacket) by 4.3 meters high and has a capacity of 12,500 liters. Tank 103 is constructed of
17 1.3-centimeters-thick Type 309 (25-12) austentic Columbium stainless steel. The outer cooling
18 water jacket is of 0.32 centimeter Type 18-8 austentic Columbium stainless steel.
19

20 **2.3.2.2.1.4 Tank 108.** Tank 108 is 2.0 meters in diameter (including cooling jacket) by
21 4.3 meters high and has a capacity of 12,000 liters. Tank 108 is constructed of 1.3-centimeter-
22 thick Type 309 (25-12) austentic Columbium stainless steel. The outer cooling water jacket is of
23 0.32 centimeter Type 18-8 austentic Columbium stainless steel.
24

25 **2.3.2.2.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
26 closure are the four tanks, the associated piping, the vault liner and potentially the surrounding
27 concrete following final removal of equipment supporting the D-Cell liquid waste treatment
28 system.
29

30 **2.3.2.3 Sample Room (Room 145) Description**

31
32 The sample room (Room 145) contains shielded sampling equipment for the HLV and
33 LLV tanks. The sample room is a 2.7-meters x 1.8-meters x 2.6-meters metal enclosure with a
34 concrete-shielded roof located on the first floor in the northwest corner of the EDL-146.
35

36 **2.3.2.3.1 Construction and Operational Detail.** Inside the sample room is a shielded
37 stainless-steel sample collection and loadout box that has vacuum sampling lines to the HLV
38 tanks. The sample collection box has viewing ports and covers. A separate Plexiglas sample
39 collection and loadout box for the LLV tanks is located at floor level in the corner of the room.
40 Samples of all the tanks were taken in 1990. The HLV sample system was not used routinely
41 because of high dose rates associated with loadout of the samples. Although the sample
42 collection and loadout boxes are well maintained, the boxes are internally contaminated.
43

1 **2.3.2.3.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
2 closure are the isolation of piping associated with the HLV/LLV tanks.
3

4 **2.3.3 Description Of The Piping System**

5

6 The piping system within the 324 Building serves a variety of functions, with separate
7 lines for liquid transfers, tank sampling, tank venting, and sparging. The piping system also
8 includes chemical addition lines, raw (cooling) water supply lines, raw water return to the
9 retention process sewer, instrument air lines, compressed air lines and steam lines.
10

11 **2.3.3.1 General Characteristics of the Piping System.**

12

13 The piping associated with the REC and the two vaults varies from 0.64 centimeters to
14 7.6 centimeters in diameter and is made of stainless steel with welded joints. At the time of
15 installation in 1964/1965, all building piping was pressure tested at 21 kilopascals and at
16 1,720 kilopascals (water and steam), respectively, and did not experience pressure loss in a
17 24-hour period.
18

19 Liquids are moved using jets (siphon pumps). Unlike mechanical pumps, jets essentially
20 are maintenance free. The jets function by creating a suction that draws the liquid to the desired
21 location. The steam jets can be used to move liquids between the vaults and the REC, between
22 cells, between tanks in the vaults, and between the vaults. Air jets are used to collect samples
23 from the vault tanks.
24

25 Gravity also is used for moving the liquids. The piping that enters the vaults flows to the
26 vault tanks by gravity flow. The gravity piping system was designed with a fall of
27 0.52 centimeter per meter of run. This slope yields a flow capacity of 30 liters per minute for the
28 3.8-centimeter diameter pipe and 60 liters per minute for the 5.1-centimeter diameter pipe.
29 Instrumentation piping, vent piping, sparging piping, and sampling piping have a continuous
30 upward slope from the vault tanks to eliminate the potential for siphoning in these piping
31 systems.
32

33 Within the two vaults, the piping was constructed over the stainless steel lining and above
34 the tanks. The vault serves as secondary containment in the event a pipe leak should develop.
35 All piping originally associated with the HLV system is embedded at 0.6 meters inside the
36 concrete floor or walls. Piping added to HLV Tank 106 in 1977 to support the inter-building
37 pipeline for transfer of dissolved spent fuel is sleeved inside a 30.5-centimeter diameter stainless
38 steel pipe. Outside of the vaults, there is no specific secondary containment for most of the
39 piping system other than the structural concrete of the floor and walls. Exposed concrete is
40 painted in most cases but impermeability cannot be assured.
41

42 Piping from the HLV is routed to the pipe trench in the REC airlock. Piping is routed
43 from the pipe trench through the structural concrete to various locations in the REC Cells, such

1 as through shield plugs to B-Cell, cubicles servicing A-Cell and B-Cell, piping manifolds on the
2 east and west walls of C-Cell and D-Cell, various jet stations in the trucklock and cask handling
3 area, and the loadout stall located in the trucklock. The piping system was designed to offer the
4 greatest flexibility in transferring liquids, allowing liquids to be routed to any location within the
5 REC complex depending on jumper configurations made in the pipe trench, loadout stall, or cell
6 cubicles.
7

8 **2.3.3.2 Construction and Operational Detail**

9
10 Piping from the HLV and LLV tanks are of all-welded stainless steel construction. Pipe
11 diameters range from nominal 7.6 centimeters down to 1.3 centimeters, with the majority of
12 pipes being 2.5 centimeters. There are an estimated 1,676 linear meters of piping associated with
13 the HLV and LLV systems. Approximately two-thirds of this (1,117 meters) is in the HLV
14 system with the remainder (559 meters) in the LLV system. All pipes from the HLV are
15 embedded in the concrete floor and are buried at least 0.6 meters into the REC cell floors. Piping
16 typically is encased in a nominal 10-centimeters diameter fiberglass reinforced epoxy pipe where
17 the piping passes through a concrete structure. For some of the HLV piping, a nominal
18 30.5-centimeter stainless steel pipe is used for secondary containment.
19

20 Some of the piping into the REC cells is routed into a duct space underneath the REC air
21 lock floor and into the pipe trench in the REC air lock. Piping is routed from the pipe trench to
22 various locations associated with the cells, either through shield plugs into the B-Cell basement,
23 through shield walls to 'cubicles' in the gallery walls of A-Cell and B-Cell, to piping manifolds
24 in C-Cell and D-Cell, to the jet station in the cask handling area, the tank level indicator station
25 in the trucklock, or the loadout stall. Although this feature generally was unused, the piping
26 system was designed to be flexible, allowing for liquids to be routed to any number of locations
27 by making different jumper connections in the REC air lock pipe trench.
28

29 Accessible piping and equipment is inspected during daily surveillance rounds.
30 Deficiencies are noted and corrective maintenance is initiated based on the observations from the
31 surveillance rounds.
32

33 **2.3.3.3 Closure Unit Components (Pipelines into the REC, HLV, and LLV)**

34
35 Pipelines associated with dangerous and mixed waste transfer operations among the REC,
36 the HLV, and the LLV are closure unit components (Table 2-1). Ancillary piping and equipment
37 to the tanks that was used to distribute, meter, or control the flow of dangerous wastes per
38 WAC 173-303-040 are included. The inter-building pipeline used for the transfer of dissolved
39 spent fuel is outside the closure boundary and will be dispositioned as part of building D&D and
40 TPA past practice processes.
41

1 **2.3.4 Other 324 Building Areas within the Closure Unit Boundary**

2
3 The following four other areas are of importance within the closure boundary: the cask
4 handling area, the trucklock, EDL-146, and the operating galleries.
5

6 **2.3.4.1 Cask Handling Area**

7
8 The cask handling area is situated immediately north of the SMF cells and immediately
9 east of the REC cells. All entries into either airlock are staged from the cask handling area.
10

11 The cask handling area provides access to the manipulator repair shop (Room 147), the
12 vault sample room (Room 145), and the EDL-146. Cover blocks providing access to Zone 1
13 ventilation A-Frame HEPA filters are in the southwestern portion of the area. The cover blocks
14 to the HLV are located approximately on the north/south centerline on the north end of the room,
15 directly in front of the REC airlock door. An abandoned wet cask transfer basin is in the floor
16 just south of the HLV. This basin has been filled with sand and has a concrete cap.
17

18 The east wall of the REC airlock borders the cask handling area. The window, the remote
19 mechanical manipulators, and door are accessible in the cask handling area. The airlock wall has
20 a shielded window and manipulators for the REC airlock and the shielded door to the airlock.
21 The west wall of the cask handling also has three cable reel housings (one for the B-Cell/airlock
22 crane, one for the D-Cell crane, and one for the C-Cell crane; and a short balcony that extends
23 out from the D-Cell operating gallery (used as an observation platform and a staging area for
24 moving equipment to and from the D-Cell operating gallery). There are also various instruments
25 and controls in the wall. The east wall of the cask handling area gives access to Room 147,
26 Room 145, and EDL-146. Room 147 and EDL-146 both have large roll-up doors as well as
27 personnel doors. Mounted near the ceiling is piping for various services. The north wall has
28 large foldout doors to the trucklock, wide rollup door near the ceiling for crane access, and a
29 personnel door just to the west of the foldout doors. The south wall has wide doors to the SMF
30 airlock access area, and a hand-winch door to allow cask handling area crane access to the
31 SMF airlock foyer area.
32

33 **2.3.4.1.1 Construction and Operational Detail.** The cask handling area (Figure 2-3) is
34 10.4 meters x 20.1 meters x 10.7 meters high. The floor of the cask handling area is concrete.
35 The HLV is located under the floor of the cask handling area. The cask handling area provides
36 access into the airlock via a steel shield door. An overhead bridge crane (27.2-metric-ton
37 capacity main hoist and 4.5-metric-ton capacity auxiliary hoist) spans the east-west dimension of
38 the cask handling area. This crane also services the trucklock allowing heavy loads to be moved
39 from the trucklock to the SMF air lock or the REC airlock entrances.
40

41 Services contained in the cask handling area include: compressed air; vacuum; vacuum
42 air sampling; compressed gas (argon); process water; emergency shower water; high pressure
43 steam; breathing air; instrument air; acid; fire detection/suppression; telecommunications;
44 heating, ventilation, and air conditioning; alarms and monitors; and electrical service/equipment.

1 Steam, water, and compressed air are included in a 'jet station' in the north west corner of the
2 room.
3

4 **2.3.4.1.2 Closure Unit Component.** There are no closure components within the cask
5 handling area. However, the HLV resides immediately below the area and is considered a
6 separate area. The HLV area is described in Section 2.3.2.1.
7

8 **2.3.4.2 Trucklock**

9

10 The trucklock (Figure 2-3) is located to the north of the cask handling area. The east side
11 of the room is a stall where trucks are admitted into the building. This area is lower than the rest
12 of the room by 1.5 meters, providing a loading dock area on the south and north sides of where a
13 truck would be backed into the room. The southeast corner of the truck stall has a short flight of
14 stairs and the stall has a sump. Sump contents can be transferred to tank 102 in the LLV using a
15 jet siphon. The west side of the room contains the loadout stall for radioactive liquids from the
16 bowling ball casks, discussed in the following paragraphs. The trucklock shares a bridge crane
17 with the cask handling area discussed above.
18

19 On the south wall is a cabinet containing manometers that show tank levels in the HLV
20 tanks and the LLV tanks and valves for the jet station in the southwest corner of the truckstall.
21

22 **2.3.4.2.1 Construction and Operational Detail.** The trucklock is 11 meters by
23 10.4 meters by 10.7 meters high. Trucks, trailers, and train cars that are 9.2 meters long or less
24 can be accommodated. Outside access into the trucklock is via a 3.7-meter-wide x 3.1-meter-
25 high vertically sliding door.
26

27 Located within the trucklock is a decontamination and cask loadout stall. The stall is a
28 2.1-meter-long, 1.5-meter-wide, and 3.1-meter-high steel and stainless enclosure. Large front
29 and top doors provide access to the stall. The loadout stall is a shielded enclosure for loading
30 and unloading radioactive liquids to and from the HLV tanks and the LLV tanks. Radioactive
31 liquids often are transported in shielded tanks ('bowling ball casks'). The loadout stall has
32 services to enable operators to decontaminate the 'bowling ball casks' before allowing the casks
33 to be shipped out of the building.
34

35 The loadout stall is constructed out of steel and lead and has a stainless steel liner. The
36 roof of the loadout stall is hinged and can be pulled up to lean against the west wall of the
37 trucklock using a pulley and cable arrangement. There is also a wide access door on the north
38 wall of the stall, with a shielded window in the door. The loadout stall has lead glass windows in
39 the south, east, and north walls, and remote/mechanical manipulators on the south and east walls.
40

41 **2.3.4.2.2 Closure Unit Component.** There are no components within the trucklock that
42 require closure (Table 2-1). The loadout stall was used to radiologically decontaminate exteriors
43 of casks, this is not a TSD operation and therefore does not require closure.
44

2.3.4.3 Engineering Development Laboratory-146 (Room 146)

The EDL-146 (Figure 2-3) is a radiological contamination area located east and adjacent to the cask handling area. EDL-146 is used primarily for engineering development work with low levels of radioactivity. A partial mezzanine in the room divides the room into two floors. The mezzanine and parts of the first floor area are served with a bridge crane. Room 145, which is situated adjacent to the EDL-146, contains the vault tank sampling station.

EDL-146 contains energized laboratory equipment, along with various nonenergized equipment and supplies. There are several fume hoods on the southeast and north walls. There is a large walk-in hood that contains testing equipment (vitrifier). There are also several argon and nitrogen compressed gas cylinders. There are two transformers mounted on the north wall, numerous electrical panels located around the room, and an emergency safety shower and eye wash station. The mezzanine contains electrical equipment storage racks, an unused walk-in enclosure, and an electrical transformer.

2.3.4.3.1 Construction and Operational Details. EDL-146 is a large unshielded room 9.1 meters wide, 14.6 meters long, and 10.4 meters high. Service connections for various utilities (steam, air, and water), waste lines, and ventilation headers are located along two walls. Access is from the cask handling area via a 3.1-meter-wide by 4.3-meter-high roll-up door. There are also personnel access doors into the cask handling area and the SMF gallery.

2.3.4.3.2 Closure Unit Components. As shown in Table 2.1, the components requiring closure are those involved with isolation of EDL-146 piping associated with the HLV and LLV tanks. No other known TSD activities are associated with the EDL. However, deactivation end points have been established for Room 146.

Operating Galleries

The basement, first floor, second floor, and third floor galleries (Figures 2-2 to 2-5) are the personnel access spaces around the REC. Operating stations for the remote equipment with viewing windows are located in the galleries for the REC. Various utility lines (steam, water, air, chemical addition) are available in the galleries for connecting to the REC. The galleries also provide access to A-Cell and B-Cell cubicles.

In the basement, galleries provide access to the south and west exterior of B-Cell. On the first floor, galleries provide access to the south exterior of C-Cell, the south, west, and north exteriors of B-Cell, and the north exterior of A-Cell. On the second floor, galleries provide access to the south exterior of D-Cell, the south, west, and north exterior of B-Cell, and the north exterior of A-Cell. On the third floor, galleries provide access to the south exterior of D-Cell and the north exterior of A-Cell.

1 The REC operating galleries consists of:

- 2
- 3 • Room 18
- 4 • Corridor 13
- 5 • Room 131
- 6 • B-Cell sample loadout
- 7 • Room 244
- 8 • Room 245
- 9 • Room 311
- 10 • Stairwells 7 and 8.
- 11

12 Rooms 131, 244, 245, and 311 form the operating galleries, while the other areas listed
13 either are support or, in the case of the sample loadout, special purpose areas. Common to these
14 areas are shielded observation windows, shield plugs and split plugs, remote/mechanical
15 manipulators, periscopes, and testing equipment. Other features common between these areas
16 are the panels for cell lighting, floor drains, ventilation supply, ventilation alarms (in case of
17 airflow reversal), and high-level alarms. Common cell features that extends into the galleries is
18 the cubicles.

19
20 Corridor 13 is the passageway between the step off pads at the change room and various
21 areas in the contaminated portions of the 324 Building. Specifically, Corridor 13 leads to
22 Room 131 (the first floor operating gallery and serves A-Cell, B-Cell, and C-Cell), the C-Cell
23 operating gallery portion; stairwell number 7, the cask handling area, and the SMF operating
24 access to the SMF airlock. The C-Cell portion of the room has a large observation window in the
25 north wall, allowing a view of the C-Cell Operating Gallery.

26
27 The C-Cell portion of the room is partitioned off from the B-Cell and A-Cell areas with a
28 double door. Operating controls for the C-Cell 2-ton crane are in this portion of the room.

29
30 The B-Cell and A-Cell portions of Room 131 are not separated. The A-Cell portion of
31 Room 131 is fairly narrow and contains the door to stairwell number 8, which can be used to go
32 to the upper REC cell galleries. On either side of the A-Cell window is a cubicle (A11 on the left
33 and A12 on the right). These cubicles have service connections from the cell and from various
34 HLV and LLV tanks, and to the pipe trench. Cubicles provide access to piping to easily reroute
35 fluids through the REC tanks and systems. All cubicles are shielded with thick, shielded double
36 doors.

37
38 The B-Cell portion of the room contains portable equipment used for in-cell work:
39 plasma torch support equipment, medium pressure water wash equipment, the hydraulic unit for
40 a hydraulic powered cutter, and controls for the B-Cell electrostatic precipitator. There are three
41 shielded viewing windows at B-Cell work stations on the north, west, and south walls. Operating
42 controls for the B-Cell cranes are also in this room. The west window has a cubicle on either
43 side (B14 on the left and B12 on the right). Room 131 also contains the B-Cell sample room,
44 which is a small room outside the northeast corner used to collect process samples during

1 operation and to transport small equipment into the cell. The B-Cell sample room contains a
2 transfer tray to transfer equipment between the room and B-Cell. The transfer mechanism has a
3 Plexiglas hood in front to help with radiological contamination control.
4

5 Room 244 is the operating gallery for the upper floor of B-Cell and the second floor of
6 A-Cell, and contains building service connections.
7

8 The A-Cell portion of Room 244 (northeast section) contains a shielded window with two
9 manipulators and a cubicle on either side of the window (A21 on the left and A22 on the right).
10 There is also a door into Stairway Number 8.
11

12 The B-Cell portion of Room 244 surrounds B-Cell on the north, west, and south. In the
13 middle of the north wall of B-Cell is an air conditioning unit. The northwest corner of the room
14 has an emergency exit into Corridor 20 and a cluster of steam lines. The west wall has two
15 clusters of tank level transmitters and the southeast corner of the room has a jet control station
16 and the door to Room 245.
17

18 Room 245 is the D-Cell operating gallery. The entrance from Room 244 is through
19 double doors into a short corridor formed by an extension of the D-Cell floor into the operating
20 gallery. The southern end of this short corridor has a door into Stairway Number 7 and directly
21 across from here is a short stairway onto the working floor of the D-Cell gallery. Directly above
22 the door into Room 244 is a grated platform, accessed by ladder from the working floor, that
23 allows access to various controls and instruments. Immediately at the top of the short stairway
24 into the main part of the room is an instrument panel.
25

26 On the east wall of the room is a double door that opens on to a mezzanine overlooking
27 the cask handling area.
28

29 Room 311 is the third floor operating gallery for A-Cell. This room does not have a
30 viewing window, but does have two cubicles (A31 and A32). Also in this room are some
31 electropolishing controls, the reel housing for the A-Cell crane cable reel, and some transformers
32 and switchgear. The door at the east end of the room opens into the trucklock area for crane
33 maintenance.
34

35 **2.3.4.4.1 Construction and Operational Detail.** These areas are considered buffer or
36 support areas and were not designed as primary containment or to provide radiological shielding.
37

38 **2.3.4.4.2 Closure Unit Components.** As shown in Table 2.1, the components requiring
39 closure are the piping associated with the HLV and LLV tanks. No other known TSD activities
40 are associated with the galleries.
41

1 **2.3.4.5 Room 18**

2
3 Room 18 is an 'L' shaped room that borders the west and south sides of the B-Cell
4 basement. Room 18 contains the shield plug openings into B-Cell. Room 18 also includes motor
5 control center Number 6N, four monitoring stations for retention process sewer diverters,
6 electrical equipment, asbestos-insulated piping (approximately 24 linear meters), ventilation
7 systems, and blanked off floor drains. The floor, walls, and ceiling are all painted concrete.
8 There is an open vent in the ceiling that connects Room 18 air space with that of Room 113.
9 There also are two sealed access ports: one to the Zone II ventilation tunnel, and one to the
10 ventilation crawl spaces under A-Cell, C-Cell, and the airlock. Ventilation and balance smoke
11 lines (for HEPA leak/seal checks) for the A-Frame HEPA filters are also present in the
12 northeastern corner of the room.

13
14 **2.3.4.5.1 Construction and Operational Detail.** Room 18 is considered a support area
15 and was not designed as primary containment or to provide radiological shielding.

16
17 **2.3.4.5.2 Closure Unit Components.** As shown in Table 2-1, the components requiring
18 closure are the piping associated with the HLV and LLV tanks and potentially the concrete
19 surrounding the B-Cell shield plug openings.

20
21 **2.4 Security Information**

22
23 The general security requirements in the 300 Area, as described, are current as of March
24 1998. Continued reduction in security measures is expected due to the reduction of 300 Area
25 special nuclear material inventories.

26
27 All persons entering the 300 Area must display a RL-issued security identification badge
28 indicating appropriate authorization. Personnel are subject to random searches of items carried
29 into and out of the 300 Area. Signs posted at the 300 Area boundaries currently state:

30
31 'NO TRESPASSING. SECURITY BADGES REQUIRED BEYOND THIS
32 POINT. PUBLIC ACCESS PROHIBITED,'

33
34 or an equivalent legend.

35
36 The 324 Building is currently locked at all times, and access is limited to personnel with
37 keys or proximity cards; badged visitors must contact their host from the door to gain entry.
38 Proximity cards only can be obtained by trained personnel who have completed the Hanford
39 General Employee Training program, the facility hazards communication training, and the
40 facility orientation training. The access, when granted, is typically for normal operations hours
41 only (i.e., 6:00 a.m. - 5:00 p.m.). Twenty-four hour access is granted only to those who have a
42 need based on job responsibilities.

1 Inside the 324 Building, the lobby and first and second floor offices are the only
2 nonradiologically controlled areas. Access to the REC, HLV, and other radiologically controlled
3 areas is restricted. Entry codes are required for access. Entry into the REC airlock and hot-cells
4 are administratively and physically controlled requiring use of multi-organizational authorization
5 (i.e., operations supervision, radiological control, hot cell operations) and physically controlled
6 by a double-key entry system. In addition, access to the HLV and LLV are physically controlled
7 with cover blocks requiring the use of a crane for removal.
8

9 Currently, there is 24-hour surveillance of building areas and systems. Post-deactivation
10 requirements will include removal of the key-card system and physical locks at the building
11 entrance. The 324 Building entrance will be padlocked and other points of access sealed.
12 Periodic surveillance will be planned and implemented pending final deactivation and
13 decommissioning (refer to Chapter 8.0)

1

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Table 2-1. Areas of the Building Pursuing Closure.

Area	Require Closure Activities	Components for Closure
A-Cell	No	None
B-Cell	Yes	Dispersible material and debris, liner, concrete
C-Cell	No	None
D-Cell	Yes	Waste container storage area; HLV liquid treatment process equipment area
Airlock	Yes	Piping from HLV/LLV
Pipe Trench	Yes	Piping from HLV/LLV
HLV	Yes	Four tanks, piping, liner, concrete
LLV	Yes	Four tanks, piping, liner, concrete
HLV sample room (Room 145)	Yes	Piping from HLV and LLV
Cask handling area	No	None
Trucklock	No	None
EDL-146	Yes	Piping from HLV/LLV
Galleries	Yes	Piping from HLV and LLV
Room 18	Yes	Piping from HLV and LLV and potentially concrete surrounding B-Cell shield plugs.

4

1
2

Table 2-2. High-Level Vault Tank Data.

Tank	Capacity	Input	Output
104	15,000 liters	A-Cell cubicles, A-11, A-12; B-Cell cubicles, B-12, B-14; loadout station; C-Cell; D-Cell; pipe trench; LLV tank 102; Tank 107; Tank 105; vault sump	Loadout stall; Tank 105; pipe trench
105	19,000 liters	A-Cell cubicles, A-11, A-12; B-Cell cubicles, B-12, B-14; airlock; loadout station; pipe trench; Tank 106; Tank 104	Tank 104; loadout stall; pipe trench
106	1,700 liters	Loadout station; B-Cell cubicles, B-12, B-14; D-Cell; pipe trench; Tank 107	Loadout stall; pipe trench; Tank 107; Tank 105
107	3,600 liters	Chemical addition line; Tank 106	Loadout stall; pipe trench; Tank 106; Tank 104

3

Table 2.3. LLV Tank Data.

Tank	Capacity	Input	Output
101	12,800 liters	Process drains: A-Cell cubicles A11, A12; B-Cell cubicles B12, B14; cubicle drains: A-Cell cubicles A11, A12, A21, A22, A31, A32; B-Cell cubicles B12, B14; Room 145 sampler drain; Room 11 drain; loadout stall, pipe trench; tank 108; B-Cell tank 115.	340 Building, tank 102
102	19,000 liters	A-Cell cubicles A11, A12; B-Cell cubicles B12, B14; C-Cell; D-Cell; EDL-146; header in Rooms 146 and 147; tank 108; tank 101; tank 103; trucklock sump; pipe trench; LLV sump	HLV Tank 104; Loadout Station; 340 Building
103	12,800 liters	Loadout station; pipe trench	Loadout stall; pipe trench; header in Rooms 146 and 147; tank 102; tank 101
108	12,800 liters	Room 146 drains; pipe trench	Tank 101; tank 102

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2

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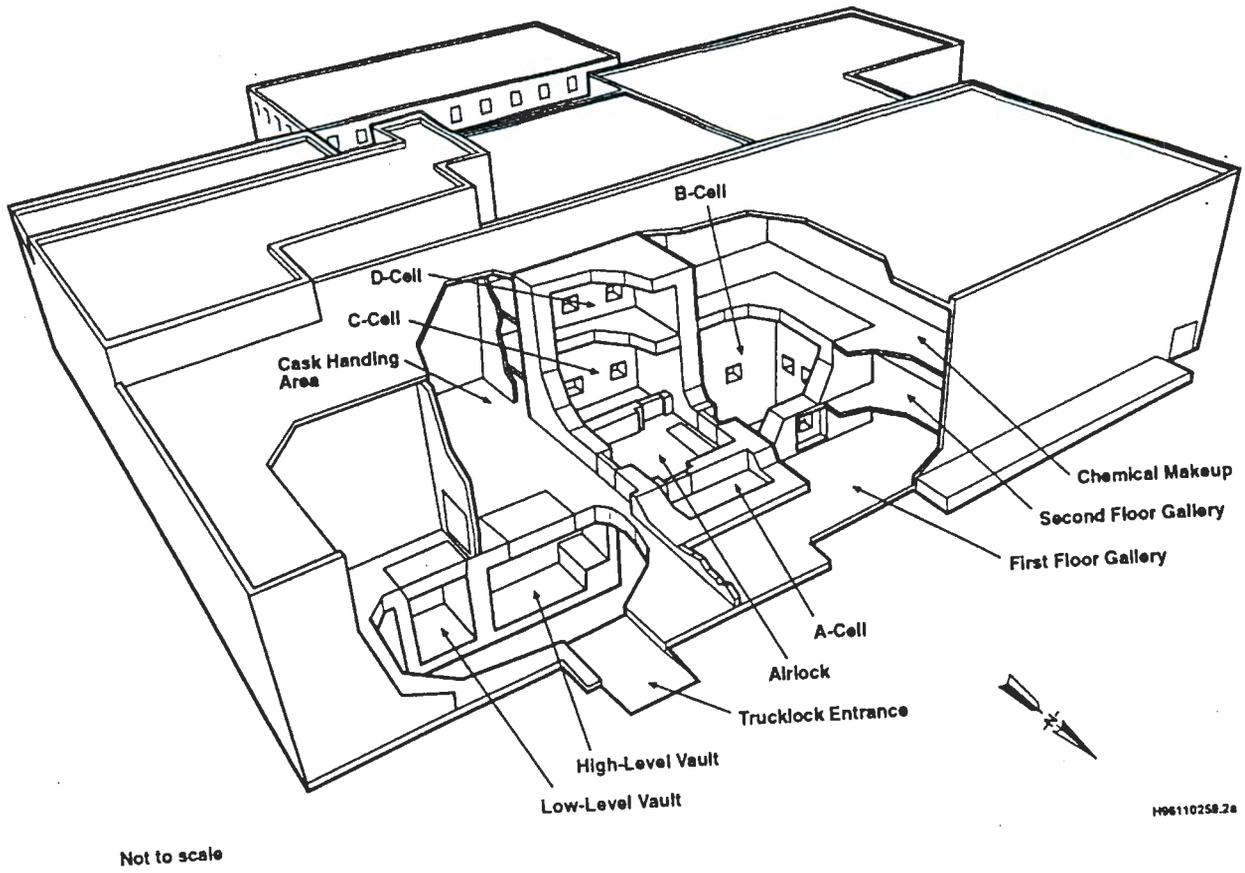


Figure 2-1. Cut-away of the 324 Building showing the High-Level Vault, Low-Level Vault, and the Radiochemical Engineering Cells.

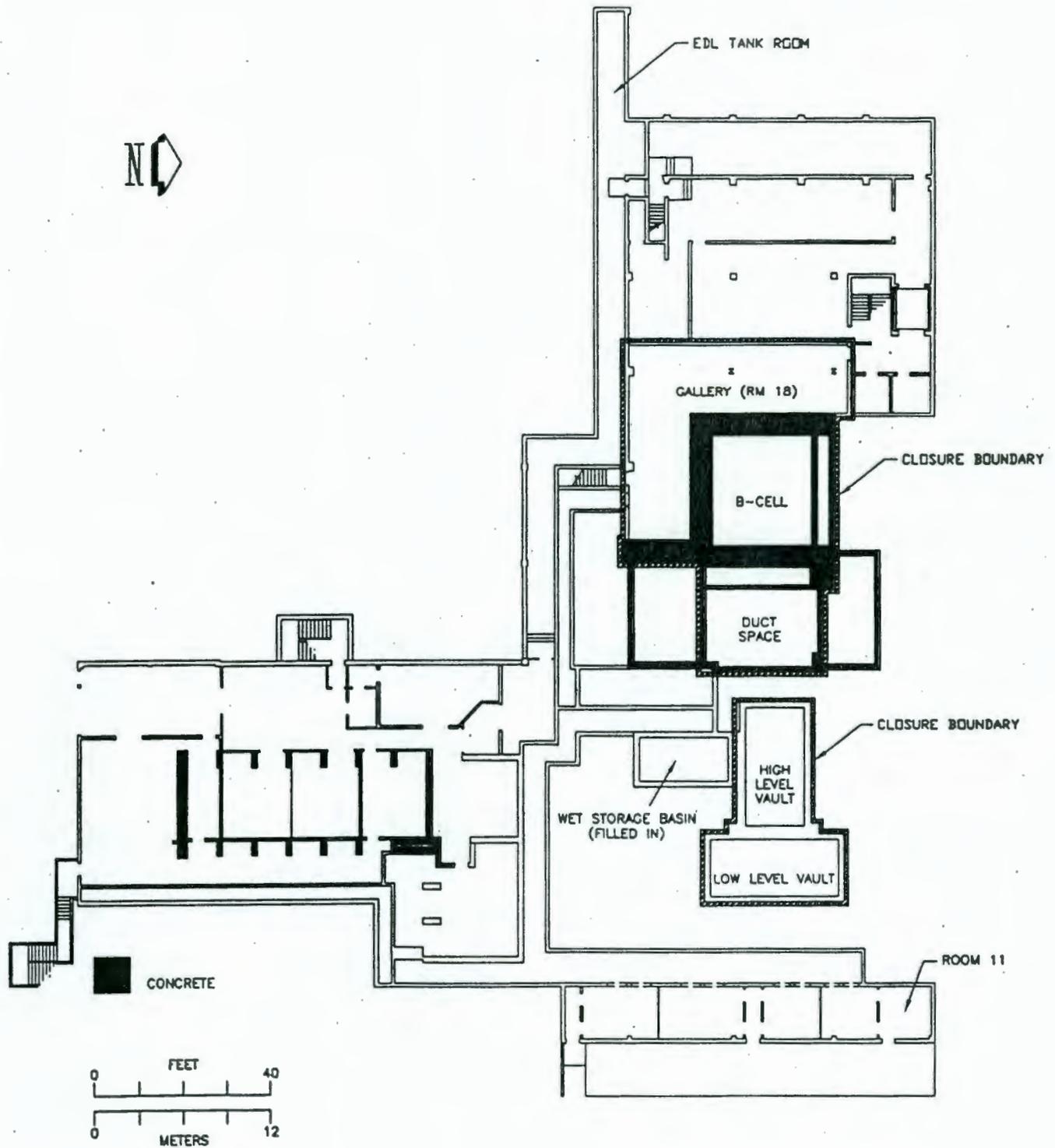
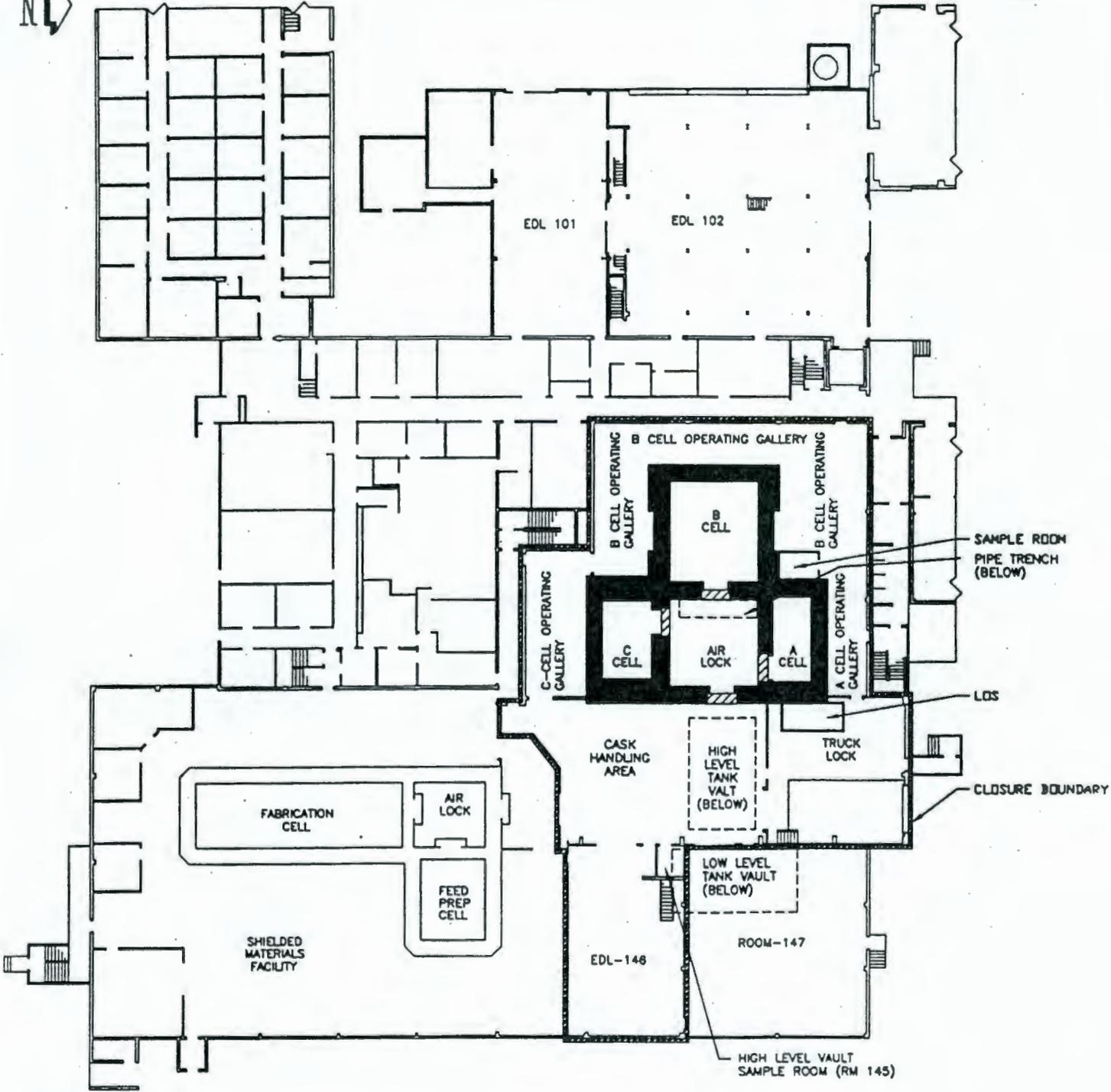


Figure 2-2. 324 Building Basement Plan.



 CONCRETE
 EDL = ENGINEERING DEVELOPMENT LABORATORY
 LOS = LOAD OUT STATIONZ

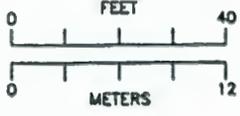
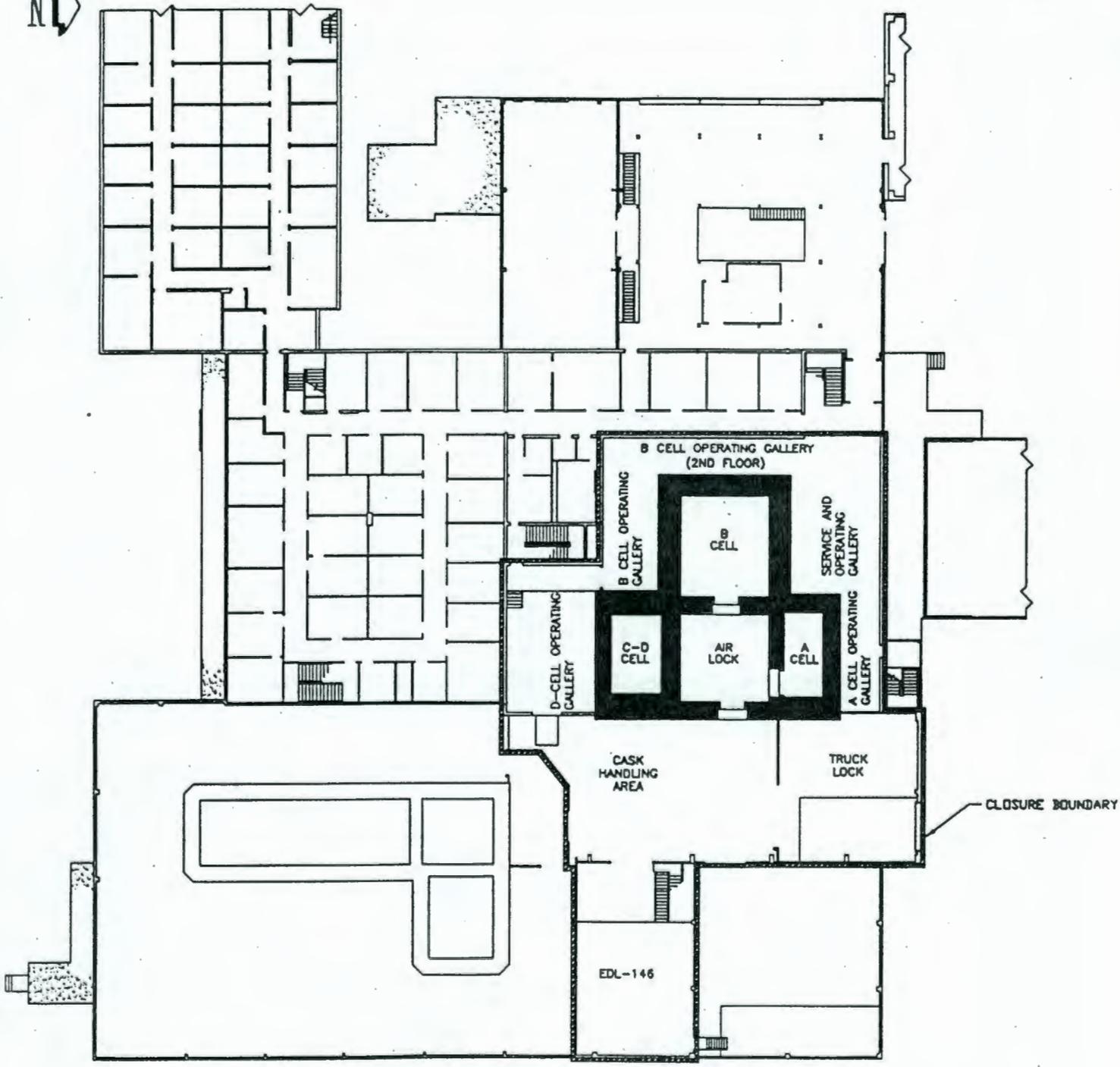


Figure 2-3. 324 Building First Floor Plan.



■ CONCRETE
EDL = ENGINEERING DEVELOPMENT LABORATORY

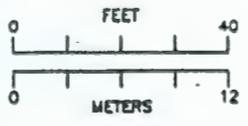
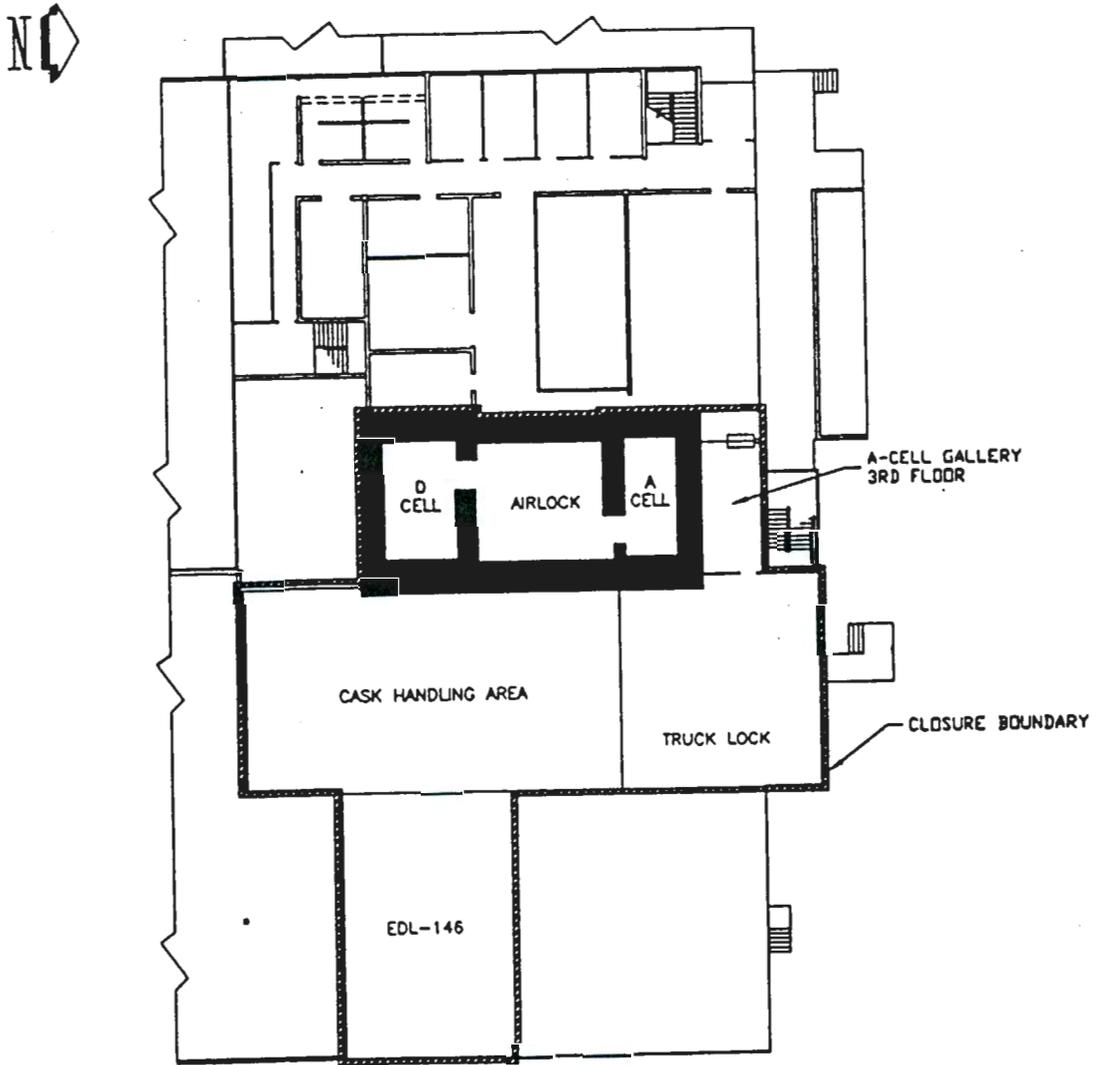


Figure 2-4. 324 Building Second Floor Plan.



■ CONCRETE

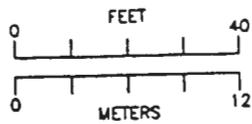


Figure 2-5. 324 Building Third Floor Plan.

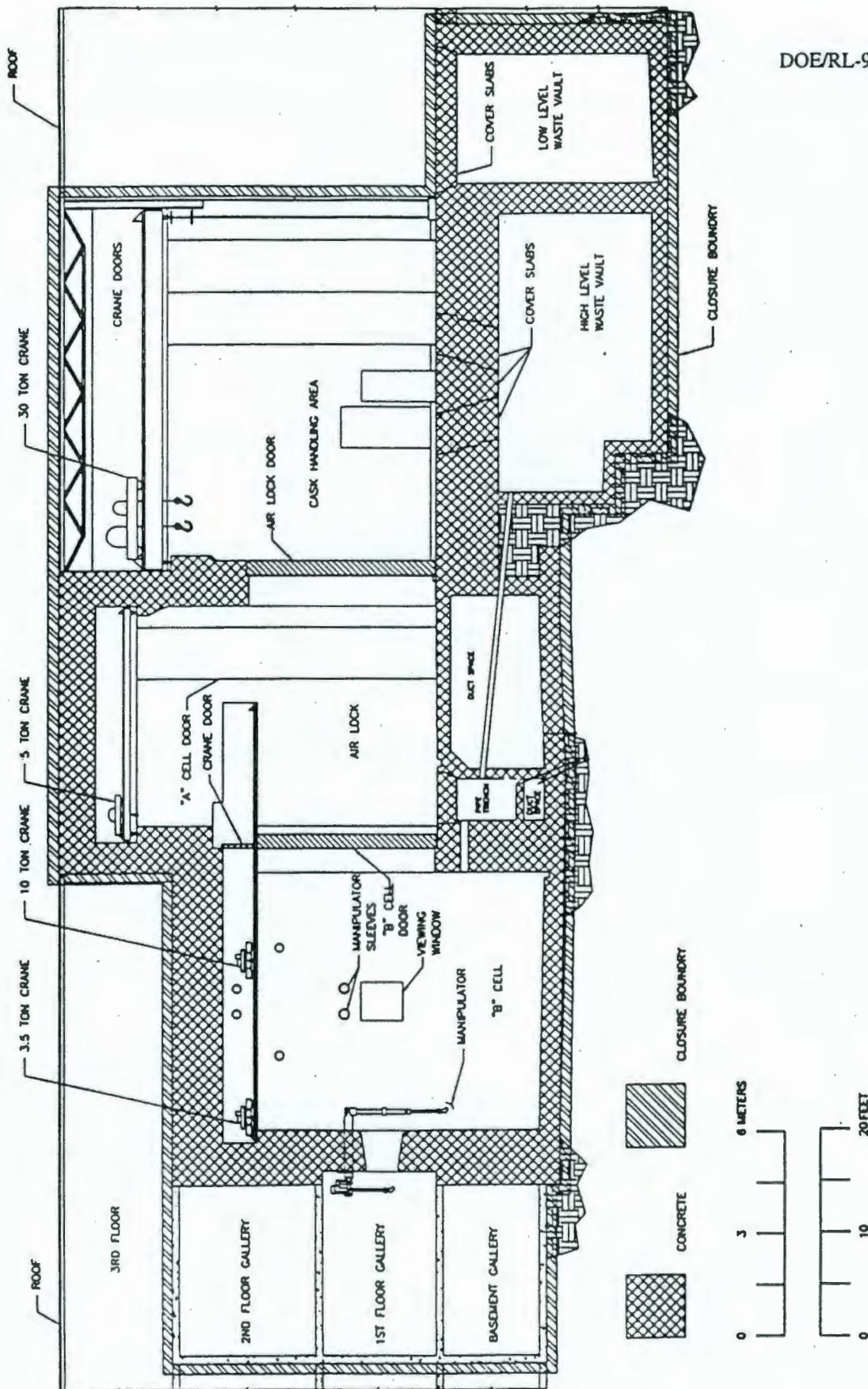
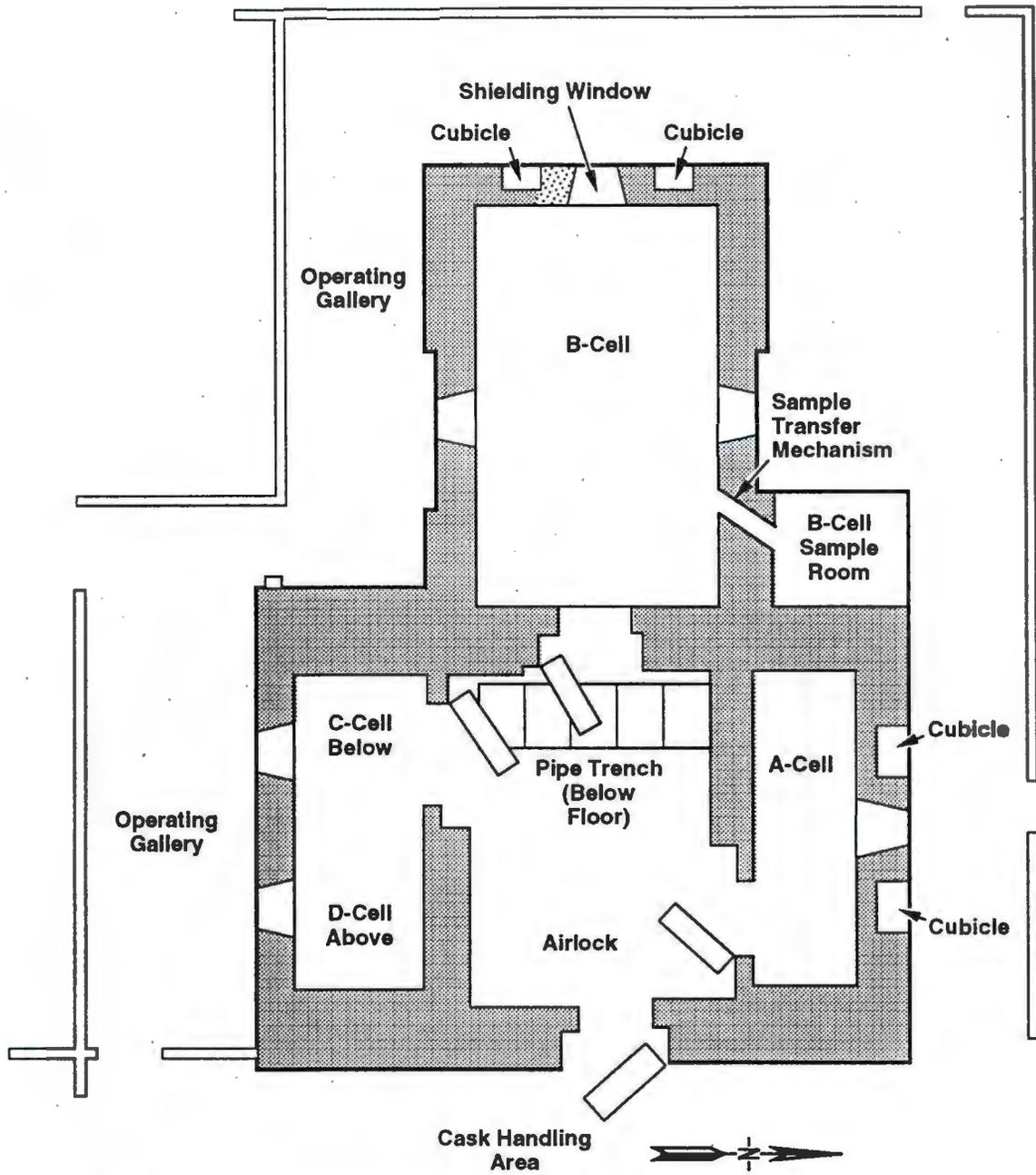


Figure 2-6. 324 Building Cross-section Through the High-Level Vault, Low-Level Vault, Airlock, and B-Cell.



■ = Concrete

Not to Scale

Note: Hot cell and airlock doors are interlocked.
Airlock cannot be accessed when any hot cell door is open.

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Figure 2-7. Overall Planning for 324 Building Radiochemical Engineering Cells.

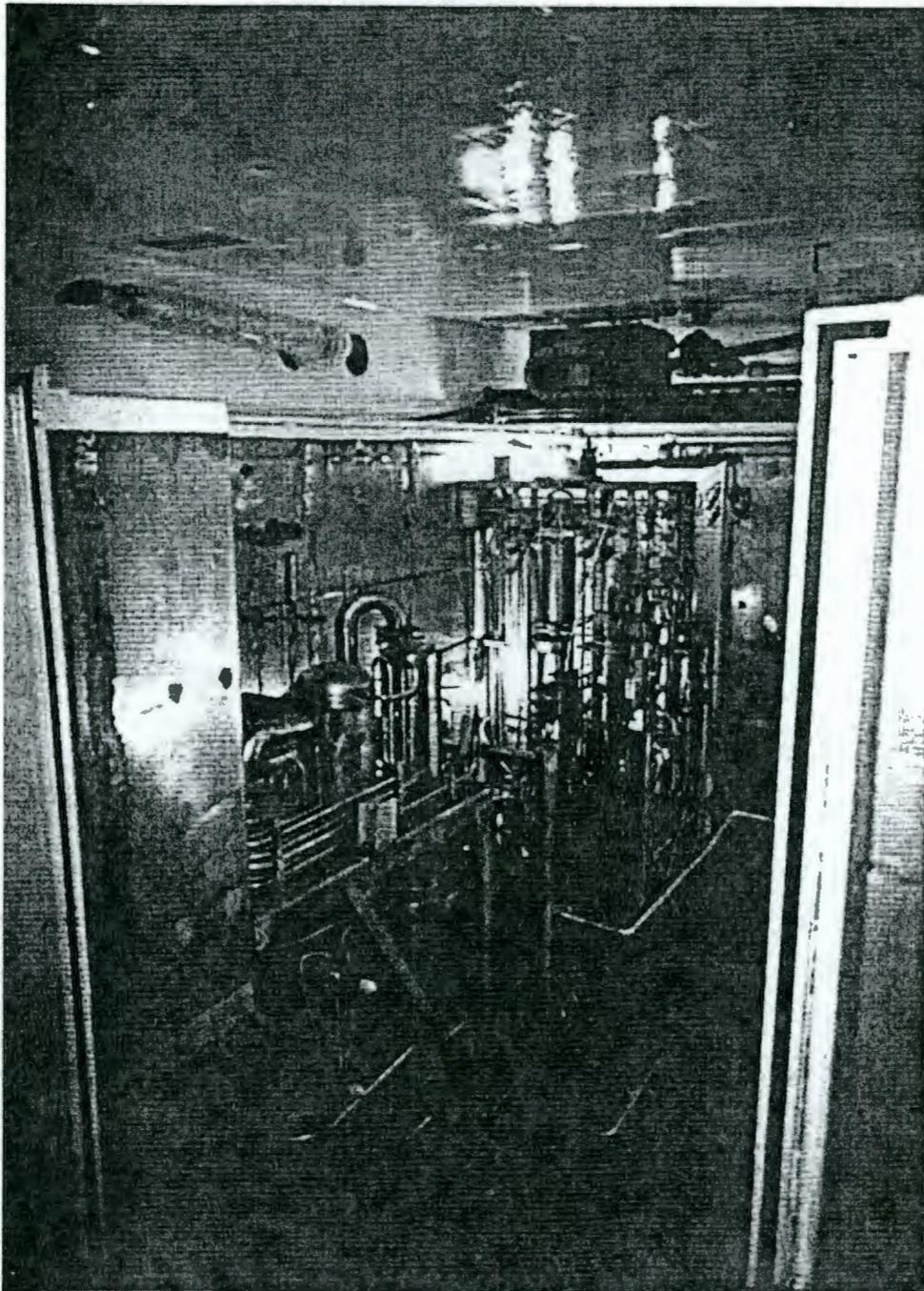
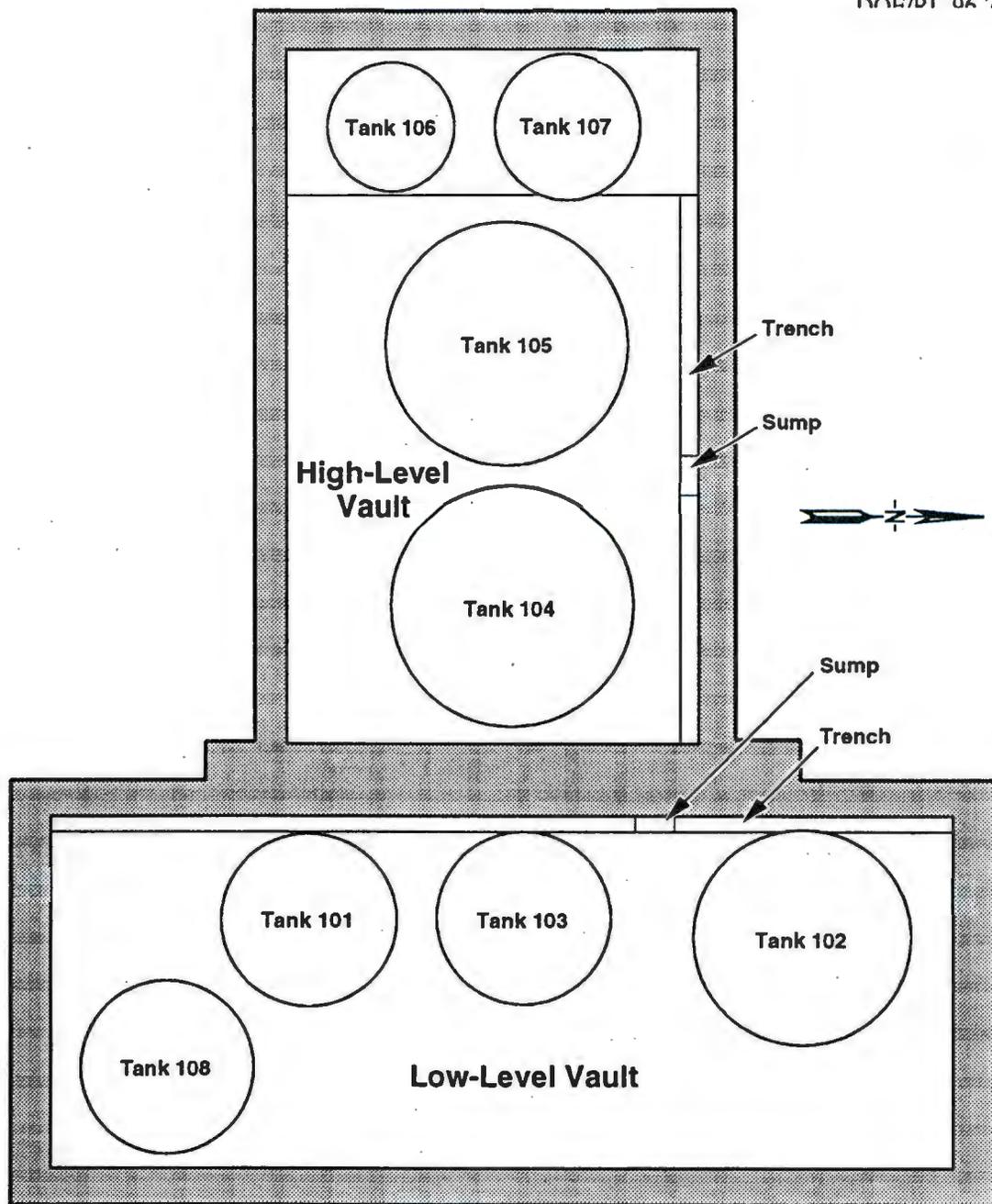


Figure 2-8. 324 Building REC B-Cell



■ = Concrete

Not to Scale

H96110259.8d

Figure 2-9 324 Building High-Level Vault, Low-Level Vault, and Vault Tanks. Piping omitted for clarity.

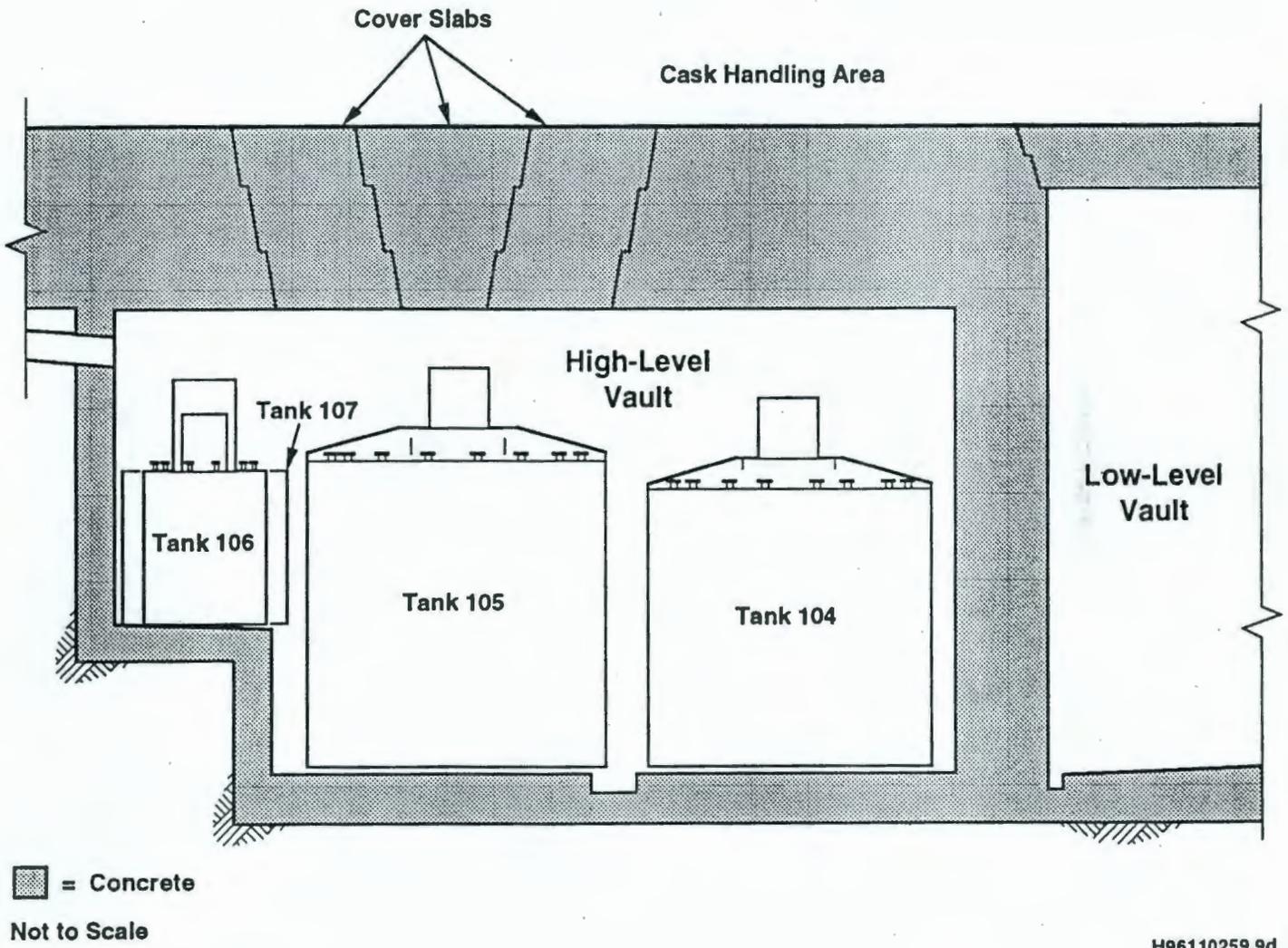


Figure 2-10 324 Building High-Level Vault Cross-Section. Piping omitted for clarity.

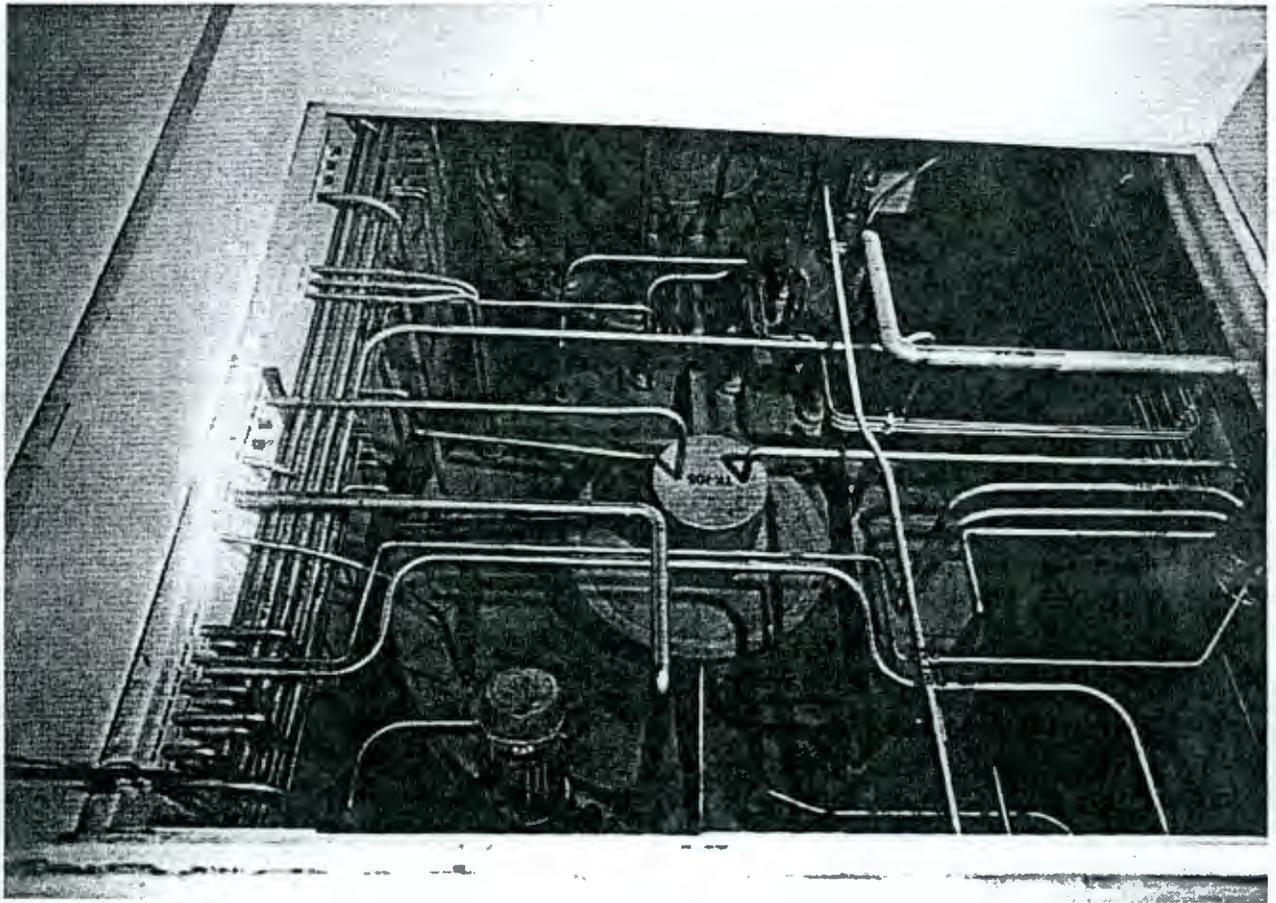


Figure 2-11. 324 Building High-Level Vault Construction Photograph Before Sealing the Cover Blocks (looking east at tanks 105 and 104).

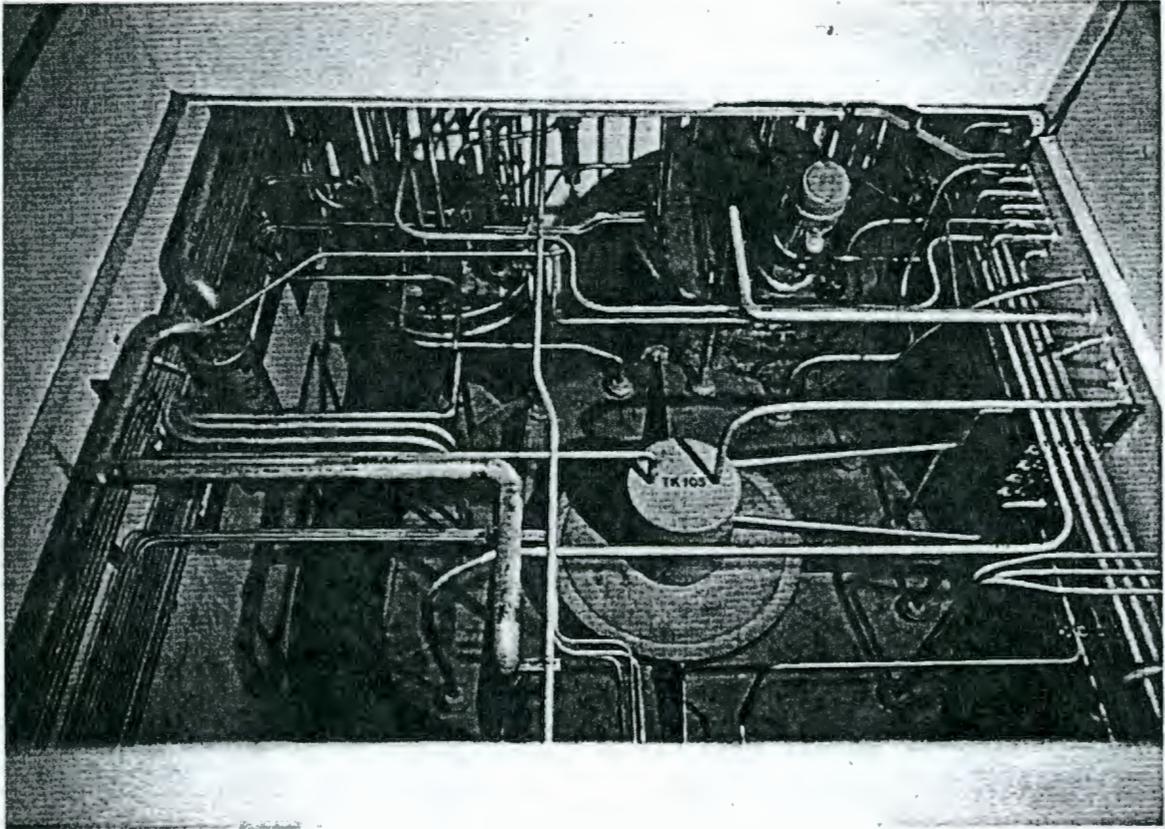


Figure 2-12. 324 Building High-Level Vault Construction Photograph Before Sealing the Cover Blocks. Looking west at tanks 105 (center foreground), 107 (right rear), and 106 (left rear).

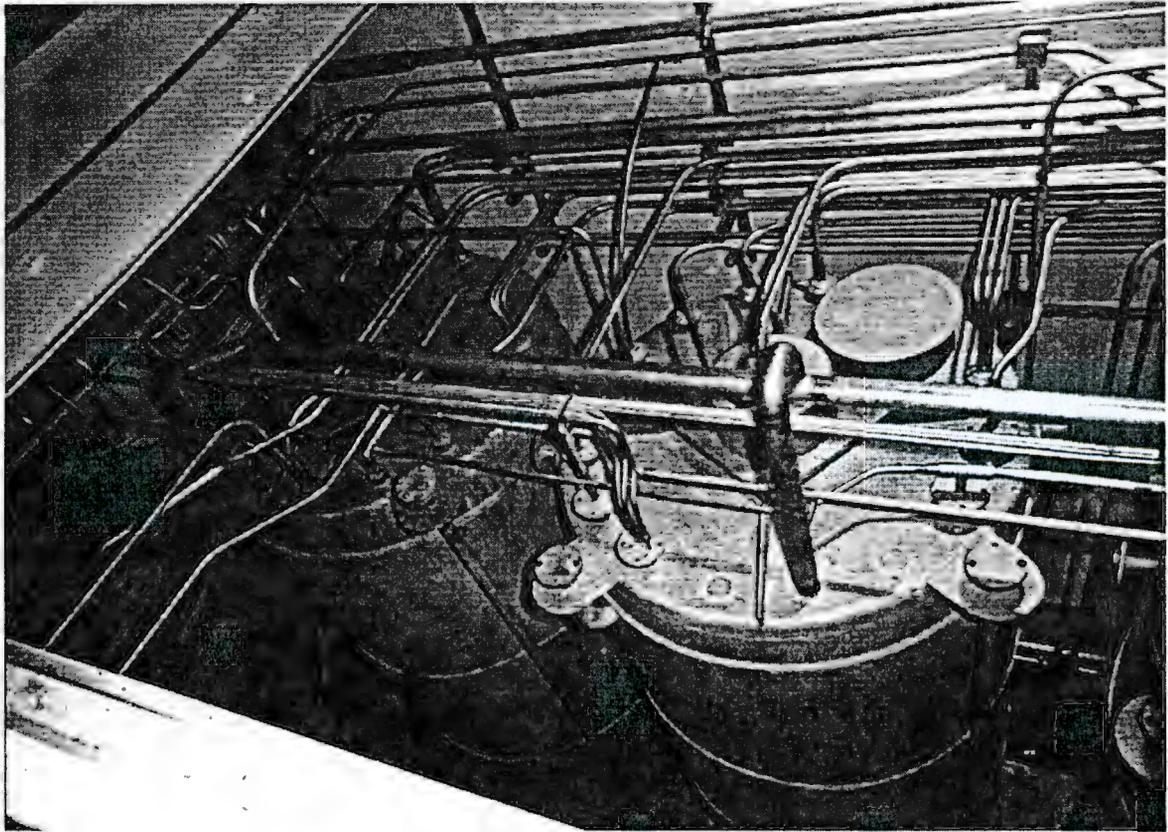


Figure 2-13. 324 Building Low-Level Vault Construction Photograph Before Sealing the Cover Blocks. Looking east (left to right) at tanks 108, 101, and 103.

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3.0 PROCESS INFORMATION

The 324 Building was constructed in the early 1960s to provide capabilities necessary to perform research and development (R&D) activities associated with waste management, structural material for use in the nuclear industry, and nuclear fuels design and construction. This chapter provides information on the R&D processes and waste management activities that have occurred in the building. Historic process information for all areas included in the closure boundary is presented in Section 3.1. TSD activities either identified in the initial violation (storage of mixed waste in B-Cell and HLV tanks, and subsequently the LLV tanks) or allowed under the consent agreement to close the violations (HLV tanks liquid waste treatment system), are presented in Section 3.2. Finally, past and current removal activities in support of closure and in support of deactivation (for those areas within the closure boundary that do not require action) are presented in Section 3.3. The actual closure activities for portions of the 324 Building undergoing closure are described in Chapter 7.0.

Information included in this chapter was gathered through discussions with knowledgeable building personnel, searches of existing building operating records, reports including the *Integrity Assessment Plan for PNL 300 Area Radioactive Hazardous Waste Tank System*, (SAIC 1993), and PNNL documents prepared during operations. Many operational records are no longer available (for instance, archive files before 1998 for tank-to-tank liquid transfers cannot be found).

3.1 Waste Producing Processes

Liquid and solid radioactive and mixed waste has been generated during the conduct of various programs within 324 REC. Liquid waste generated within the REC has been discharged at various times to the HLV tanks and LLV tanks. The waste consisted of solutions generated during R&D activities and solutions from radiological decontamination activities. Solution transfers occurred through piping between various tanks in the HLV and LLV and the REC cells. Solutions from the LLV tanks can be discharged to the 340 Building. While the piping system has been designed so that solutions can be transferred from the LLV tanks to the HLV tanks, solutions cannot be transferred directly from the HLV tanks to the LLV tanks.

Solid materials classified as waste also were generated in the REC cells during this time. Solid material was and still is packaged in U.S. Department of Transportation or DOE approved packages and transferred to burial grounds or storage facilities in the 200 Area. Most of the solid material classified as waste generated in the REC Cells was LLW. After 1988, solid materials classified as containing dangerous waste, such as radioactively contaminated lead brick, lead shot, and process rack components that contained lead for counterbalance purposes, were packaged separately from LLW and transferred as mixed waste (MW) to the Central Waste Complex in the 200 West Area.

1 The following R&D projects and programs have been conducted in the identified closure
2 plan boundary areas since construction of the 324 Building:

3
4 **A-Cell**

- 5 • Waste Solidification Engineering Prototype Program (WSEP)
- 6 • Nuclear Waste Vitrification Project (NWVP)
- 7 • Federal Republic of Germany (FRG) Program (Production of Sealed Isotopic Heat
8 Sources)

9
10 **B-Cell**

- 11 • Waste Solidification Engineering Prototype Program (WSEP)
- 12 • Nuclear Waste Vitrification Project (NWVP)
- 13 • Zeolite Vitrification Demonstration Project (ZVDP)
- 14 • Testing and Operation of the Radioactive Liquid-Fed Ceramic Melter (RLFCM)
- 15 • Federal Republic of Germany (FRG) Program (Production of Sealed Isotopic Heat
16 Sources)

17
18 **C-Cell**

- 19 • Waste Solidification Engineering Prototype Program (WSEP)
- 20 • Waste Fixation Program
- 21 • Spent Fuel Handling and Packaging Program
- 22 • Waste Isolation Program

23
24 **D-Cell**

- 25 • Waste Solidification Engineering Prototype Program (WSEP)
- 26 • Waste Fixation Program
- 27 • Spent Fuel Handling and Packaging Program
- 28 • Materials Characterization Center Program
- 29 • Commercial Spent Fuel Management Program
- 30 • High-Level Vault Interim Removal Action Project

31
32 **3.1.1 A-Cell**

33
34 Between 1966 and 1972, A-Cell was used to perform radiological and physical
35 measurements of glass canisters produced throughout the Waste Solidification Engineering
36 Prototype (WSEP) program (see Section 3.1.2.1). Waste generated in the cell were radioactive
37 only and classified as LLW. From 1972 to 1982, the cell was used as a storage area for WSEP
38 glass canisters. In 1982, the cell was used to perform radiological and physical characterization
39 of glass canisters produced during the Nuclear Waste Vitrification Program (NWVP). Waste
40 generated during the NWVP characterization work were classified as LLW. No work was
41 performed in the cell from 1982 to 1985.
42

1 In 1977, after discovery of a leak in the ventilation duct space under A-Cell, a test was
2 conducted to determine the integrity of the cell sump and stainless steel floor liner. The sump
3 and liner were flooded with water containing dye. The ventilation duct space was monitored for
4 evidence of the dye solution, with negative results.
5

6 It should be noted that A-Cell has a mild steel wall liner that is butt welded to the stainless
7 steel floor liner. The weld occurs approximately 1.5 meters above the floor. The mild steel wall
8 liner consists of seam welded plates that run up to the crane rail level. There is no seal between
9 the mild steel liner and the concrete wall at the crane rail. This makes it possible for solutions
10 used to decontaminate the A-Cell crane in the REC airlock to run down the crane rails into
11 A-Cell, and run down the wall between the concrete and the mild steel liner. Administrative
12 controls were put in place in 1980 to ensure that dams were put in place on the crane rails in the
13 REC airlock to prevent water running into the cell during decontamination activities at crane rail
14 height in the REC airlock.
15

16 A-Cell was cleaned and refurbished in 1985 before the installation of the FRG Program
17 (Production of Sealed Isotopic Heat Sources) electropolisher and water-cooled FRG canister
18 storage rack. In 1988, a total of 34 FRG canisters were electropolished, and stored in the cell
19 (see Section 3.1.2.6). Canisters were stored until 1997, when the canisters were repackaged in
20 storage casks and transferred to a dry storage area in the 200 Area the Central Waste Complex.
21

22 Electropolishing was the only activity performed in A-Cell that produced dangerous waste.
23 Canisters produced during the FRG Program were electropolished in 85 wt% phosphoric acid.
24 The electropolishing process removed about 1 kg of surface metal and contaminants per canister
25 (refer to Chapter 4.0 for analytical information on this material). The electrolyte, phosphoric
26 acid, contained trace amounts of chromium and nonregulated radiological constituents
27 cesium-137, and strontium-90. In October 1988, 2,463.5 liters of this solution were transferred
28 to LLV Tank 102, where the solution was neutralized and transferred to the 340 Building. The
29 electropolishing tank in A-Cell was made a less-than-90-day storage area until the waste was
30 containerized and transferred to the Central Waste Complex. The tank was triple-rinsed in
31 October 1988 as part of the waste retrieval process.
32

33 3.1.2 B-Cell

34
35 B-Cell was used to demonstrate chemical engineering pilot-scale processes for radioactive
36 waste management programs. These programs left B-Cell filled with equipment that is highly
37 contaminated with radioactive waste, radioactive materials, and materials that have been
38 designated as mixed waste. Additionally, B-Cell contains dispersible (i.e., easily spreadable)
39 material containing mixed-waste contaminants (heavy metals).
40

41 The majority of mixed waste producing activities of concern for closure occurred in
42 B-Cell. The B-Cell activities are summarized in Table 3-1. Periods listed as 'no activity'
43 indicate that no project or R&D activities were occurring in the cell during that time.
44

1 3.1.2.1 Waste Solidification Engineering Prototype Program

2
3 The WSEP program was the first program to be performed in B-Cell. The WSEP program
4 began in 1966 and continued through 1972. The program was designed to demonstrate three
5 methods of solidifying highly radioactive waste: pot solidification, spray solidification, and
6 phosphate glass formation.

7
8 **3.1.2.1.1 Pot Solidification.** Two separate processes were considered pot solidification
9 methods: pot calcination and rising level glass. In the pot calcination method, the waste was fed
10 into a heated pot and concentrated to a salt cake by elevating the temperatures. The salt cake
11 was then heated to 900⁰ C to decompose the residual nitrates, which resulted in the final product
12 of a soluble calcine comprised primarily of oxides. Escaping vapors from the process were
13 condensed and collected; noncondensibles were filtered and released as airborne effluents.

14
15 The rising level glass method consisted of feeding a liquid waste along with glass-forming
16 materials into a stainless steel pot heated to 900⁰ C. A melt took place, creating three layers in
17 the pot: fluid glass, calcine (sinter), and a waste liquid on the top. The feed rate of the liquid
18 waste and glass formers was varied such that the resulting liquid and calcine layers were at a
19 minimum. Once the container was full with 100 percent fluid glass, the pot was cooled to allow
20 solidification. Off gasses from this process were condensed and collected; noncondensibles were
21 filtered and released as airborne effluents.

22
23 **3.1.2.1.2 Spray Solidification Process.** The basic operations accomplished in spray
24 solidification were: (1) conversion of aqueous waste solution to finely divided oxide powder by
25 spray calcination, and (2) formation of a melt (glass) that solidified to a coherent mass that was
26 physically stable and chemically inert. Melting was performed directly in the receiver canister
27 (in-can melting).

28
29 The first step of the process was to feed the liquid through a pneumatic atomizing nozzle
30 into the top of the spray calciner. As the spray traveled down the heated portion of the calciner,
31 the solution was dried into a powder. The powder, or calcine, fell directly into the in-pot melter.
32 Flux materials and silicate were added to the in-pot melter to ensure formation of durable glass.
33 Depending on the types of waste used and the desired characteristics, the following different
34 fluxes were used, either alone or mixed with another: P₂O₅, oxides of Li-Na-Al,
35 CaB₂O₃(colemite), B₂O₃, and SiO₂. The waste powder, flux material, and silicate were melted at
36 a temperature between 700 to 1,200⁰ C. Once a canister was full, the canister was cooled and
37 sealed for storage.

38
39 **3.1.2.1.3 Phosphate Glass Process.** The phosphate glass process was carried out in two
40 continuous steps: (1) a low-temperature (120 to 140⁰ C) concentration step in which aqueous
41 waste, chemically adjusted by the addition of phosphoric acid together with certain metal salts
42 (when required), was continuously concentrated and partially denitrated to a thick slurry, and
43 (2) a high temperature (1,000 to 1,200⁰ C) glass-forming step in which final removal of water,
44 nitrates, and other volatile constituents was accomplished. When the receiver canister was full,
45 the canister was removed, sealed, and taken to storage.

1
2 The WSEP Program was designed to investigate treatability processes for defense
3 production waste. The feed-material compositions used in the WSEP program were prepared to
4 demonstrate the bounding conditions relative to glass forming for simulated waste streams
5 representative of: (1) PUREX process waste solution that contained a large amount of iron, such
6 as would result when an iron canister is used to transfer nuclear fuel elements and the canister
7 was co-dissolved with the nuclear fuel and (2) a PUREX process waste solution optimized to
8 produce a waste containing a minimum quantity of nonfission product material. Several
9 elemental substitutions were made for the fission products. Elements present in the WSEP feed
10 included molybdenum, nickel, cobalt, copper, potassium, rubidium, iron, and aluminum.
11

12 **3.1.2.2 Period of No Activity**

13
14 WSEP Program activities were completed in 1972. From 1972 to 1976, no activities
15 occurred in B-Cell other than required minimum safe surveillance and maintenance activities
16 such as ventilation filter changes. Only solid LLW, such as expendable personal protective
17 equipment and plastic sheeting used during high contamination area entries, was generated
18 during this time.
19

20 **3.1.2.3 Nuclear Waste Vitrification Project**

21
22 The NWVP provided a demonstration of the vitrification of the liquid high-level waste
23 (HLW) stream highly radioactive liquid waste from spent nuclear fuel that was discharged from
24 an operating light water reactor.
25

26 The objective of the NWVP was to provide a demonstration of the vitrification of liquid
27 HLW from spent fuel discharged from LWR. The NWVP encompassed two tasks of the
28 Commercial High-Level Waste Immobilization Program: waste preparation and demonstration of
29 vitrification of HLW. The project was started in April 1976 and was terminated in June 1979. In
30 preparation for the project, some canister inspection equipment was demolished and removed
31 from B-Cell as LLW. A dissolver system was installed in B-Cell to dissolve the commercial
32 spent fuel, and piping was added to the pipe trench and HLV tanks to allow transport of
33 dissolved spent fuel and reprocessing HLW to and from the neighboring 325 Building.
34

35 The NWVP involved equipment in both 324 and 325 Buildings. The 324 Building was
36 used for fuel unloading, fuel disassembly, shearing, dissolving, waste calcination and
37 vitrification. Solvent extraction with 30 percent volume tri-butyl phosphate in a normal paraffin
38 hydrocarbon diluent (rendering the solvent immiscible with the aqueous based dissolver
39 solution), and ion exchange processes on the dissolved fuel were performed in A-Cell of the
40 325 Building before transferring the resulting HLW back to the 324 Building. A triple encased
41 underground pipeline between the two buildings served to transfer dissolver solution to the
42 325 Building, and HLW from the 325 Building to the 324 Building (refer to Chapter 2.0, Section
43 2.3.1.6.1).

1
2 Commercial LWR fuel assemblies were received in the trucklock unloading area in
3 approved shipping casks. The fuel assemblies were transferred into B-Cell for storage and
4 disassembly. For disassembly and shearing, the fuel pins were withdrawn from the
5 fuel assembly in groups of five, and fed to a hydraulic shear. The cut fuel pieces dropped down a
6 chute into a basket located inside the dissolver vessel Tank 127 (removed in 1984). After a
7 period of time to allow for dissolution of the spent fuel, the dissolver solution (nitric acid) was
8 filtered and sent to holding Tank 126 (removed in 1984). The dissolver solution was transferred
9 from Tank 126 to A-Cell in the 325 Building through the interbuilding pipeline.

10
11 After processing, the resulting dilute HLW feed was transferred back through the
12 interbuilding pipeline to HLV Tank 106 in the 324 Building. The HLW was transferred to
13 Tank 107, where the chemical composition was adjusted to that of typical waste by the addition
14 of uranium and nonradioactive chemicals. Inert chemicals added to the HLW in Tank 107 were:
15 NaNO_3 , $\text{Fe}(\text{NO}_3)\cdot 9\text{H}_2\text{O}$, $\text{Cr}(\text{NO}_3)\cdot 9\text{H}_2\text{O}$, $\text{Ni}(\text{NO}_3)\cdot 6\text{H}_2\text{O}$, and H_3PO_4 (75 percent). The waste
16 feed material was transferred to B-Cell feed Tank 114, and to evaporator Tank 113 to adjust the
17 acid concentration and volume for the vitrification process. The concentrated solutions from the
18 waste feed preparation process were used for the two batch operations of the spray calcine/in-can
19 melter system. Glass forming compounds added to the HLW calcine during the vitrification
20 process were SiO_2 , Na_2O , B_2O_3 , TiO_2 , Li_2O , MgO , ZrO_2 , and La_2O_3 .

21
22 During 1979, the spray calciner was plugged with calcined material during a melting run.
23 During efforts to unplug the calciner, several kilograms of calcine dropped out of the calciner and
24 ended up on the floor of B-Cell. This calcine is part of the dispersible material present today in
25 B-Cell.

26
27 Because of the high radioactivity of the glass logs produced, the logs were designated as
28 SCW with no identified disposal path. After negotiations with the Ecology in 1995 and
29 subsequent revision of the Hanford Facility RCRA Permit (Ecology 1994), the glass logs were
30 transported for storage to the PUREX Storage Tunnels.

31 32 **3.1.2.4 Period of No Activity**

33
34 NWVP activities were completed in 1979. From 1979 to 1981, no activities occurred in
35 B-Cell other than required minimum safe surveillance and maintenance activities such as
36 ventilation filter changes. Only solid LLW, such as expendable personal protective equipment
37 and plastic sheeting used during high (radiological) contamination area entries, was generated
38 during this time.

39 40 **3.1.2.5 Zeolite Vitrification Demonstration Project**

41

1 ZVDP was designed to demonstrate that zeolite ion exchange resins could be vitrified as
2 an alternate means to immobilize radionuclides present in the resin for storage. ZVDP was
3 started and completed in 1981.
4

5 Zeolite ion exchange resin that had been used to sorb radioactive strontium and cesium
6 from waste water at the Three Mile Island site were used in the demonstration. Equipment was
7 fabricated and placed in B-Cell to allow the dry zeolite to be mixed with dry glass formers and
8 fed to a canister inside an in-can melter. Glass formers used in the process were SiO_2 , Na_2O ,
9 B_2O_3 , TiO_2 , Li_2O , MgO , ZrO_2 , and La_2O_3 . A total of five resin beds were received and used in
10 the demonstration, which produced eight glass logs. Because of the high radioactivity of the
11 glass logs produced, the logs were classified as SCW for which no disposal pathway existed.
12 After notification to the Ecology and revision of the Hanford Facility RCRA Permit in 1995
13 (Ecology, 1994), the glass logs were transferred to the PUREX Storage Tunnels.
14

15 3.1.2.6 Pilot Scale Radioactive Liquid-Fed Ceramic Melter Testing Task

16
17 The RLFCM testing task including the installation and testing of the ceramic melter in B-
18 Cell occurred from 1982 to 1986. Existing equipment in the cell, including dissolver tanks
19 installed for the NWVP, the spray calciner system, two in-can melting systems, fuel disassembly
20 table, glass canister storage tank, and ZVDP equipment were demolished and shipped as LLW to
21 the burial grounds in the 200 Area to make room for the turntable/melter and auxiliary
22 equipment racks necessary for the process.
23

24 RLFCM program consisted of a ceramic melter capable of handling liquid slurries of waste
25 directly. Waste slurries were fed into the top of the melter, where liquids in the slurry were flash
26 evaporated. The waste formed a crust of material that floated on top of a layer of molten glass.
27 The crust gradually would melt to fusion temperatures, joining the molten glass beneath. An air
28 lift system was incorporated into the melter to allow periodic draining of the molten glass pool
29 formed in the melter. Molten glass was poured into stainless steel canisters moved beneath the
30 melter discharge by a turntable system. The system allowed continuous production of glass
31 during a melter run.
32

33 A liquid metal seal was used to seal the ceramic melter to the turntable system so that
34 negative pressure could be maintained on the entire system. The seal consisted of an alloy with
35 low melting characteristics (refer to Chapter 4.0 for description of alloy). The alloy was
36 contained in a unit that was installed on the turntable. The unit consisted of a circular trough
37 filled with the low temperature alloy, and steam lines that surrounded the trough. After
38 installation of the unit on the turntable, steam was circulated through the steam lines. The heat of
39 the steam melted the low temperature alloy, creating a pool of liquid metal. The melter air lift
40 system was lowered into the liquid metal pool, and bolted in place on the melter. After steam
41 was shut off to the liquid metal seal unit, the metal solidified, forming an excellent seal to the air
42 lift system that could be easily breeched by simply heating the low temperature alloy with steam.
43 The liquid metal seal unit allowed easy maintenance or equipment replacement of both melter
44 and turntable components.

1
2 Two auxiliary racks also were installed in the cell. The feed rack consisted of two feed
3 tanks in which the waste slurry was prepared and fed to the melter system. The melter off gas
4 rack contained condensers and scrubbing systems necessary to control the volumes of vapors
5 discharged from the melter system. The melter off gas rack was connected to the existing off gas
6 handling equipment in the cell, while the feed rack was connected to in-cell process tanks
7 associated with feed preparation.
8

9 RLFCM was made operational in 1985. Testing of the RLFCM included a 'cold run' in
10 which no radionuclides were included in the feed, and a 'hot run' in which depleted uranium and
11 natural thorium oxide were added to the feed. Details of the composition of feed material are
12 provided in Chapter 4.0. A total of four canisters of glass were produced during RLFCM testing.

13 After testing, the RLFCM was used to produce the heat and radiation sources for the FRG
14 Program. These four canisters subsequently were stored in A-Cell pending completion of the
15 FRG Program (refer to Section 3.1.2.6.2).
16

17 **3.1.2.6.1 Fabrication of Cesium and Strontium Heat and Radiation Sources**

18 **Program.** In 1986 through 1987, the RLFCM task produced 30 isotopic heat sources in canisters
19 for FRG to be used as part of a repository testing program. These activities, which frequently are
20 referred to as the FRG Program, involved the filling, closure, and decontamination of the 30
21 canisters. The canister filling and decontamination processes used the vault tanks for feed waste
22 solution, process condensates, and decontamination solutions as described in the following
23 sections.
24

25 **3.1.2.6.2 FRG Canister Filling.** During three separate processing campaigns (RLFCM-7,
26 -8, and -9), canisters were filled using the radioactive liquid-fed ceramic melter to produce a
27 borosilicate glass. Feed materials for these campaigns were cesium-137 and strontium-90 laden
28 nitrate solutions from B Plant Complex. Details of the composition of feed materials are
29 provided in Chapter 4.0. The original feed stock solutions were made from cesium-137 chloride
30 capsules fabricated at WESF and strontium-90 fluoride. Capsule contents, including impurities
31 such as lead, chrome, and traces of plutonium (in the strontium capsules only), were converted to
32 nitrate solutions before being transferred from the B Plant complex to the 324 Building.
33 Residual halides (in small quantities) were expected in the waste feed solutions. The waste feed
34 solutions were stored in HLV tanks 104 and 105. Waste feed solutions were batch transferred
35 from Tank 104 and Tank 105 to Tank 112, where the temperature was controlled and monitored
36 and the solution was agitated. The contents of Tank 112 were transferred to the evaporator Tank
37 113 for denitrification (addition of formic acid) and volume reduction. . The concentrated
38 product from Tank 113 was transferred to feed makeup Tank 114, where nonradioactive glass-
39 forming chemicals were added. The resulting feed slurry was sent to the RLFCM feed rack,
40 where the slurry was fed into the RLFCM and melted to form a borosilicate glass.
41

42 A total of 30 canisters were filled with glass during the three RLFCM campaigns. The
43 canisters were unloaded from the turntable and transported to A-Cell for installation of a welded
44 lid, decontamination, and storage. During 1986, melter feed that consisted of a nitric acid
45 solution that contained cesium, strontium, and impurities including lead, chrome, and plutonium

1 spilled onto the floor of B-Cell and evaporated. The resulting dry material was conservatively
2 assumed to be dispersible. These 30 canisters and the four produced in the earlier RLFCM task
3 were loaded in storage casks and transferred to a storage area in the Central Waste Complex.
4

5 **3.1.2.7 Auxiliary Effluent and Process Feed Handling Systems**

6
7 The PUREX off gas handling system in B-Cell was in service from 1966 through 1987.
8 Major parts of the system were unchanged during that time, although replacement of several
9 condensers in the system and addition of another off gas scrubber rack occurred between 1984
10 and 1985 as part of an equipment upgrade to support the RLFCM testing task and FRG
11 Program.
12

13 The process feed handling system is interrelated to the effluent handling system. Process
14 feed stocks were cycled through the effluent handling system, principally the evaporator and
15 fractionator, to prepare the feed for introduction to the melting systems. This system consists of
16 two process tanks and transfer piping.
17

18 Process auxiliaries necessary for operation of the melter systems tested in B-Cell consist
19 of equipment for (1) preparing aqueous waste solutions for feeding the melter systems,
20 (2) decontaminating the melter system off gas, and (3) decontaminating the melter system
21 condensate and recovering nitric acid.
22

23 Effluents generated from vitrification (glass-making) processes consisted of volatilized
24 material from the feed, entrained liquid or solid aerosols, and process air. The volatilized
25 materials consisted primarily of water, nitric acid, various oxides of nitrogen, and a small
26 amount of ruthenium tetroxide (RuO_4). Noncondensable constituents in the melter system off
27 gases were discharged to the atmosphere after treatment by in-cell process off gas scrubbers and
28 HEPA filtration.
29

30 In the 324 Building auxiliary system, vapors from the melter systems were routed through
31 a condenser to the evaporator. The condensate was concentrated in the evaporator. Entrained
32 aerosols in vapors from the evaporator were removed in the evaporator tower by impingement
33 plates, bubble caps, and a mist eliminator, and recondensed. The evaporator condensate was
34 concentrated in the acid fractionator where nitric acid was recovered. Vapors from the
35 fractionator were again condensed; about 80 percent of the fractionator distillate was recycled to
36 the evaporator as acid stripwater, while the remaining 20 percent was discharged to storage in
37 HLV tanks. Remaining off gasses were treated by in-cell HEPA filtration, run through a
38 scrubbing system, and through additional HEPA filtration (both in the process off gas blower
39 room and the building zone 1 ventilation system) before being discharged to the atmosphere.
40 Figure 3.1 illustrates the effluent treatment auxiliary system.
41

42 The effluent treatment auxiliary system included Tank 113 (evaporator), Tank 115
43 (fractionator), Tank 116 (fractionator distillate receiver), and Tank 118 (scrubber) located in

1 B-Cell of the 324 Building. The following describes process routes for liquid effluent
2 discharges in this system.

3
4 The major process route for Tank 113 was transfer of concentrated effluent to Tank 112
5 or Tank 114 (feed tank) for immediate use in the vitrification process or transfer of concentrated
6 effluent to HLV Tank 104 for future use. Process routes for reclaimed acid from the fractionater
7 (Tank 115) was to HLV Tank 105 for storage, or to Tank 116 or process condensers for
8 condensate pH adjustments. Vapors from the evaporator (Tank 113) were sent through two
9 stages of condensing before discharge to the fractionater distillate (strip water) receiver tank
10 (Tank 116). Process routes for effluent discharge from Tank 116 was to LLV Tank 101 or
11 Tank 108 (condensate storage), to LLV Tank 102 (condensate sample and storage), to the
12 fractionator Tank 115 as makeup solution, and to process condensate collector Tank 117.
13 Liquid effluent discharges from Tank 118 (scrubber bottoms) were sent to HLV Tank 104.

14
15 The spray calciner/in-can melter system used during WESP and NWVP could receive
16 feed from the interconnected utility Tank 112 (evaporator feed tank) and Tank 114 (calciner
17 feed tank). Tank 112 received feed material from HLV Tank 104, Tank 105, and Tank 107 or
18 the evaporator (Tank 113) and discharged to the evaporator or Tank 107. Tank 114 received
19 material from HLV Tank 107 and discharged to the melter system or Tank 105. Although not
20 used between 1966 and 1987, additional piping present in tanks 112 and 114 went to rack face
21 connections, which allowed process connections to be made to other equipment. One of these
22 lines from Tank 112 was used to connect a vacuum transfer system to D-Cell to facilitate
23 treatment of HLV tanks solutions in 1996 (see Section 3.2.4).

25 3.1.3 C-Cell

26
27 C-Cell has been used since 1968 for materials characterization work in support of several
28 programs. Most of the characterization work performed involved leaching studies of glass
29 produced during the WSEP Program and spent fuel from various commercial reactors. The
30 leaching studies performed centered around characterization of groundwater effects on waste
31 forms. Leachates used were distilled water, onsite groundwater, brines, and some carbonate
32 buffered aqueous solutions. Programs supported include WSEP, the Waste Fixation Program,
33 Spent Fuel Handling and Packaging Program, and the Waste Isolation Program.

34
35 In 1977, after discovery of a leak in the ventilation duct space under C-Cell, a test was
36 conducted to determine the integrity of the cell sump and stainless steel floor liner. The sump
37 and liner were flooded with water containing dye. The ventilation duct space was monitored for
38 evidence of the dye solution, with negative results.

39
40 Equipment in C-Cell was removed and the cell decontaminated in 1989. Since 1989,
41 C-Cell has been used for R&D activities of spent fuel and target assemblies. In addition,
42 equipment was installed in 1996 to perform treatability studies on waste tank sludge from the
43 200 Area.

1 3.1.4 D-Cell

2
3 Work activities performed in D-Cell include preparation of WSEP glass samples for
4 analysis, characterization, sectioning, and sample preparation of commercial spent fuel samples,
5 and production of glass standards for the Materials Characterization Center Program; spent fuel
6 heat and radiation degradation studies for the Commercial Spent Fuel Management Program;
7 and operation of equipment used during the HLV Liquids Interim Action Project. Solid LLW
8 materials were produced during these activities and transferred to the burial grounds in the
9 200 Areas. Lead used for shielding and counterweights was classified as low-level mixed waste
10 and transferred the Central Waste Complex.

11
12 A radioactive liquid waste leak was detected in 1977 under C-Cell. At the time, D-Cell
13 operations performed work for the Materials Characterization Center Program involving
14 strontium-90 fluoride. In performing cell cleanup during operations, water was siphon jetted
15 from the sump present in the cell. Several days later, while performing work in the ventilation
16 duct space under C-Cell, liquid containing high levels of radiation was noted as leaking from a
17 crack in the concrete ceiling of the crawl space (actually the floor of C-Cell). The immediate
18 assumption was that there was a leak in either C-Cell or A-Cell that was causing the liquid leak
19 in the ventilation duct space. A leak test was conducted in C-Cell and A-Cell. The sumps and
20 floor areas were flooded with a dye solution and left for an extended period, then siphon jetted
21 to HLV Tank 104. The test showed that the sumps and stainless steel floor liners were intact in
22 both C-Cell and A-Cell.

23
24 After further investigation, a determination was made that the source of the leak was a
25 transfer line that was used to jet the contents of the D-Cell sump to the LLV tanks. This was
26 confirmed through analysis of the leaking solution, which showed high levels of strontium-90.
27 The only work occurring with strontium-90 was in D-Cell. It was assumed that the line, which
28 is imbedded in the concrete walls of both C-Cell and D-Cell, failed for unknown reasons.
29 Liquid being carried in the line during jetting operations leaked into the concrete, finding an exit
30 in a crack in the concrete ceiling of the C-Cell crawl space.

31
32 The suspect line was isolated to prevent further use, and another transfer line was
33 designated for use during future sump jet operations. Additionally, catch trays were installed in
34 the ventilation duct space to catch any leaking liquid in the event that a similar leak occurred in
35 the future. The catch trays drain to the HLV sump, which is monitored for liquid level. No
36 liquid level alarms attributable to leaks in the crawl space have occurred (refer to Section 3.2.9.1
37 for a discussion of free liquids in the HLV).

38
39 The D-Cell has a significant nonregulated inventory. The fuel pin inventory of D-Cell
40 consists of approximately 50 kilograms of BWR and pressurized water reactor SNF rod
41 segments and fuel pellets contained in two spent fuel storage containers.

42
43 There are five strontium filters encased in specially designed stainless steel canisters, nine
44 ion exchange columns encased in specially designed stainless steel canisters, and one
45 transuranic (TRU) column encased in a specially designed stainless steel canister. The filters

1 and ion exchange columns are part of the HLV Liquid Waste Interim Removal Project residual
2 waste stream. Both the SNF and HLV filters and columns will be removed before closure.
3

4 **3.1.5 Airlock**

5
6 The airlock allows for access to the four REC (A-, B-, C-, and D-Cells) and the pipe
7 trench, and is used primarily as a transition zone for maintenance, and for transfer of material
8 and equipment into and out of those areas. The airlock is used for final radiological
9 decontamination of containers before releasing to the cask handling area (Note: Packages are
10 decontaminated in B Cell before entering the airlock. Decontamination in the airlock is required
11 because of the airborne nature of radiological contaminants within B-Cell). The
12 decontamination solutions currently gravity flow to the pipe trench. In Chapter 7.0,
13 Section 7.1.5 addresses closure activities for the airlock and Table 7-1 lists specific piping to be
14 isolated to accomplish the isolation of the airlock and pipe trench from the HLV.
15

16 **3.1.6 Pipe Trench**

17
18 The pipe trench was used to make utility, process, and waste handling piping connections
19 between the cells and the HLV tanks. Process and waste handling piping runs between the pipe
20 trench, HLV and LLV tanks, and B-Cell. The pipe trench will be isolated from the HLV.
21

22 The pipe trench also was designed to contain water used for decontamination of external
23 surfaces of containers with radiological contaminants above packaging requirements (primarily
24 caused by airborne contamination during transfer of container from in-cell to the airlock) in the
25 REC airlock, and radiological decontamination of the airlock itself. The liquid collected in the
26 bottom of the trench. The pipe trench was equipped with a steam jet that enabled solutions
27 collected in the trench to be transferred to LLV Tank 102. The steam jet ceased functioning in
28 1985. Since 1985, collected water has been managed by monitoring the pipe trench level, and
29 curtailing use of water in the airlock if levels reach an administrative control level.

30 Alternatively, a pump was connected to tubing running into the pipe trench. The outlet for the
31 pump is connected to a line that passes through a shield plug in the airlock into B-Cell.
32

33 **3.1.7 Other 324 Building Areas**

34
35 Four other areas of importance are within the closure boundary: cask handling area, the
36 trucklock, the EDL-146, and the galleries.
37

1 **3.1.7.1 Cask Handling Area**

2
3 The cask handling area is used for equipment and cask storage. No dangerous waste
4 activities take place in the cask handling area. However, packaged waste does pass through the
5 cask handling area to exit the building.
6

7 **3.1.7.2 Trucklock**

8
9 The trucklock provides access into and out of the 324 Building for all radioactive
10 material. The area consists of a loading bay accessible by truck or rail car, and a radioactive
11 liquid loadout stall used to transfer radioactive liquids into or out of the facility using
12 appropriate transport casks. The loadout stall is a shielded and ventilated cubicle that contains
13 piping connections and valve manifolds that allowed routing of liquids to or from the HLV and
14 LLV tanks. It was last used during the production of sealed isotopic heat sources for the FRG
15 Program to transfer radioactive cesium and strontium solutions to HLV tanks 104 and 105 in
16 1986.
17

18 The trucklock contained a less-than-90-day storage area periodically used as a staging
19 area for contact-handled mixed waste. The trucklock also contains satellite accumulation areas
20 that are used to accumulate contact-handled mixed waste from the REC. All mixed waste is
21 packaged for radiological contamination control before being brought into the trucklock area.
22

23 **3.1.7.3 Engineering Development Laboratory-146 (Room 146)**

24
25 The EDL-146 has been used for bench and pilot-scale process development activities.
26 EDL-146 has contained satellite accumulation areas and less-than-90-day storage areas. No
27 TSD activities have occurred in the EDL-146.
28

29
30 The Sodium Removal Pilot Plant, which was located within the EDL-146, was a RCRA
31 permitted treatment facility that underwent Procedural Closure pursuant to the requirements of
32 the Tri-Party Agreement, Section 6.3.3. The Sodium Removal Pilot Plant will not be addressed
33 by this closure plan except that piping to the LLV tanks will be isolated and will undergo
34 closure activities (Chapter 7.0, Section 7.3).

35 **3.1.7.4 Operating Galleries**

36
37 The operating galleries are radiologically controlled areas for use by personnel working
38 with material in the REC. The galleries include locations for operating remote manipulators
39 connected to the cells, view ports into the cells, access to the cell cubicles, and pass-through
40 ports from the REC.
41

1 The galleries are of concern for closure because of the pipes (steam lines, air lines, and
2 chemical addition lines) that run from the second floor gallery into B-Cell and the HLV tanks.
3 Connections in the operating gallery allow for different combinations of air, steam, and
4 chemicals to be used depending on the operations required in B-Cell and the HLV tanks.
5

6 The chemical addition lines were used during the HLV tanks treatment process to add the
7 chemical rinse solutions. These lines were flushed following use, and therefore, no chemical
8 residues are expected in these gravity flow lines.
9

10 **3.1.7.5 Room 18**

11
12 Room 18 is a support area located in the basement adjacent to B-Cell. Room 18 is a
13 concern for closure because of piping from B-Cell and the potential for the concrete surrounding
14 the B-Cell shield plugs to be contaminated with mixed waste.
15

16 **3.1.8 Other Components**

17
18 Other areas of concern to the closure are the pass-through ports and the cubicles.
19

20 **3.1.8.1 Pass-through Ports**

21
22 Pass-through ports were used to support transfer of special tools and services for cell
23 operations. No specific waste generation or waste handling were specifically associated with
24 the ports.
25

26 **3.1.8.2 Cell Cubicles**

27
28 The A-Cell cubicles (A-11, A-12, A-21, A-22, A-31, A-32) and B-Cell cubicles (B-12
29 and B-14) were used to make process connections into the cells. No specific waste handling
30 process was associated with the cubicles. In all eight cubicles, cubicle drain lines run directly to
31 the LLV Tank 101. Also, process lines run through the cubicles to the LLV tanks 101 and 102,
32 to the HLV tanks 104 and 105, and to other hot cells.
33

34 **3.1.9 High-Level Vault and Low-Level Vault**

35
36 The following sections describe the processes associated with the tanks contained in the
37 HLV and LLV Vault. Tank configuration and lineups also are described. All the discharge
38 points to the vault tanks currently have administrative controls. The current tank piping
39 configuration is shown in Figures 3-1 through 3-8.
40

1 3.1.9.1 High-Level Vault

2
3 Before the cessation of processing activities in 1988, the HLV tanks were used for the
4 storage of highly radioactive process feed solutions, distillates from in-cell vitrification
5 processes, and nitric acid recovery. HLV tanks also were used to collect liquid effluent from the
6 in-cell sumps and to receive highly radioactive liquids transferred through the loadout stall in
7 the trucklock (refer to section 3.1.2). The HLV Interim Waste Removal Action project drained
8 and flushed the tanks in 1996.
9

10 **3.1.9.1.1 Tank 104.** Tank 104 was able to receive solutions from C-Cell, D-Cell, A-Cell
11 cubicles A-11 and A-12, B-Cell cubicles B-12 and B-14, the loadout stall; HLV sump; and HLV
12 tanks 105 and 107 and LLV Tank 102. The contents of Tank 104 were transferred to the
13 loadout stall and Tank 105. There also are process connections to and from Tank 104 and the
14 pipe trench (Figure 3-1).
15

16 Tank 104 stored cesium nitrate solution containing trace amounts of heavy metals
17 received from B Plant complex to support the FRG Program (Section 3.1.2.6). Information on
18 the chemical composition of the solution is presented in Chapter 4.0, Section 4.2. Since 1988,
19 transfers have occurred from Tank 104 to Tank 105, Tank 112, and Tank 107. Periodic
20 additions of water have historically been made to Tank 104 to maintain liquid level above the
21 instrument lines in the tank. Although no documented evaporation calculations are available,
22 the loss of liquid level in the Tank is suspected to be from evaporation. Evaporation occurring
23 in ventilated tanks is not unusual. Other tanks in the HLV were experiencing an equivalent
24 liquid level reduction at the time. Additionally no incident of a HLV sump alarm was noted
25 during this period, which would be expected if the Tank was leaking into the vault.
26

27 **3.1.9.1.2 Tank 105.** Tank 105 was able to receive solutions from tanks 104 and 106,
28 A-Cell cubicles A-11 and A-12, B-Cell cubicles B-12 and B-14, the loadout stall, and the
29 airlock. The contents of Tank 105 were transferred to Tank 104 and the loadout stall. There
30 also are process connections to and from Tank 105 and the pipe trench (Figure 3-2).
31

32 Tank 105 stored strontium nitrate solution containing trace amounts of heavy metals
33 received from B Plant complex to support the FRG Program (Section 3.1.2.6). Since 1988,
34 transfers have occurred to Tank 105 from Tank 104 and Tank 107. Periodic additions of water
35 have historically been initiated to Tank 105 to maintain liquid level above the instrument lines
36 in the tank. Although no documented evaporation calculations are available, the loss of liquid
37 level in the tank is suspected to be from evaporation. Evaporation occurring in ventilated tanks
38 is not unusual. Other tanks in the HLV were experiencing an equivalent liquid level reduction
39 at the time. Additionally, no incident of a HLV sump alarm was noted during this period, which
40 would be expected if the tank was leaking into the vault.
41

42 **3.1.9.1.3 Tank 106.** Tank 106 was able to receive solutions from Tank 107, the loadout
43 stall, B-Cell cubicles B-12 and B-14, and D-Cell. The contents of Tank 106 were transferred to
44 the loadout stall and tanks 105 and 107. There are process connections between Tank 106 and
45 the pipe trench (Figure 3-3).

1
2 Tank 106 was used to receive dilute HLLW from the 325 Building via the interbuilding
3 pipeline. The interbuilding pipeline was used to transfer dissolver solution to the 325 Building
4 and used to transfer dilute HLLW from the 325 Building to Tank 106. Connections between
5 the interbuilding pipeline and tanks in the building were made in the pipe trench. After
6 receiving the dilute HLLW in Tank 106, the diluted HLLW was transferred to Tank 107 for
7 processing.

8
9 There are no recorded transfers of process solutions into or out of this tank since
10 October 1988, except that the tank was rinsed in 1990.

11
12 **3.1.9.1.4 Tank 107.** Tank 107 was able to receive solutions from Tank 106 and from
13 gravity fed chemical addition lines originating in the chemical makeup room on the third floor
14 of the building. The contents of Tank 107 were transferred to the loadout stall and tanks 104
15 and 106. Tank 107 also can receive and transfer to the pipe trench (Figure 3-4).

16
17 Diluted HLW that was used as feed material for the NWVP was stored in Tank 107 (refer
18 to section 3.1.2.3 for further details). Dilute nitric acid was added to Tank 107 on
19 January 31, 1989, May 19, 1989, and November 10, 1989, to maintain liquid level above the
20 instrument lines in the tank and to ensure that products in the material stayed in solution. In
21 January 1990, the solution and subsequent rinse water was transferred to Tank 112 in B-Cell,
22 leaving Tank 107 empty. Tank 112 is a process supplementary tank located in B-Cell process
23 rack 1B. Information on the function of this tank is provided in Section 3.1.2.7. The material
24 was transferred to Tank 112 as the first step in a potential treatment evaluation process that was
25 not performed. The material and rinse water were returned to Tank 107 in November 1992.
26 Periodic additions of water were historically added to Tank 107 to maintain liquid level above
27 the instrument lines in the tank. Although no documented evaporation calculations are
28 available, the loss of liquid level in the tank is suspected to be from evaporation. Evaporation
29 occurring in ventilated tanks is not unusual. Other tanks in the HLV were experiencing an
30 equivalent liquid level reduction at the time. Additionally, no incident of a HLV sump alarm
31 was noted during this period, which would be expected if the tank were leaking into the vault.
32

33 **3.1.9.2 Low-Level Vault**

34
35 The LLV tanks were used to accumulate and neutralize various low activity liquid
36 effluents in preparation for transfer to the 340 Building for transfer to in the Double-Shell Tank
37 (DST) System in the 200 Area.
38
39

1 **3.1.9.2.1 Tank 101.** Tank 101 was able to receive solutions from tanks 103 and 108;
2 Tank 115 within B-Cell; the loadout stall, the process drains in cubicles A-11, A-12, B-12, and
3 B-14, the cubicle drains in cubicles A-11, A-12, A-21, A-22, A-31, A-32, B-12, and B-14; the
4 pipe trench, the sampler drain in the sample room; and the Room 11 drain. The contents of
5 Tank 101 were transferred to Tank 102 or to the 340 Building (Figure 3-5).
6

7 Tank 101 was used during process runs to receive condensate from the fractionator
8 distillate receiver in B-Cell. The fractionator distillate condensed vapors coming from the
9 melters. Since 1988, the only solution transfer that occurred to Tank 101 was a partial transfer
10 from Tank 103 in October 1989 (refer to section 3.1.9.2.3 for further information).
11

12 The solution (5,300 liters) that was present in Tank 101 in June 1990 was sampled and
13 analyzed. Between 1990 and 1996, the liquid level steadily decreased; since mid-1996, the tank
14 has been empty. Although no documented evaporation calculations are available, the loss of
15 liquid level in the tank is suspected to be from evaporation. Evaporation occurring in ventilated
16 tanks is not unusual. Other tanks in the LLV were experiencing an equivalent liquid level
17 reduction at the time. Additionally, no incident of a LLV sump alarm was noted during this
18 period, which would be expected if the tank was leaking into the vault.
19

20 **3.1.9.2.2 Tank 102.** Tank 102 was able to receive solutions from tanks 101, 103, and
21 108; the LLV sump; cubicles A-11, A-12, B-12, and B-14; C-Cell; D-Cell; and the EDL safety
22 showers. The contents of Tank 102 were transferred to HLV Tank 104, the loadout stall, or to
23 the 340 Building (Figure 3-6).
24

25 Tank 102 was used to receive condensate from the fractionator distillate receiver in
26 B-Cell via a connection in the pipe trench (refer to Section 3.1.2 for further information).
27 Throughout the life of the building, Tank 102 also was used to collect solutions from
28 decontamination sinks and emergency showers and eyewashes in Rooms 146 and 147 and the
29 trucklock sump.
30

31 In October 1988, Tank 102 received a phosphoric acid solution from A-Cell. The
32 material was neutralized and transferred to the 340 Building. In January 1989, Tank 102
33 received solution from Tank 103 and the solution was transferred to the 340 Building. In
34 November 1990, Tank 102 received C-Cell and airlock decontamination water from Tank 103;
35 the solution was transferred to the 340 Building. In May 1991, Tank 102 received a nitric acid
36 solution containing chromium from Tank 108. The solution was neutralized with sodium
37 hydroxide and transferred to the 340 Building in May 1991, followed by a water flush.
38

39 **3.1.9.2.3 Tank 103.** Tank 103 was able to receive radiological decontamination
40 solutions from C-Cell, the airlock, the loadout stall and the pipe trench sump. The contents of
41 Tank 103 can be transferred to tanks 101 and 102, and the loadout stall (Figure 3-7).
42

43 No documentation of the use of Tank 103 during processing is available. However, it is
44 known that Tank 103 was used to receive radiological decontamination solutions from the pipe
45 trench before the pipe trench sump jet line ceased operating in 1989. In November and

1 December 1988, Tank 103 received C-Cell and airlock decontamination water. In
2 January 1989, the contents of Tank 103 were transferred to Tank 102 and to the 340 Building.
3 In January and February 1989, Tank 103 again received solution from the pipe trench that
4 originated from C-Cell and airlock decontamination activities. In October 1989, a partial
5 transfer of solution from Tank 103 was made to Tank 101. In November 1990, the remaining
6 contents of Tank 103 were transferred to Tank 102.
7

8 **3.1.9.2.4 Tank 108.** Tank 108 was able to receive solutions from the EDL-146 drains
9 and the pipe trench (Figure 3-8).
10

11 During FRG Program canister fabrication, Tank 108 was used to receive nitric acid from
12 the acid fractionator in B-Cell via a connection in the pipe trench (refer to Section 3.1.2.7 for
13 further information). The solution in Tank 108 was sampled and analyzed in June 1990. In
14 May 1991, the solution was transferred to Tank 102. A water flush of Tank 108 also was sent to
15 Tank 102.
16

17 **3.2 Dangerous Waste Treatment and Storage Activities**

18

19 Dangerous waste treatment and storage activities were and are conducted within the
20 closure boundary including dangerous waste storage within the REC, liquid dangerous waste
21 treatment within D-Cell, and liquid dangerous waste transfer to and from the HLV tanks and
22 potentially to the LLV tanks for storage and/or treatment. The following section describes the
23 activities that were or are being conducted within the specific closure boundary area.

24 **3.2.1 A-Cell**

25

26 A-Cell did not treat or store dangerous waste, except as a less-than-90-day storage area
27 for electropolisher electrolyte (refer to Section 3.1.1).
28

29 **3.2.2 B-Cell**

30

31 B-Cell currently is used to store mixed waste produced during process operations (refer to
32 Section 3.1.2) pending packaging and removal. In addition, process Tank 112 and associated
33 transfer lines were used in the processing and treatment of the HLV tank waste (refer to section
34 3.2.4). Past waste removal activities associated with the B-Cell Cleanout Project (BCCP) are
35 described in Section 3.3.2. The dangerous and mixed waste generated in B-Cell are described in
36 Chapter 4.0.

37 **3.2.3 C-Cell**

38

39 C-Cell did not treat or store dangerous waste, except as a less-than-90-day storage area
40 for waste produced during recent tank sludge treatability studies begun in 1996.
41

1 3.2.4 D-Cell

2
3 D-Cell had been used to store a 208-liter container of mixed waste containing waste
4 mineral oil mixed with diatomaceous earth (adsorbent) from July 1994 until January 1996. This
5 waste was generated in B-Cell from a window leak. The container was removed from D-Cell in
6 January 1996 and transferred to the PUREX Storage Tunnels as SCW.

7
8 A portion of D-Cell currently is used to stage HLV tank liquid waste treatment
9 equipment. The waste treatment equipment is being staged in D-Cell in support of 324 Building
10 deactivation and will remain operational until a determination is made that there is no further
11 need for the equipment. The HLV tanks liquid waste treatment involved transferring the waste
12 and rinsates from the HLV tanks to D-Cell via Tank 112 in B-Cell. The treatment process
13 involved the following process, the waste in the HLV tanks was transferred to HLV Tank 104.
14 From Tank 104, the waste was steam jetted to Tank 112 in B-Cell, and vacuum transferred to
15 the waste treatment system in D-Cell. The solutions were adjusted chemically to precipitate the
16 heavy metals present; the precipitates were collected on filters enclosed in specially designed
17 stainless steel canisters. The supernate from the filtration process again was treated chemically
18 by addition of calcium carbonate; this precipitated the strontium-90 present in the supernate.
19 The precipitate was collected for use in the medical isotope program. The supernate from this
20 process was passed through an ion exchange column to collect the cesium-137. After sampling,
21 the remaining low-level liquid was transferred to the 340 Building for subsequent transfer to the
22 200 Area DST system (refer to Chapter 4.0 for analytical results). The waste treatment system
23 in D-Cell was constructed with drip pans beneath the system to contain any leakage. In
24 addition, the system was maintained under a vacuum (using process vent lines attached to the
25 building HVAC system). This approach helped to contain and minimize the impact of potential
26 leakage as well. Filters contaminated with heavy metals from this treatment process are
27 considered as mixed waste (refer to Chapter 4.0 for details). The filters were collected in
28 D-Cell before being transferred to B-Cell to await transfer to an appropriate TSD unit for
29 storage or disposal.

31 3.2.5 Airlock

32
33 The airlock was not used to treat or store dangerous waste. It is used, however, to
34 perform radiological decontamination of cranes and other equipment from the hot cells before
35 maintenance activities. Solutions generated during decontamination, as well as rinse water used
36 to flush the airlock after decontamination activities, gravity flow to the pipe trench.

1 **3.2.6 Pipe Trench**

2
3 The pipe trench is not believed to have treated or stored dangerous waste. It was used,
4 however, as a shielded pipe chase to allow transfer piping from the HLV/LLV tanks to connect
5 to service plugs on the 1A, 1B, and 2A racks in B-Cell. In addition, residual dust and dirt from
6 settling of airborne particulates through the airlock and pipe trench have become radiologically
7 contaminated because of decontamination activities carried out in the airlock. Final
8 determination of the existence of this material and subsequent sampling and analysis to
9 determine if dangerous waste constituents exist currently is not feasible because of the piping
10 and drip pans present in the pipe trench. To allow inspection and sampling, piping to the 1A,
11 1B, and 2A rack plugs must be removed. If sludge is present in the trench and sampling
12 determines that it is dangerous waste, the sludge will require appropriate handling and
13 packaging during pipe trench cleanout (refer to Chapter 7.0).
14

15 **3.2.7 Other 324 Building Areas**

16
17 The cask handling area, the trucklock including the loadout stall, EDL-146, and the hot
18 cell galleries, including Room 18, were used to support operations in the hot cells. The
19 trucklock and loadout stall were used to transport radioactive solutions contaminated with heavy
20 metals into the building for use during the production of sealed isotopic heat sources for the
21 FRG Program (refer to Section 3.1.2.6). Piping in the loadout stall associated with radioactive
22 solutions transfers will be included in closure (refer to Chapter 7.0). Radioactive contamination
23 from B-Cell leaked into Room 18 via the lower B-Cell, 5A service plug on three known
24 occasions (in 1977, 1985, and 1988). The radioactively-contaminated water originated from
25 decontamination/flushing operations within B-Cell. Actions were taken to repair/replace the 5A
26 service plug seal and decontaminate the affected wall and floor area within Room 18. No
27 dangerous waste treatment or storage activities took place in these areas.
28

29 **3.2.8 Other Components**

30
31 Other areas of concern to the closure are the pass-through ports and the cubicles. These
32 areas did not treat or store dangerous waste.

33 **3.2.9 High-Level Vault and Low-Level Vault**

34
35 The following sections describe the TSD activities that did or are taking place in the HLV
36 and LLV tanks.
37

38 **3.2.9.1 High-Level Vault**

39
40 Material stored in the HLV tanks was considered product material in storage until

1 April 1994. The product material was used to support a number of nuclear materials programs
2 and processes (described in Section 3.1). In April 1994, RL determined that there was no future
3 use for this product material, as the programs involved had been discontinued, and, as such, the
4 product material was classified as mixed waste. The HLV tank liquid waste treatment project
5 drained and flushed the tanks in 1996. Information on sampling and analyses conducted on
6 HLV tanks is present in Chapter 4.0.

7
8 There is one documented case of free liquids contained within the liner of the HLV area.
9 On September 7, 1995, liquid totaling 61.7 liters accumulated in the HLV sump, triggering the
10 HLV sump alarm. The source of the liquid was traced to decontamination solution accumulated
11 in the pipe trench from the liquid originated from decontamination activities in the airlock. The
12 decontamination solution was collected in the pipe trench. Because the amount of
13 decontamination solution generated in a short time, liquid levels in the pipe trench were higher
14 than normal, and reached the bottom of a 30.1-centimeters secondary containment pipe that
15 encases transfer piping that runs between the pipe trench and the HLV tanks. A small amount of
16 the decontamination solution ran down the pipe and discharged into the HLV, collecting in the
17 sump.

18
19 The level of liquid present in the sump was monitored over a period of a month. The
20 level gradually decreased from 14.4 to 1.0 centimeters. This gradual decrease was consistent
21 with expected evaporation rates, so no leakage from the vault sump is suspected.

22
23 After this incident, airlock decontamination methods were modified to ensure that liquid
24 levels in the pipe trench are monitored during decontamination activities. If pipe trench liquid
25 levels approach an administrative maximum, decontamination activities are halted and liquids in
26 the pipe trench are either pumped to B-Cell via the 2A Rack for evaporation or allowed to
27 evaporate in place.

28
29 **3.2.9.1.1 Tank 104.** Material stored in Tank 104 was considered a product material in
30 storage until April 20, 1994, when the RL determined there was no future use for the material
31 and reclassified it as mixed waste. Tank 104 was flushed and drained in 1996 as part of the
32 HLV tank waste removal activity (Section 3.3.9). Tank 104 currently is empty. Information on
33 sampling and analyses conducted on this tank can be found in Chapter 4.0, Section 4.3.

34
35 **3.2.9.1.2 Tank 105.** Material stored in Tank 105 was considered a product material in
36 storage until April 20, 1994, when the RL determined there as no future use for the material and
37 reclassified the product material as mixed waste. Tank 105 was flushed and drained in 1996 as
38 part of the HLV tank waste removal activity (Section 3.3.9). Tank 105 currently is empty.
39 Information on sampling and analyses conducted on this tank can be found in Chapter 4.0,
40 Section 4.3.

41
42 **3.2.9.1.3 Tank 106.** As part of the HLV Tank Liquid Waste Interim Removal Project,
43 Tank 106 was flushed and drained in 1996 (Section 3.3.9). Tank 106 currently is empty.
44 Information on sampling and analyses conducted on this tank can be found in Chapter 4.0,
45 Section 4.3.

1
2 **3.2.9.1.4 Tank 107.** Material stored in Tank 107 was considered a product for material
3 in storage until April 20, 1994, when the RL determined there was no future use for the material
4 and reclassified the material as mixed waste. Tank 107 was flushed and drained in 1996 as part
5 of the HLV tank waste removal activity (refer to Section 3.3.9). Tank 107 currently is empty.
6 Information on sampling and analyses conducted on this tank can be found in Chapter 4.0,
7 Section 4.3.
8

9 **3.2.9.2 Low-Level Vault**

10
11 As part of the data quality objective process leading to the development of this closure
12 plan, all parties agreed that the LLV/tanks could continue activity in support of the closure and
13 decontamination activities. For this reason, the LLV was included within the closure boundary
14 and would require closure actions after HLV and REC transfers were completed.
15

16 Tank contents were sampled and analyzed in June 1990 (refer to Chapter 4.0, Section 4.2
17 and Tables 4-1 through 4-7 for additional information). There are no documented occurrences
18 of free liquids contained within the vault liner in the LLV area.
19

20 **3.2.9.2.1 Tank 101.** Tank 101 currently is empty. Information on sampling and analyses
21 conducted on this tank can be found in Chapter 4.0, Section 4.3.
22

23 **3.2.9.2.2 Tank 102.** Tank 102 currently is empty. Information on sampling and analyses
24 conducted on this tank can be found in Chapter 4.0, Section 4.3.
25

26 **3.2.9.2.3 Tank 103.** Tank 103 is currently empty. Tank 103 was used to receive
27 radiological decontamination solutions from C-Cell and the airlock via the pipe trench.
28 Information on sampling and analyses conducted on this tank can be found in Chapter 4.0,
29 Section 4.3.
30

31 **3.2.9.2.4 Tank 108.** Tank 108 currently is empty. Information on sampling and analyses
32 conducted on this tank can be found in Chapter 4.0, Section 4.3.
33

34 **3.2.9.3 High-Level Vault Sample Room (Room 145)**

35
36 Inside the sample room is a containment box that has vacuum sampling lines to the LLV
37 tanks and HLV tanks. The room was last used in 1990 to sample all of the tanks. Vacuum
38 sampling is not the preferred option for the HLV tanks because operations personnel are
39 exposed to a significant radiation dose during sampling activities. Operational procedures
40 governing HLV and LLV tank sampling require that spills be cleaned up immediately upon
41 discovery before proceeding with the sampling procedure. There is no documentation or
42 evidence of leaks from either the HLV or LLV sampling system.
43

1 **3.2.9.4 324 Building Piping System**

2
3 Piping connected to the vault tanks serves a variety of functions, including process liquid
4 transfer, chemical addition, waste transfer, instrumentation access, tank venting and sparging,
5 cooling water supply and return, and sampling. Information on the processes associated with
6 the piping is given as part of the waste activity discussion for the REC (Section 3.1) and the
7 HLV and LLV (Section 3.2).
8

9 **3.3 Waste Removal Activities**

10
11 Before demonstration of closure of the 324 Building closure unit, some areas within the
12 closure boundary require waste removal actions.
13

14 **3.3.1 A-Cell**

15
16 No closure activities are planned or required for A-Cell. However, as part of the building
17 deactivation project, the FRG glass log storage rack and the electropolisher storage rack and
18 related equipment will be removed and disposed as LLW.
19

20 **3.3.2 B-Cell**

21
22 B-Cell has had considerable equipment installed in the cell to support a variety of
23 processing applications. Since 1988, a number of these items have been removed (Table 3.3).
24 In 1995, RL and Ecology agreed to the M-89 milestones for mixed waste and process equipment
25 removal (Milestone M-89-02, Ecology, et. al., 1996).
26

27 The remaining equipment at that time consisted primarily of fuel storage equipment and
28 three large equipment racks. The three large equipment racks (1A, 1B, and 2A) were used to
29 support three in-cell process service tanks (Tank 112, Tank 114, and Tank 118), an evaporator
30 tank (Tank 113), an acid fractionator tank (Tank 115), and associated ancillary equipment and
31 piping. This equipment is shown in Figure 3-9. The in-cell process services tanks were sized to
32 contain feed or condensate batches of about 1,000 liters each. The reverse-dish bottom provides
33 the capability for near-emptying of the tanks by the numerous dip tubes located around the
34 periphery of the tank. All tanks have one 25.4-centimeter removable flange at the center of the
35 top head for insertion of an agitator or submerged pump. All tanks have a coil and/or jacket to
36 supply up to 73.25 kilowatt/hour heating or cooling by either heat transfer area. Internal baffles
37 are integral with the coils, thermal expansion provisions for the jackets were designed to 'wrap
38 around' the lower head of the tank. Design pressures for the coils and jackets are 690 and 100
39 KPa, respectively.
40

1 All tanks are provided with ring-shaped air spargers; air purged dip tubes for measuring
2 liquid level, specific gravity, and pressure; temperature elements in sealed walls; in-cell liquid
3 samples; chemical addition pipes; piping for process transfers in and out of the tanks, and spare
4 pipes to the manipulator-operator window areas of the cell. Additional details on tank
5 construction are provided in the following paragraphs.
6

7 The 1A Rack (evaporation and acid recovery rack) is located along the east wall of the
8 B-Cell. The 1A Rack contains an evaporator tank, Tank 113, a fractionator tank, Tank 115, and
9 various associated piping, jumpers, condensers, towers, and support equipment. The overall
10 dimensions of the rack support structure are 2.4 meters x 1.2 meters x 6.4 meters. There are
11 four rack plugs associated with the 1A Rack, two upper airlock plugs (which are lead-shielded)
12 and two lower pipe trench plugs. These plugs penetrate the east wall of the cell into the airlock
13 and pipe trench, and provide piping services to the rack.
14

15 The thermosyphon-type waste evaporator (Tank 113) is constructed of all-welded A-55
16 titanium construction and the assembled system is 5.2 meters tall. Special features include a
17 removable tube bundle, TB-113 in the reboiler, a deentraining sieve plate with bypass
18 provisions in the tower, and an integral reflux condenser. The bottom reboiler section measures
19 36-centimeters diameter by 1.5-meters high. The midsection measures 1.2-meters diameter by
20 1.8-meters high. The tower section, with a removable glass fiber mist eliminator, measures
21 36-centimeters diameter by 2-meters high.
22

23 The all-titanium acid fractionator (Tank 115) consists of a packed tower distillation
24 column surmounting a relatively standard reboil tank. The top and bottom spheroid heads are
25 partially reinforced with an extra thickness of titanium plate for added strength, similar to those
26 in the evaporator. The combined height of tank and tower is 6.4 meters, with the tower section
27 measuring 0.43-meters diameter by 4.9-meters high and the tank measuring 1.2-meters diameter
28 by 1.5-meters high.
29

30 The waste evaporator condenser (E-113) is made from titanium and nominally measures
31 0.3-meter diameter by 2.4-meters long, whereas, the fractionator condenser (E-115) is made
32 from stainless steel because of the less severe corrosion conditions. The waste evaporator
33 condenser has a condensing capacity of 530 liters/hour and the fractionator has a condensing
34 capacity of 450 liters/hour.
35

36 The 1B Rack often is referred to as the feed system rack, as this houses two feed tanks
37 and a reflux condenser. Similar to the 1A and 2A Racks, the 1B Rack is also on the east wall of
38 B-Cell and has service piping that terminates in the airlock pipe trench. It is supported on the
39 east wall by four wall plugs, nominally 30.5-centimeters diameter by 152-centimeters long. The
40 upper wall plugs contain shielding lead and will be cut from the rack and disposed as mixed
41 waste.
42

43 Each feed tank, tanks 112 and 114, has a capacity of 1,000 liters and is 1.1-meter in
44 diameter and 1.5-meters tall. The tanks are fabricated from 304-L stainless steel and have a wall
45 thickness of 0.95 centimeters. Tank 112 has a small horizontally mounted reflux condenser

1 (E-112). Both tanks have stored highly radioactive solutions and are expected to be
2 radiologically contaminated.

3
4 The 1B Rack is fabricated from 16.8-centimeters outer diameter by 0.34-centimeters
5 (Schedule 10) stainless steel pipe and measures 0.9-meter x 1.8-meters x 5.2-meters. The
6 calculated weight of the rack and components, assuming all components are empty, is about
7 3,946 kilograms.

8
9 The 2A Rack was installed as part of WSEP and contains the final off gas treatment
10 equipment for the B-Cell processing system: a caustic scrubber, two off gas preheaters, and a
11 fractionator condensate tank. Rack plugs hold the rack to the cell wall and serve as process
12 pipeways. The 2A Rack is a 2.7-meters x 1.2-meters x 5.5-meters framework made of welded
13 16.8-centimeters outer diameter x 0.3-centimeter (Schedule 10) stainless steel piping and is
14 attached to the cell wall by four wall plugs, which are nominally 1.8 meters long and
15 30.5 centimeters in diameter. About 35 nonradioactive services extend through each of the two
16 upper plugs, and piping for up to 10 radioactive process streams runs through each of the two
17 lower plugs. The upper plug piping terminates in the airlock, and the lower plug piping
18 terminates in the pipe trench and is accessible from the airlock. The lower plugs do not contain
19 lead shielding material.

20
21 The scrubber tank, Tank 118, has a 1,000-liter capacity and is 1.5 meters high by
22 1.1 meters in diameter. The 3.4-meters by 0.4-meter diameter tower (T-118) is packed with
23 2.5-centimeters Raschig rings and has a nominal capacity of 5,500 liters. The tower was
24 designed to remove acids, radoruthenium, radioiodine, and aerosols from process off gasses.
25 The recirculation pumping rate was controlled by a valve in a remotely removable pump-piping
26 jumper and was measured by the liquid level above a weir at the pump discharge point near the
27 top of the tower. An auxiliary reflux coil also was provided at the top of the tower. The
28 1,000-liter fractionator condensate tank (Tank 116) has the same dimensions as the scrubber
29 tank. Both of these tanks must be size reduced to fit the disposal containers. The two stainless
30 steel steam-heated exchangers mounted in the 2A Rack were used to heat the process gases to
31 protect the subsequent absolute filters. Heater E-116 is in the primary process ventilation
32 system and the other heater (E-118) is in the process vessel ventilation system. The steam was
33 fed to E-116 heater and routed to the E-118 heater.

34
35 The BCCP was initiated in 1988 to address the radiological safety concerns from past
36 R&D operations. The mission of the BCCP originally was to minimize radiological hazards
37 associated with dispersible radioactive material within B-Cell. Subsequently, the BCCP has
38 been modified to incorporate handling, packaging, and removal of dangerous waste stored
39 within B-Cell.

1 **3.3.3 C-Cell**

2
3 C-Cell has been used to temporarily store (less than 90 days) mixed waste. C-Cell did not
4 treat or store dangerous waste, except as a less-than-90-day storage area. Upon completion of
5 waste treatability studies (currently planned to be completed by end of fiscal year 1999), the test
6 equipment will be disassembled and removed.
7

8 **3.3.4 D-Cell**

9
10 Removal actions include removal of the waste mineral oil and absorbent stored in
11 D-Cell (completed in January 1996) and the removal of the process equipment used for the
12 processing of the HLV tanks liquid waste. This equipment currently is planned to be used for
13 decontamination liquid waste processing during the closure of B-Cell and the deactivation of the
14 324 Building radiological areas.
15

16 **3.3.5 Airlock**

17
18 No waste removal activities are required for closure.
19

20 **3.3.6 Pipe Trench**

21
22 Piping that connects HLV tanks to equipment racks in B-Cell must be removed to
23 facilitate removal of the equipment racks from B-Cell. The piping has been rinsed and flushed
24 as part of the HLV tank waste removal project. Additionally, determination of the waste
25 designation for sludge present in the pipe trench cannot be completed until samples of the
26 sludge are obtained. If the sludge designates as mixed waste, closure activities will include
27 collection of the sludge for storage or disposal at an appropriate TSD unit.
28

29 **3.3.7 Other 324 Building Areas**

30
31 Because EDL-146, cask handling area, trucklock, and galleries were not used to treat or
32 store dangerous waste, except as a less-than-90-day storage area and satellite accumulation area,
33 waste removal activities will not be performed. Current planning includes removal and/or
34 isolation of the piping between these areas and the vault tanks
35

1 **3.3.8 Other Components**

2
3 Other areas of concern to the closure are the pass-through ports and the cubicles. These
4 components were not used to treat or store dangerous waste, so no waste removal activities will
5 be performed on these areas.
6

7 **3.3.9 High-Level Vault Waste Removal Activities**

8
9 To comply with Tri-Party Agreement Milestone M-89-01, liquid waste stored in the HLV
10 tanks was removed and the HLV tanks were rinsed and flushed in September 1996. Additional
11 closure activities are in Chapter 7.0, Section 7.2. Briefly, the waste in the HLV tanks was
12 transferred to Tank 104 in the HLV. From Tank 104, the waste was steam jetted to Tank 112 in
13 B-Cell, and vacuum transferred to the waste treatment system in D-Cell. The solutions were
14 chemically adjusted to precipitate the heavy metals present; the precipitates were collected on
15 enclosed filters. The supernate from the filtration process was again chemically treated by
16 addition of calcium carbonate; this precipitated the strontium-90 present in the supernate. The
17 precipitate was collected for use in the medical isotope program (RL 1997). The supernate from
18 this process was passed through an ion exchange column to collect the cesium-137. The
19 remaining low-level liquid was transferred to the 340 Building for subsequent transfer to the
20 DST System.
21

22 The HLV tanks were triple rinsed; the rinse solutions were jetted through each tank and
23 transferred to D-Cell for treatment. The first two rinses were dilute nitric acid, the third was a
24 dilute carbonate rinse. Information on sampling and analyses conducted on the HLV tank
25 contents can be found in Chapter 4.0.
26

27 **3.3.10 Low-Level Vault Waste Removal Activities**

28
29 All of the LLV tanks currently are empty.
30

31 **3.3.11 Piping Removal Activities**

32
33 That portion of the piping that connects the HLV tanks to equipment racks in B-Cell and
34 that runs through the pipe trench must be removed to proceed with equipment rack removal
35 activities in B-Cell. Piping in B-Cell equipment racks also will be removed during demolition
36 of the equipment racks. The piping will be rinsed and appropriately disposed. Details on
37 closure activities for all other piping within the closure area can be found in Chapter 7.0.

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Table 3-1. Chronology of B-Cell Activities.

Activity	Dates
Waste Solidification Engineering Prototype Program (WSEP)	1966-1972
No Activity*	1972-1976
Nuclear Waste Vitrification Project (NWVP)	1976-1979
No Activity*	1979-1981
Zeolite Vitrification Demonstration Project (ZVP)	1981
Pilot-scale Radioactive Liquid-Fed Ceramic Melter (RLFCM) testing task (includes cell prep and installation of RLFCM equipment)	1982-1986
Federal Republic of Germany (FRG) Program (production of isotopic heat sources)	1986-1987
No Activity*	1987-1988
B-Cell Cleanout	1988-present.

*Periods listed as 'no activity' indicate that no project or R&D activities were occurring in the cell during that time.

Table 3-2. Summary of Major B-Cell Equipment Items.

FY	Rack	Major equipment in rack	Cleanout status ¹	Total m ³	Approximate dimensions in m (ft)	Construction materials	Equipment use
1990		Disassembly table	R	8.15	2.4 x 0.9 x 3.7 8 x 3' x 12'	SS	Support and placement of fuel assemblies for shearing operations
		Dissolver (Tank 127)	R	.22	3.0 x 0.3 OD 10' x 1' OD	SS	Dissolution of chopped PWR spent fuel
		Auxiliary dissolver reservoir	R	.22	3.0 x 0.3 OD 10' x 1' OD	SS	Reservoir for dissolver solution
		Condenser	R	.22	3.0 x 0.3 OD 10' x 1' OD	SS	Off gas treatment
		Containment vessel	R	3.50	3.0 x 1.2 OD 10' x 4' OD	SS	Liquid solution secondary containment
1990	7C	--	R	1.3	1.2 x 0.3 x 3.7 4' x 1' x 12'	SS	Equipment service rack
1991	4C	--	R	2.0	2.1 x 0.3 x 0.3 7' x 1' x 10'	SS	Equipment service rack
1991		Acid holding tank (Tank 125)	R	.35	1.2 x 0.6 4' x 2' OD	SS	PWR hull acid soak tank
		Solution storage (Tank 126)	R	.35	1.2 x 0.6 4' x 2' OD	SS	Dissolver solution storage (up to 300 g/L U)
1991		Hull rinse tanks (tanks 128 and 129)	R	.17	2.4 x 0.3 8' x 1' OD (each)	SS	Washing of PWR hulls after shearing
1992	5A	Induction-heated furnace	R	11.3	3.0 x 1.2 x 3.0 10' x 4' x 10'	SS	NWVP in-can induction furnace
1992	3C	--	R	2	2.1 x 0.3 x 3.0 7' x 1' x 10'	SS	Support structure
		Packed scrubber (Tank 111)	R	.19	2.7 x 0.3 9' x 1' OD	SS	Off gas treatment
		Condenser (E-119)	R	.19	1.8 x 0.3 6' x 1' OD	SS	Off gas treatment

1

1993	3A	--	R	13.4	2.4 x 1.1 x 5.2 8' x 3-1/2' x 17'	SS	Support structure
		Venturi scrubber	R	.02	1.2 x 0.030 OD 4' x 1' OD	Inconel	Primary RLFCM off gas treatment
		Scrub solution storage tank (Tank 134)	R	2.5	0.9 x 1.5 x 1.8 3' x 5' x 6'	Inconel Hastelloy	Venturi scrub solution recirculation tank
1993	3B	--	R	10.8	2.4 x 0.9 x 4.9 8' x 3' x 16'	SS	Support structure
		Waste feed tanks (tanks 130 and 131)	R	3.2	2.4 x 0.9 8' x 3' OD (each)	SS	Preparation and storage of RLFCM feeds (cesium and strontium solutions to 3.7×10^{13} Bg/L)
		Hydraulic pulser (A-130)	R	.33	2.4 x 0.5 8' x 1-1/2' OD	SS	Feed tank agitation
		Seal pot (Tank 135)	R	.08	1.2 x 0.3 4' x 1' OD	Inconel Hastelloy	RLFCM pressure relief
1994	4A	--	R	8.1	2.4 x 1.2 x 2.7 8' x 4' x 9'	SS	Support structure
		Canister storage (Tank 120)	R	.76	2.4 x 1.2 x 2.7 8' x 4' x 9'	SS	Storage of waste canisters currently unacceptable for burial
1994	6A	RLFCM containment vessel	R	4.7	2.1 x 1.8 x 1.2 7' x 6' x 4'	SS, Inconel, various types of ceramic insulating bricks	Liquid-fed ceramic, melter tank (cesium and strontium glass up to 55.5 Bg/g)
		Turntable	R	7.2	2.7 x 1.8 9' x 6' OD	SS	RLFCM canister containment and positioning
		Glass-level detection system source positioner	R	.47	3.7 x 0.3 12' x 1' OD	SS	Measurement of glass level in RLFCM canisters

1

		Miscellaneous					
Sep/Oct 1996	7B	Fuel storage rack	R	9.9	2.1 x 1.5 x 3.0 7' x 5' x 10'	SS	Spent fuel storage
		Weld/rinse station	R	.54 2.0	3.4 x 0.5 11' x 1-1/2' OD 2.4 x 0.9 x 0.9 8' x 3' x 3' (support stand)	SS	Preliminary decontamination of RLFCM/FRG canisters and weld closure
		FRG canister storage pods	R	6.0 .64	0.9 x 0.9 x 1.2 3' x 3' x 4' (6) 1.2 x 0.3 4' x 1' OD (8)	SS	Temporary storage for FRG canisters
		FRG instrumented canister furnace	R	.35	1.2 x 0.6 4' x 2' OD	SS	Annealing furnace for FRG glass cracking tests
		Failed pumps/agitators	R	2.1	2.4 x 0.6 8' x 2' OD (3)	SS	Various process vessels
		Miscellaneous equipment	PR		Varies	SS primarily	Various equipment dropped to floor over 20-year period
1998	1B	--		14	2.4 x 1.2 x 4.9	SS	Support structure
		Storage tanks (tanks 112 and 114)		2.6	1.5 x 1.1 OD each	SS	Storage of cerium, cesium, strontium, and dissolver waste solutions 1 (up to 3.7×10^{13} Bg/L)
1998		Containment vessel (Tank 119)		4.2	3.7 x 1.2 12' x 4' OD	SS	Secondary liquid containment for tanks 125 and 126)
1998	2A	--		18	2.7 x 1.2 x 5.5	SS	Support structure
		Condensate collection (Tank 116)		1.3	1.5 x 1.1 5' x 3-1/2' OD	SS	Final off gas condensate collection (low-level liquid waste)
		Heater (E-116)		0.08	1.2 x 0.3 4' x 1' OD	SS	Off gas heater for filter protection
		Filter assemblies (F-111, F-112, F-113)		.67	0.3 x 0.6 x 1.2 1' x 2' x 4' (each)	SS	HEPA filter enclosure assemblies
		Final scrubber (Tank 118) and Tower (T-118)		1.3 2.6	3.7 x 0.3 OD (T- 118) 5' x 3-1/2' OD (TK-118)	SS	Final off gas treatment (low-level liquid waste)

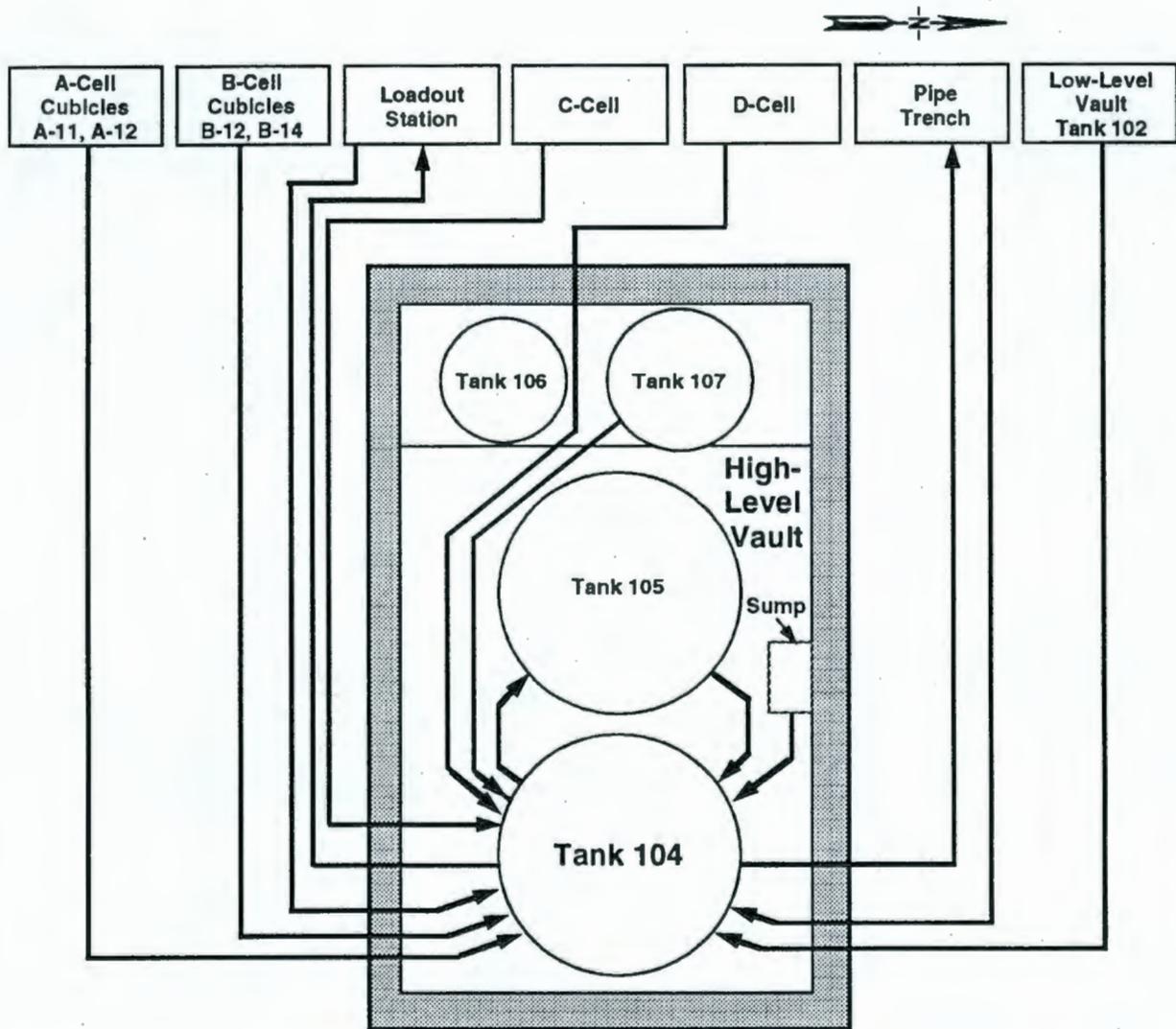
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1999	1A	--		19	2.4 x 1.2 x 6.4	Stainless steel (SS)	Support structure
		Evaporator (Tank 113)		1.7	3.0 x 1.2 OD	Titanium	Waste concentrator, preparation of cerium, cesium, strontium, and dissolver solution waste (up to 3.7×10^{13} Bg/L)
		Evaporator tower (T-113)		0.15	2.1 x 0.30 OD 2.1 x 0.3 7' x 1' OD (T-113)	Titanium	Tower for evaporator
		Evaporator condenser (E-113)		0.18	2.7 x 0.6 OD	Titanium	Off gas treatment
		Fractionator (Tank 115)		1.7	1.5 x 1.2 OD	Titanium	Acid collection and concentration
		Fractionator and tower (T-115)		0.63	4.9 x 0.3 OD	Titanium	Tower for fractionation
		Fractionator condenser (E-115)		.24	2.4 x 0.6 OD	SS	Off gas treatment

2 SS = stainless steel OD = outside dimension ¹R designates equipment removed PR designates equipment partially removed.

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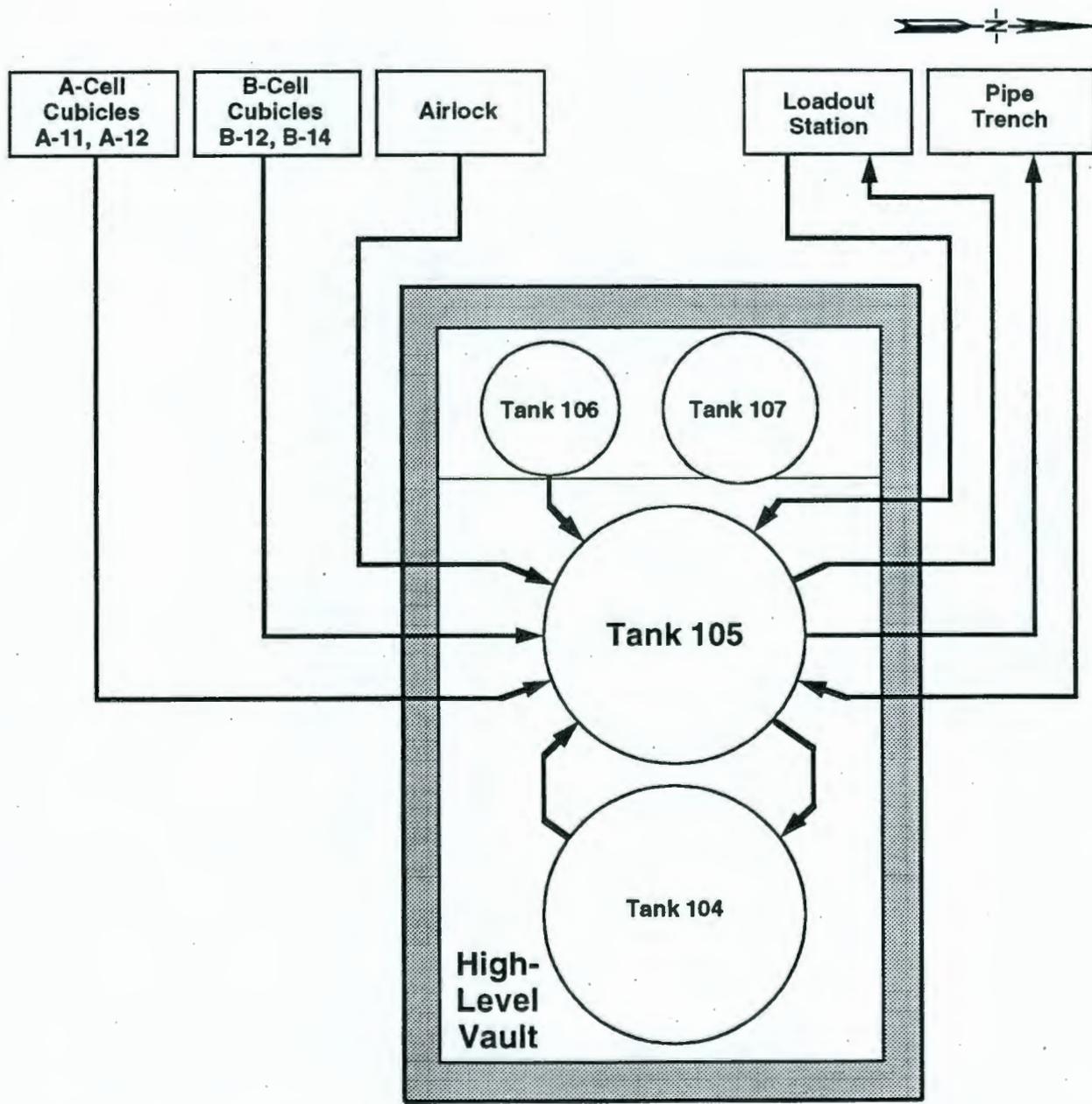


 = Concrete
Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-1. Schematic of the 324 Building High-Level Vault Process Piping for Tank 104.

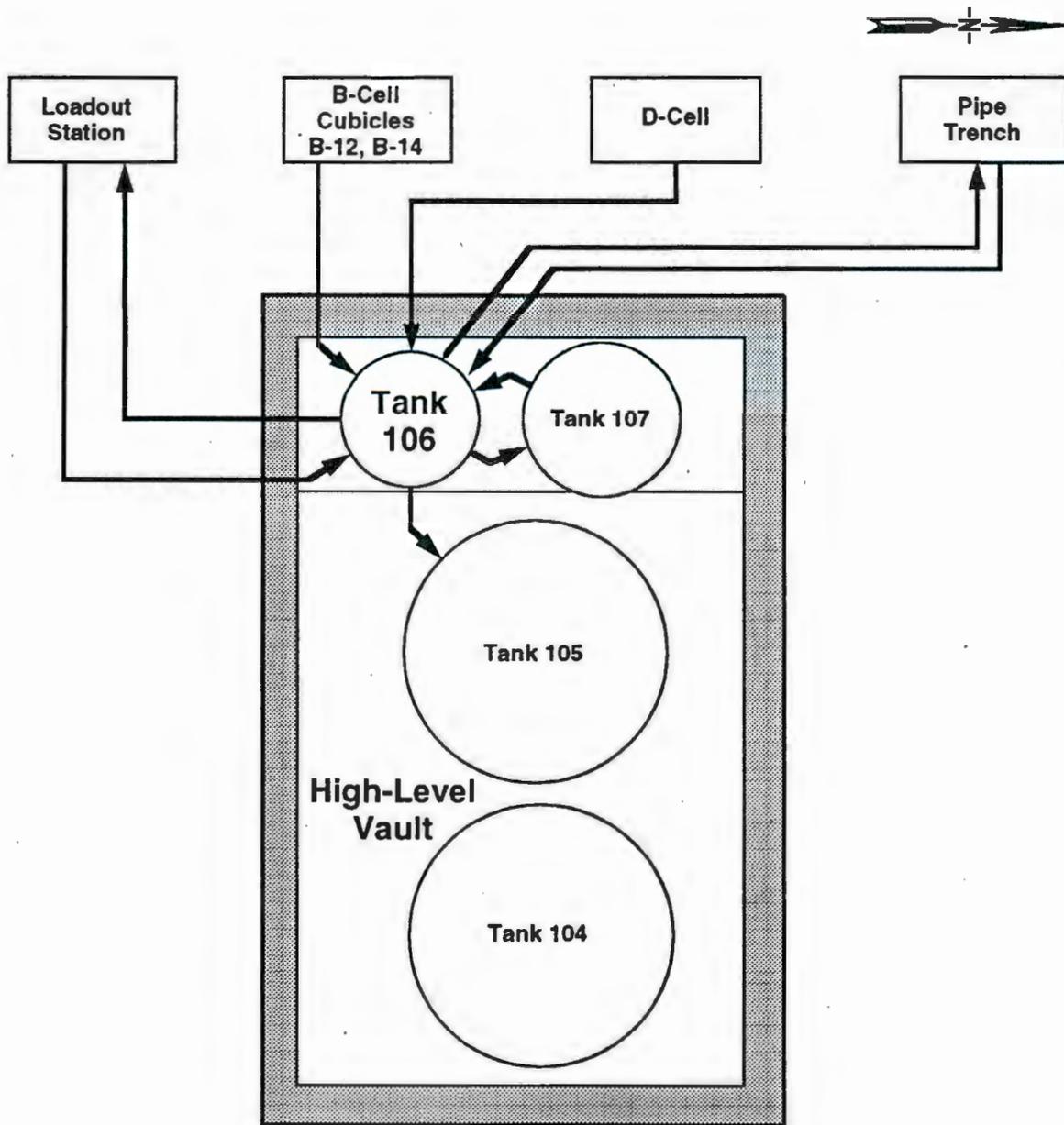


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Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-2. Schematic of the 324 Building High-Level Vault Process Piping for Tank 105.



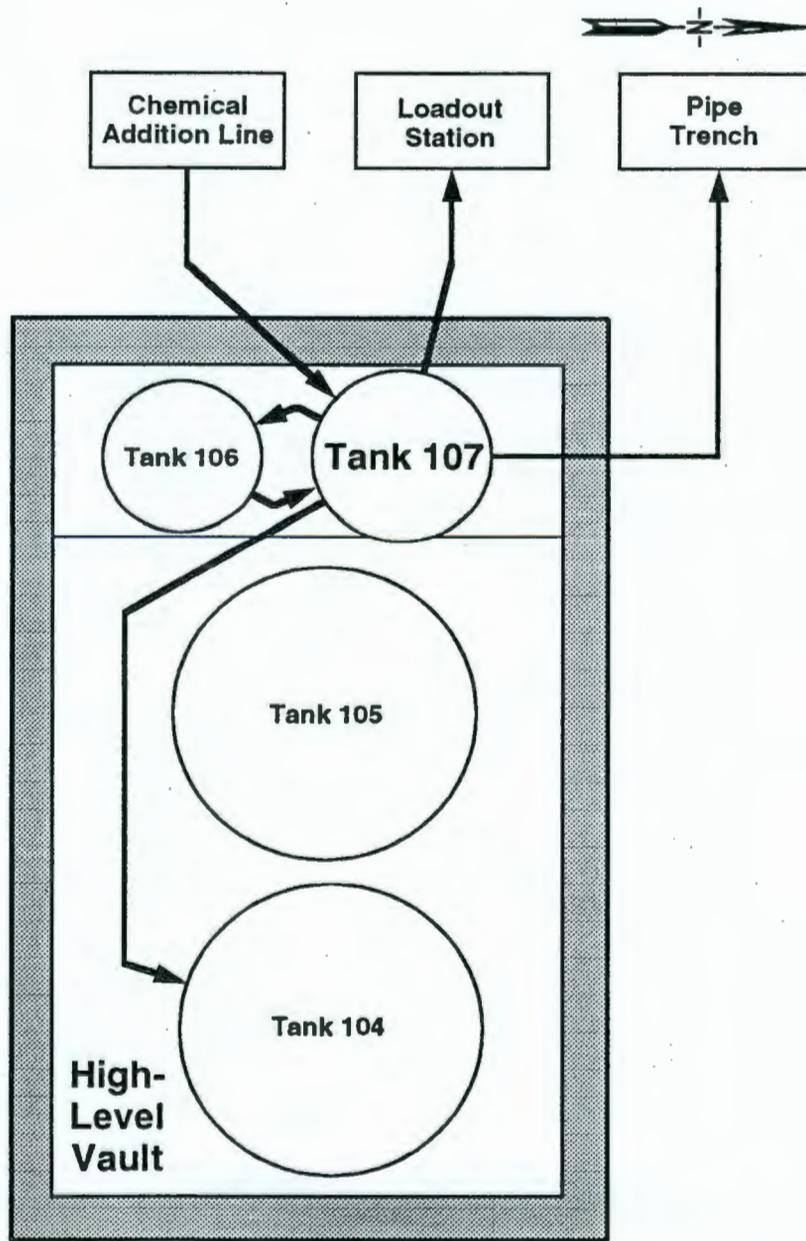
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Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-3. Schematic of the 324 Building High-Level Vault Process Piping for Tank 106.

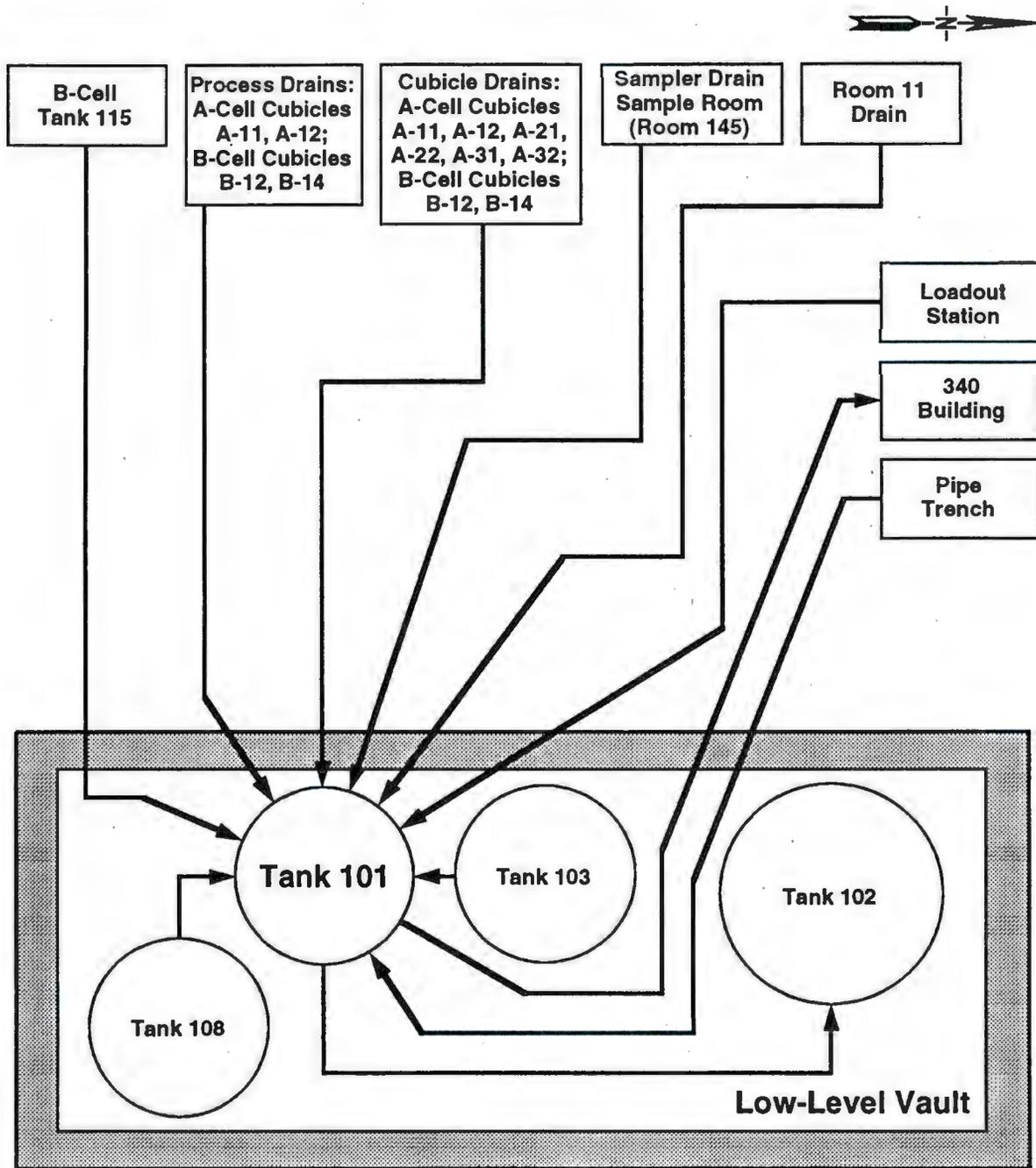


■ = Concrete
Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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Figure 3-4. Schematic of the 324 Building High-Level Vault Process Piping for Tank

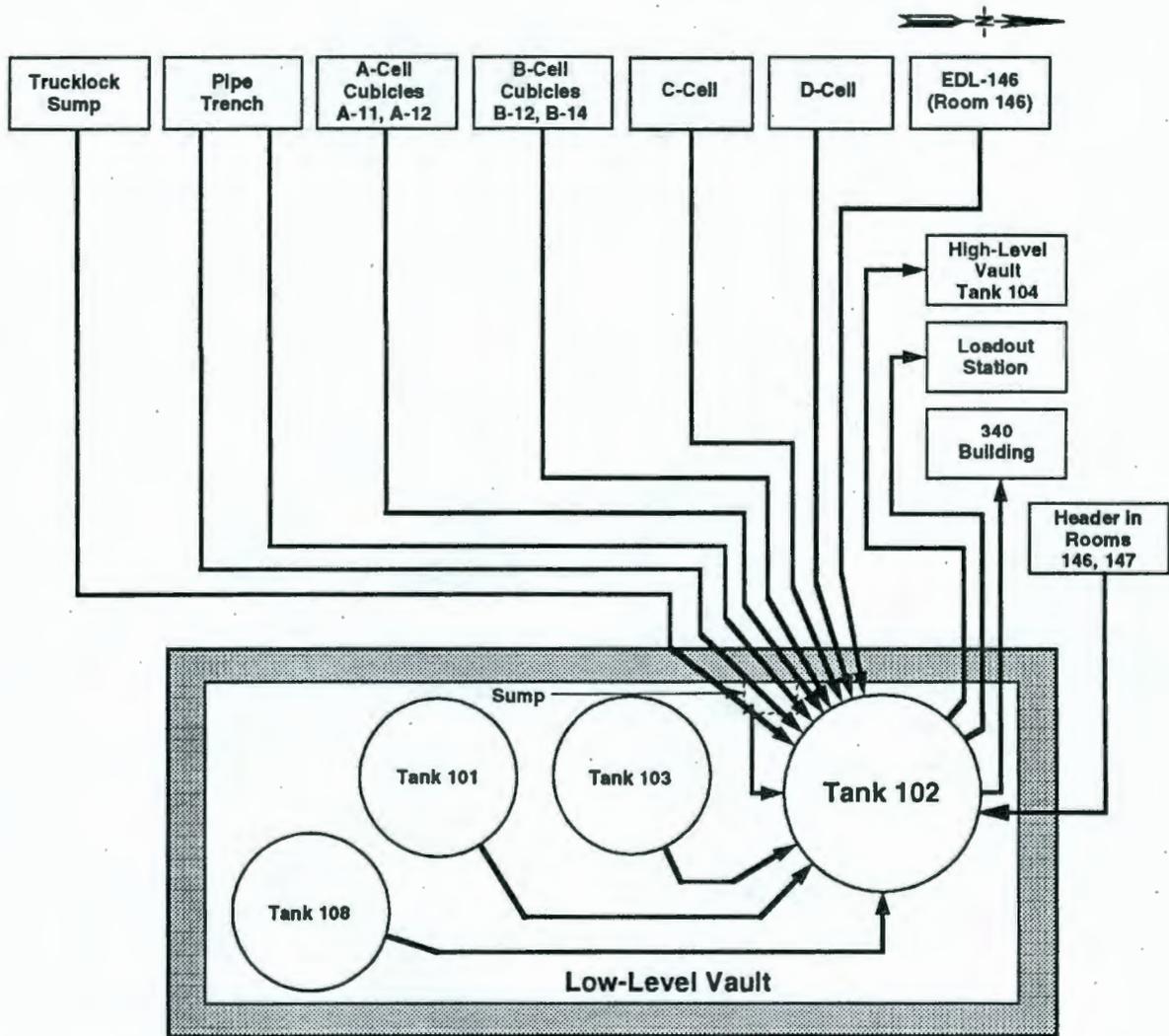


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Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-5. Schematic of the 324 Building Low-Level Vault Process Piping for Tank 101.



EDL = Engineering Development Laboratory

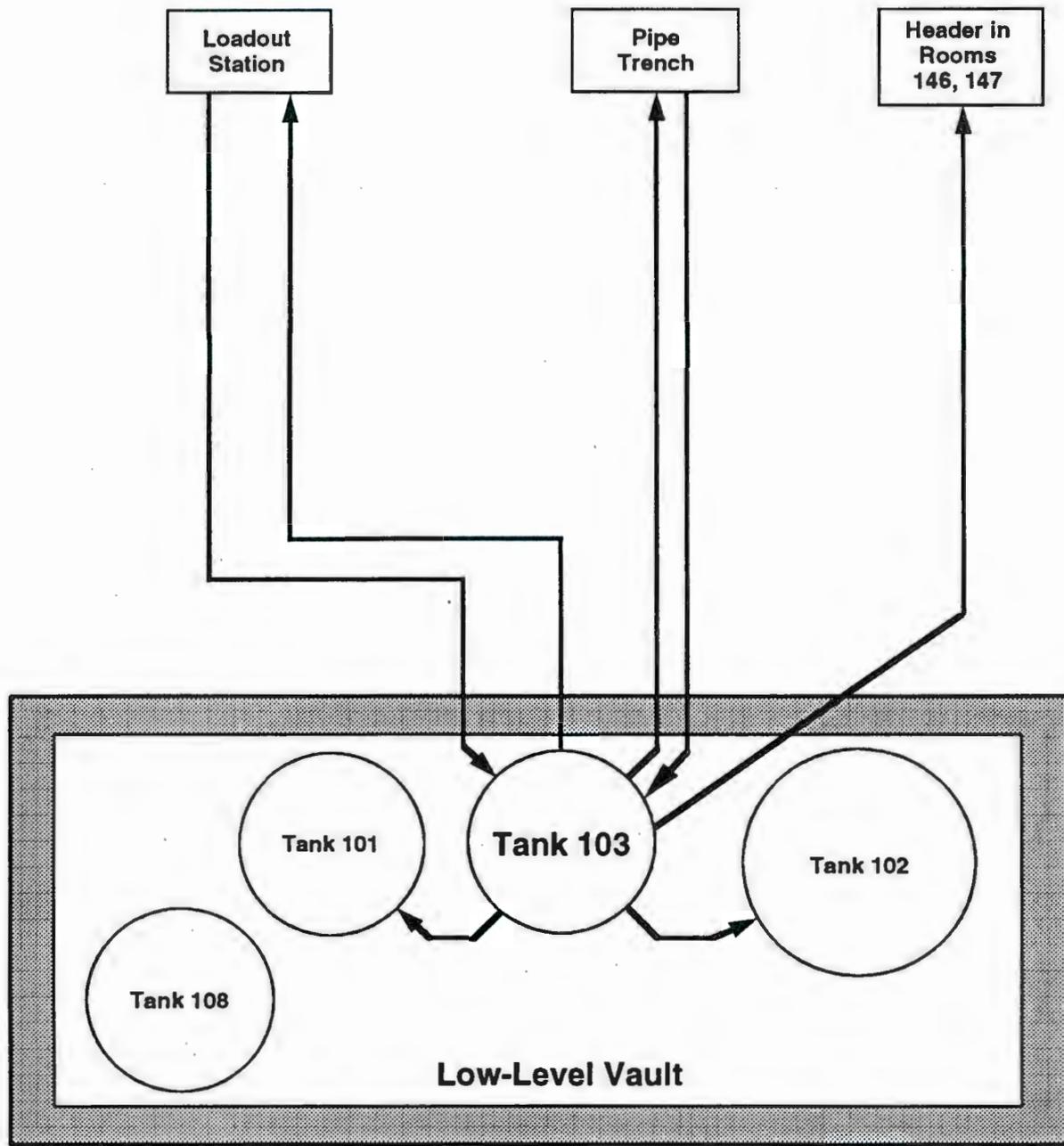
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Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-6. Schematic of the 324 Building Low-Level Vault Process Piping for Tank 102.

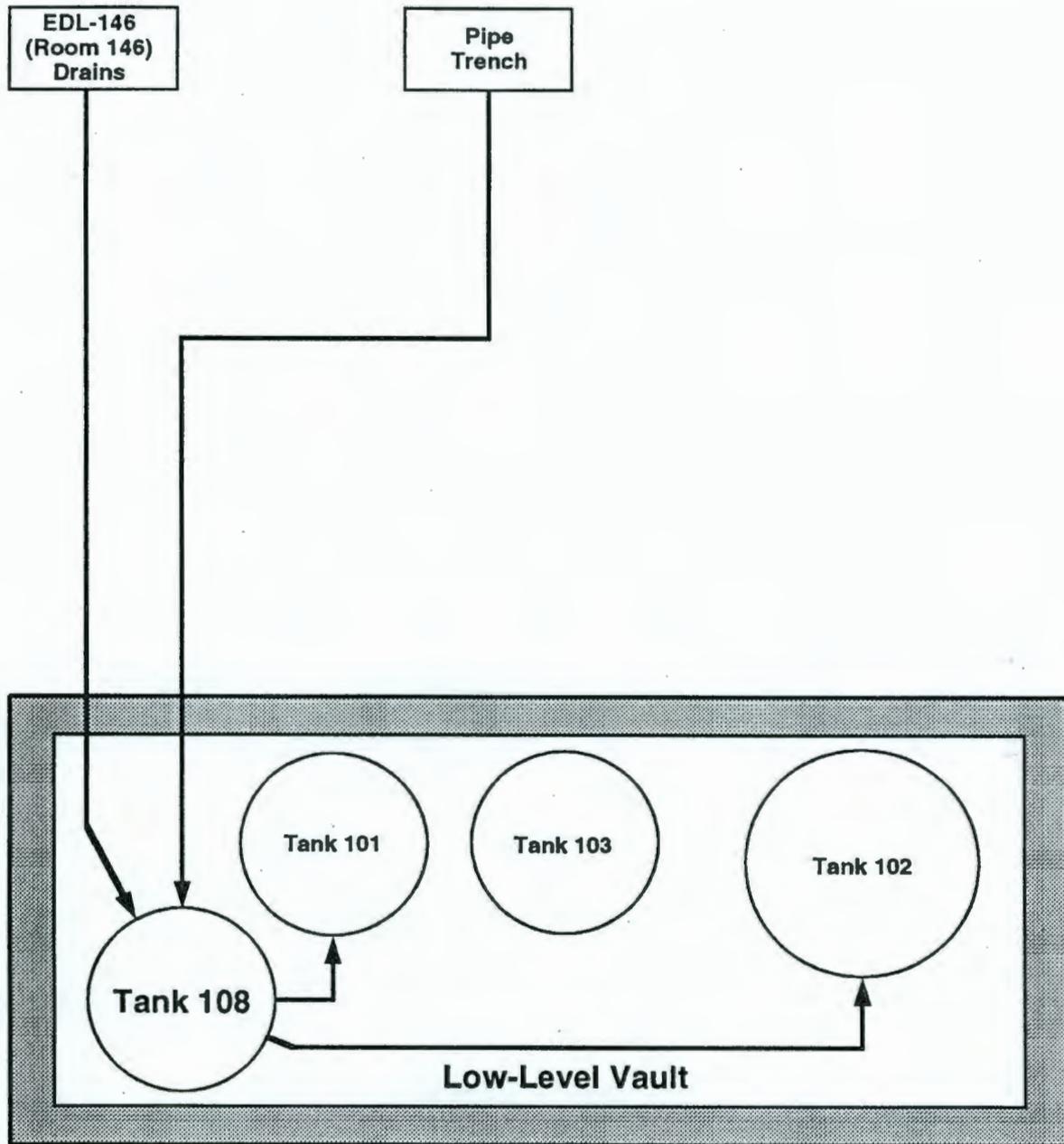


■ = Concrete
Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-7. Schematic of the 324 Building Low-Level Vault Process Piping for Tank 103.



EDL = Engineering Development Laboratory.

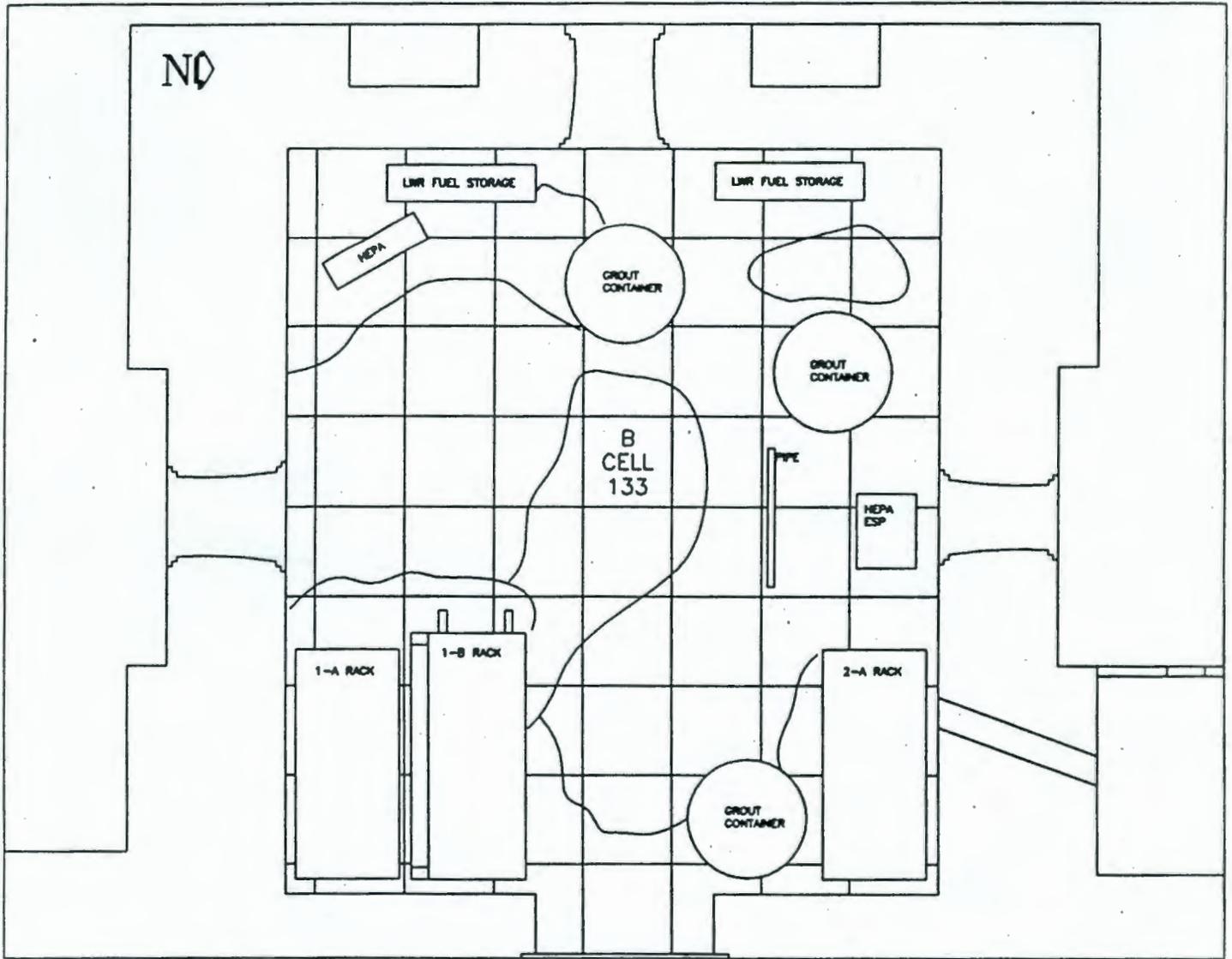
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Not to Scale

Note: Instrument lines, sample lines, compressed air lines, and vessel ventilation lines have been omitted for clarity.

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1 Figure 3-8. Schematic of the 324 Building Low-Level Vault Process Piping for Tank 108.



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Figure 3-9. B-Cell Racks

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4.0 WASTE CHARACTERISTICS

This chapter describes the quantities and characteristics of the waste stored in the REC, HLV, and LLV. The description of the waste characteristics is based on an evaluation of process records, process knowledge, and available waste analyses data. The quantities of waste are the estimated volumes that existed before inventory removal. The information is summarized in Tables 4-1 and 4-2.

The process used to gather the information included discussions with knowledgeable building personnel and research of historical documentation (e.g., process records). Wherever gaps in information were identified, knowledgeable personnel were asked to provide any historical information, documentation, or information that would provide insight to chemicals or feedstocks used during past operations.

Chemical analysis of the material was not always amenable to the use of specific SW-846 (WAC-173-303-110) methods because of as low as reasonably achievable (ALARA) concerns with respect to radiation exposure. Because of the safety constraints and the limitations of technology available for remote sampling and analysis, a comprehensive analytical waste characterization was not conducted.

4.1 B-Cell Processes Feedstock Compositions

The waste material in the REC and the HLV and LLV tanks came primarily from the processes performed in B-Cell. This section summarizes the information available on the feedstocks used in those processes. For some processes, searches for historical documentation provided little specific information.

4.1.1 Waste Solidification Engineering Prototypes Program

The WSEP Program (Chapter 3.0, Section 3.1.2.1) was active from 1966 through 1972. The program was used to demonstrate three methods of solidifying radioactive high-level waste (HLW). These methods were pot solidification, spray solidification, and phosphate glass formation. A description of these processes is provided in Chapter 3.0. The feed material compositions used in the WSEP program represented high-level waste from aqueous reprocessing plants.

The WSEP studies involved formulating study glasses; about 1,500 melts using different ratios of added inert chemicals, different waste-to-frit ratios, and different radioisotopic loadings. Table 4-3 lists several typical feedstock compositions tested. The information presented is compiled from quarterly progress reports for the Atomic Energy Commission Research and Development, 1965-1967 (e.g., BNWL-1186). All of the feed formulated during this program was mixed with silica frit to form the glass (EPRI-NP-44-SR).

1 4.1.2 Nuclear Waste Vitrification Project

2
3 The NWVP process vitrified liquid high-level waste produced during demonstration of
4 separation of fissile materials from commercial spent nuclear fuel. Initially, the plutonium and
5 uranium were extracted at the 325 Building. The remaining liquid HLW solution was returned to
6 324 Building and vitrified in B-Cell. Two glass-producing runs were made. The liquid HLW
7 was used to formulate a feed stock using the PW-8a composition (Table 4-3). The liquid HLW
8 was dried at high temperatures to form a granular powder (calcine). The frit-to-calcine ratio used
9 in the program was 4.2:1 and 2.2:1, respectively, for the two glass-making runs performed
10 (EPRI-NP-44-SR and PNL-3038).

11
12 Some liquid HLW solution not used in production of glass was retained in HLV Tank
13 107 for future use. The material in Tank 107 was included in the solutions treated during the
14 HLV Interim Waste Removal Action Project (Chapter 3.0, Section 3.3.9).

16 4.1.3 Zeolite Vitrification Demonstration Project

17
18 The ZVDP was used to demonstrate that zeolite ion exchange resins could be vitrified to
19 immobilize radionuclides present in the resin. The zeolite used in this vitrification process was
20 Linde Ionsiv IE-95®, which consists of a matrix of polystyrene with a nuclear sulfonic acid
21 active group. Approximately 0.45-square-meters of zeolite containing radioactive cesium and
22 strontium was used for the demonstration. The feed formulation used to produce the glass
23 canisters was 5% B₂O₃, 5% Li₂O, 8% Na₂O, 7% TiO₂, and 75% zeolite (PNL 1981).

25 4.1.4 Radioactive Liquid-Fed Ceramic Melter Testing

26
27 The RLFCM program used feed slurries containing all glass formers and waste in a single
28 nitric acid solution that was fed to the melter. Feed stocks for the slurries were separated into
29 two separate categories: (1) cold (nonradioactive) feed stocks and (2) radioactive feed stocks.
30 Cold feedstocks were used to test the operation of the melter system. The cold feedstocks were
31 identical to radioactive feedstocks except that nonradioactive metals were substituted for the
32 radioisotopes. Table 4-4 lists the composition of radioactive and nonradioactive feedstocks.

33
34 Feedstock solutions used during the production of sealed isotopic heat sources for the
35 FRG Program were kept separated in HLV Tanks-104 and -105. Tank 104 was used to hold high
36 cesium-137 concentration feedstocks, and Tank 105 held high strontium-90 feedstocks. Table
37 4-5 lists the chemical composition of these two waste types used during the FRG Program.

39 4.2 Radiochemical Engineering Cells Waste Inventory And Characteristics

40
41 Mixed-waste generation and storage occurred in B-Cell and D-Cell. B-Cell waste was
42 generated as a result of performing pilot-scale waste treatability studies. D-Cell was used to

1 temporarily store and treat mixed waste. Waste generated in B-Cell is primarily found enclosed
2 in process equipment and as a component of dispersible material present on the floor due to
3 unplanned releases of process solutions into the cell. One container of mixed waste was
4 generated by collecting mineral oil absorbed on diatomaceous earth when a shielded window in
5 B-Cell failed. The container was transferred to D-Cell for temporary storage to decrease the
6 amount of flammable combustibles in B-Cell. That container was removed and transported as
7 SCW to the PUREX Storage Tunnels in January 1996. D-Cell also was used to house the HLV
8 Interim Waste Removal Action equipment that was used to treat waste from the HLV. This
9 equipment continues to be stored in the D-Cell.

10
11 The dangerous waste components of mixed waste in B-Cell were introduced primarily
12 during testing of vitrification technologies as described in Chapter 3.0. Chemical solutions used
13 for in-cell processes were nitric acid based, resulting in solutions with pH readings less than 1.
14 Radioactive solutions high in strontium-90 and cesium-137 transported to the building from the
15 B-Plant complex in 1985 contained trace amounts of heavy metals such as chromium and lead.
16 Additionally, elemental lead was used in B-Cell both for radiation shielding and as
17 counterbalance weights on equipment. Subsequent size reduction by cutting of equipment
18 containing this shielding or counterbalance material generated small particles of elemental lead
19 that eventually mixed with dispersible materials on the cell floor.

20
21 From a review of analytical data and process and operating records, and a comparison with
22 the designation criteria of WAC 173-303, the following waste streams in the REC have been
23 designated as mixed waste:

- 24
- 25 ● Dispersible material and debris contaminated with spilled feed material
- 26 ● Elemental lead
- 27 ● Dried melter feed heels
- 28 ● Liquid metal seal
- 29 ● Window oil and oil absorption material
- 30 ● Filters containing heavy metals.
- 31

32 These classifications are described further in the following sections. Table 4-1 provides a list of
33 the dangerous waste in B-Cell and D-Cell, the dangerous waste numbers, and an estimate of
34 maximum inventory.

35 36 **4.2.1 Dispersible Material and Debris**

37
38 Dispersible material and debris, located in B-Cell, consists of dirt, dust, process residues,
39 and equipment and tools that collected on the floor during operations. Additionally, the
40 dispersible material includes 'one-time' or sporadically-spilled feed material that contained heavy
41 metals and radionuclides from B-Cell process equipment. The dangerous waste constituents
42 present are cadmium, chromium, and lead.
43

1 In 1986, an estimated 750 liters of a nitric acid solution containing cesium-137,
2 strontium-90, and trace amounts of plutonium and heavy metals (chromium and lead) were
3 accidentally released to the southeastern portion of the floor in B-Cell during RLFCM
4 operations. It is known, however, that a thick layer of fine dirt particles introduced through the
5 ventilation inlets during the life of the building was present on the cell floor. Additionally, some
6 equipment and tools dropped during operations, such as wrenches, air hoses, thermocouple wires,
7 small tools, pieces of manipulator boots, air hoses, water hoses, pieces of pipe, and glass sample
8 vials, also were present in the spill area. It is assumed that some quantity of the spilled liquid
9 was absorbed by the material on the floor, or coated larger items present. It is also assumed that
10 the liquid eventually evaporated, leaving a crusty, dried mud-like material that, if disturbed,
11 breaks into finely dispersible particles ranging in size from macro to very fine (size distribution
12 undetermined) material.
13

14 The location of equipment racks over the spill area has precluded cleanup or sampling of
15 the floor in the location of the spill. Additionally, an equipment rack is positioned over the cell
16 sump. Until the equipment racks in the eastern half of the cell are removed, access to the spill
17 area or the sump area is not possible. It has been estimated, based on the Facility Radioactive
18 Material Log, maintained in the 324 Building, that the dispersible material within B-Cell
19 contains about 1.5 million curies of radioactive materials, primarily cesium and strontium
20 isotopes.
21

22 Material in B-Cell currently is being collected for removal as part of the BCCP
23 (Chapter 3.0, Section 3.2.2). To date, 10 containers of dispersible material have been collected
24 and characterized. These engineered containers (EC) were labeled as EC-14, EC-15, EC-16,
25 EC-17, EC -19, EC-21, EC-22, EC-23, EC-24, and EC-25. After collecting the dispersible
26 material from the floor, the material was run through a sieve to remove the larger debris. The
27 sieved material was loaded into steel containers. Once the material was placed in containers, the
28 containers were moved to a work station in front of a cell window. A sample from each
29 container was obtained by coring. A sample auger of sufficient length to collect sample from the
30 top to the bottom of the container was forced through the material in the container. The sample
31 auger was unloaded into an engineered storage container; approximately five grams of material
32 was removed from this container as a sample for analysis. These samples were collected in 1995
33 and were transported to the PNNL 325 laboratory for analyses. The analytical data is
34 summarized in Table 4-6.
35

36 A pH analysis was performed on samples from all the containers. The pH analysis was
37 performed by leaching 0.5 gram of sample with five grams of water for 15 minutes. Duplicate
38 samples were run for each container. The pH of the leachate solutions ranged from 8.0 to 8.8.
39

40 Approximately five grams of each sample were analyzed using the toxicity characteristics
41 leaching procedure (TCLP) for designation purposes. All samples were extracted using a
42 20 times dilution. The extract from the TCLP was diluted 1.25 fold and analyzed using
43 inductively coupled plasma (ICP) spectroscopy. The analysis included the use of duplicate
44 samples, preparation blanks, and TCLP extract blanks. Table 4-6 provides the analytical results.
45

1 The analyzed quality control samples were within acceptable limits. Sample spike
2 recoveries for all analyses were within acceptable limits except for silver, which was low
3 (ranging from 32 percent to approximately 50 percent). The laboratory control standards also
4 showed low silver recoveries. However, it is noted that for the samples, there is no silver
5 detected above the instrument detection limit, which is 200 times below the regulatory threshold.
6 Also, the small sample size might add additional uncertainty to the values.
7

8 PNNL designated the dispersible material in B-Cell in 1995 based on these analytical
9 results. Process knowledge was used to determine that the dispersible waste was not generated
10 from a discarded chemical product, or a listed waste source. The dispersible material was not an
11 'unused chemical product.' B-Cell had been used to demonstrate engineering scale radioactive
12 processes. These processes did not include the use of any 'listed' materials. The dispersible
13 material was designated based on comparison of the analytical results with toxic characterist
14 regulatory limits (WAC 173-303-90). Based on the analytical results, the dispersible material
15 was designated as a characteristic waste for cadmium (D006), lead (D008), and chromium (D007)
16 and as extremely hazardous waste (WT01). The pH analyses indicated that the dispersible
17 material did not show the characteristic of corrosivity.
18

19 The dispersible material collected through May 1996 was transferred in 1996 to the
20 PUREX Storage Tunnels for long-term storage. As more material is collected and designated as
21 mixed waste, this waste will be transferred to an onsite TSD unit or shipped offsite to a TSD
22 facility.
23

24 **4.2.2 Elemental Lead**

25
26 Approximately 0.7 cubic meter of lead that was used as shielding or counterbalance weight
27 in B-Cell and 0.09 cubic meter of lead shot have been stored in B-Cell. Lead that was poured
28 into the legs of equipment for stability is being removed from B-Cell with the equipment as part
29 of the BCCP. The radioactive contaminated elemental lead that had been collected through May
30 1996, which was remote-handled mixed waste, was transferred in July 1996 to the PUREX
31 Storage Tunnels in 1996 for long-term storage
32

33 PNNL designated the elemental lead in 1994 based on process knowledge. As recorded in
34 a memo to file, the lead was not generated from a discarded chemical product or a listed waste
35 source. It was assumed that the elemental lead would leach during a TCLP in levels in excess of
36 the regulatory levels. This generator knowledge was used to designate the elemental lead waste
37 as characteristic for lead (D008) and as extremely hazardous waste (WT01).
38

39 **4.2.3 Dried Melter Feed Heels**

40
41 Small process feed tanks located in B-Cell were used during the FRG Program melter
42 testing project and other pilot process operations. The feed solution in the tanks dried up, leaving
43 a highly radioactive and potentially mixed waste. This dried material is referred to as dried

1 melter feed. During previous cleanup activities in B-Cell, approximately 0.17 cubic meter of this
2 material was removed from the tanks and placed in 11-liter steel-tube containers. This material
3 was transferred in February 1996 to the PUREX Storage Tunnels in 1996 for long-term storage.
4

5 PNNL designated the dried melter feed heels in 1994 based on process knowledge and
6 analytical results of the original feed material. As recorded in a memo to file, the dried melter
7 feed heels did not meet the criteria for listed waste. The analytical data available for the original
8 feed material used for designation indicated lead and chromium concentrations of 2.36
9 grams/liter and 1.72 grams/liter respectively. This information was used to calculate that the
10 concentration in the dried feed material would be approximately 5,200 parts per million lead and
11 3,800 parts per million chromium. The TCLP used to designate waste requires a 20:1 dilution
12 during the extraction process. If it is assumed that all of the metal contamination was leachable,
13 the maximum concentration in the extract would be 260 parts per million lead and 190 parts per
14 million chromium. Therefore, the dried melter feed heels were designated as characteristic for
15 lead (D008), and chromium (D-007), and as extremely hazardous waste (WT01).
16

17 **4.2.4 Liquid Metal Seal**

18
19 The liquid metal seal is a metal alloy containing 50 percent bismuth, 26.7 percent lead,
20 13.3 percent tin, and 10 percent cadmium. This alloy has a melting point of 70 °C, and it was
21 used as a seal material as part of the glass melter (refer to Chapter 3.0, Section 3.2). The waste
22 as packaged was <0.2 cubic meter in volume, and was transferred in 1996 to the PUREX Storage
23 Tunnels.
24

25 PNNL designated the liquid metal seal in 1994 based on process knowledge and analytical
26 information available on the original material. The liquid metal did not meet the criteria for
27 listed waste. The metal seal is assumed to be an alloy composed of bismuth, lead, tin, and
28 cadmium in the concentrations noted previously. The exact product information could not be
29 located; this composition was based on melting point data. It was assumed that the elements
30 would leach during a TCLP in excess of the regulatory limits. Generator knowledge was used to
31 designate the liquid metal seal waste as characteristic for lead (D008), and cadmium (D006),
32 and as extremely hazardous waste (WT01).
33

34 **4.2.5 Window Oil and Oil-Absorption Material**

35
36 An absorbent material (diatomaceous earth) was used to clean up mineral oil from a
37 leaking window in B-Cell. The material was collected and placed in a 208-liter container that
38 was moved to D-Cell in July 1994 because of flammability considerations. (Torches were being
39 used to cut up equipment being removed from B-Cell.) This container was transferred to the
40 PUREX Storage Tunnels in 1996.
41

42 PNNL designated the window oil in 1994 based on process knowledge. The window oil
43 did not meet the criteria for listed waste. The material safety data sheet (MSDS) for the mineral

1 oil listed a LD₅₀ of 2 g/kg (Dermal Rabbit). A dilution factor of three was assumed to result from
2 addition of absorbent material. The mineral oil and absorbent was designated as WT02.
3

4 **4.2.6 Filters Containing Heavy Metals**

5
6 Filters designed to collect heavy metals (e.g., barium, cadmium, chromium, lead) from the
7 HLV Interim Waste Removal Action Project treatment process performed in 1996 (Chapter 3.0,
8 Section 3.3.9) initially were stored in D-Cell where the treatment process took place. These
9 filters are considered mixed waste. The filters were moved to B-Cell and will be transferred to
10 the PUREX Storage Tunnels (or another permitted TSD), as discussed in Chapter 3.0,
11 Section 3.3.2 .
12

13 **4.3 Vault Tank Waste Inventory and Characteristics**

14
15 The HLV and LLV tanks have been used as holding tanks for feed solutions, feedstock
16 tanks for process solutions, collection tanks for process effluents, and storage tanks for waste
17 solutions since 1968. The vault tanks can receive solutions as described in Chapters 2.0 and 3.0.
18 The HLV and LLV tank contents were sampled and analyzed in 1990. As part of the HLV
19 Interim Action Removal Process, the HLV tank contents were sampled and analyzed in 1996.
20 The HLV tanks were drained and flushed in 1996 (Chapter 3.0, Section 3.3.1.5).
21

22 **4.3.1 1990 HLV and LLV Tank Contents Characterization**

23
24 The volume of material in each of the tanks during the 1990 sampling event was reported
25 as: tank 101, 5,580 liters; Tank 102, 7,100 liters; tank 103, 5,640 liters; Tank 104, 5,500 liters;
26 Tank 105, 2,060 liters; Tank 106, 1,023 liters; and tank 108, 7,100 liters (PNL 1990). The
27 material in Tank 107 had been transferred to Tank 112 in B-Cell earlier in the year for possible
28 use in a treatability study. At the time of sampling, the material in Tank 112, which had
29 originated in Tank 107, had a volume of 740 liters. The treatability study did not take place and
30 the material was returned later to Tank 107. Waste tank contents were analyzed at the PNNL 325
31 laboratory.
32

33 Sampling for all tank contents, except for tanks 105 and 107, occurred in the remote-
34 operated sample station, located in Room 145. This station used a shielded hood for sampling
35 the tank contents. Sampling was performed with special sampling equipment located in the
36 hood. Air jets were used for circulating the material to and through the sampler. The material
37 from Tank 107 was being stored temporarily in Tank 112 and was sampled directly from Tank
38 112. A sample of Tank 105 material, leftover from an earlier analyses, had been found at the
39 PNNL 325 Laboratory, and no additional samples were taken from Tank 105.
40

41 Analyses of the tank contents were conducted by the PNNL 325 Laboratory for several
42 analytes, including ICP for total metals, anions by ion chromatography (IC), and pH and

1 radiochemistry. All analyses used PNNL-specific methods in place at the time of sampling.
2 Analytical results of the samples are provided in Tables 4-7, 4-8, and 4-9.
3

4 Data from this sampling event were used to evaluate and designate the material in tanks
5 101, 102, 103, 106, and 108 (PNL, 1990). The materials in tanks 104, 105, and 112 were not
6 considered waste at that time, as it was planned to use the materials within the next 12 months,
7 and were not designated. None of the tank contents met the criteria for listed waste. The waste
8 was designated based on the concentrations of toxicity-characteristic listed metals. Tank 101
9 waste showed no concentrations above toxicity-characteristic regulatory limits, and therefore,
10 was not designated as dangerous waste. Tank 102 waste was designated as characteristic waste
11 for arsenic, (D004), barium (D005) and lead (D008). Tank 103 waste was designated as
12 characteristic for barium (D005). Tank 106 waste showed no concentrations above TC
13 regulatory limits, and therefore was not designated as a dangerous waste. Tank 108 waste was
14 designated as a characteristic waste for chromium (D007).
15

16 In 1994, the remaining tank contents were declared waste and were designated based on
17 the 1990 analytical results. The tanks contents had not been altered since the 1990 sampling
18 event except for evaporation and addition of water due to evaporation. The waste in Tank 104
19 was designated as corrosive (D002) due to a pH of 1.4 and as characteristic for lead (D008).
20 Tank 105 waste was designated as corrosive (D002), pH 1.5, and as characteristic for lead
21 (D008). Tank 107 waste was designated as corrosive (D002), pH 0.7, and as characteristic for
22 barium (D005), chromium (D007) and cadmium (D006).
23

24 The dangerous waste designations for the solutions stored in all of the HLV and LLV tanks
25 are provided in Table 4-2.
26

27 **4.3.2 1996 HLV Tank Contents Characterization**

28
29 In 1996, the waste in the HLV tanks was removed, treated, and the filtrate transferred to
30 the DST system for storage as part of the HLV Interim Waste Removal Action (Chapter 3.0,
31 Section 3.3.9). Solids from the treatment process have been designated as mixed waste, product,
32 and LLW and stored appropriately. As part of these removal activities, samples from the HLV
33 tanks containing waste were collected. Tank 106 contained no liquid before liquid waste
34 treatment activities and therefore was not sampled. The samples from the remaining HLV tanks
35 were analyzed to provide information necessary for the cleanout and treatment process. In
36 addition, samples were taken from the last rinsate used during the HLV waste removal activities.
37 The information collected is provided in the following sections.
38

39 A higher level of quality assurance and quality control is associated with the data
40 referenced in this section than for the data on the 1990 sampling and analyses event. Therefore,
41 additional detail on sampling and analyses activities is provided.

1 **4.3.2.1 HLV Tank Waste Sampling and Analyses**

2
3 For ALARA concerns, the use of the remote operated sample station location in
4 Room 145 was not used. Waste was transferred from the HLV tanks to Tank 112 in B-Cell
5 where the waste was sampled using the closed loop sampler on the tank. A representative sample
6 was collected by allowing the tank solution to recirculate through the sample bottle before
7 stopping the air jet. The turbulence of the transfer from the HLV tanks to Tank 112 in B-Cell
8 was expected to have mixed the waste thoroughly. The following information is based on entries
9 in the Solution Transfer Log for the 324 Building.

10
11 Initially, on April 25, 1996, the contents of Tank 104 (628 liters) were transferred to Tank
12 105, mixing the waste from tanks 105 and 104. On April 26, Tank 104 was rinsed with 170 liters
13 of clean water that was transferred to Tank 105. On April 29, Tank 104 was rinsed again with
14 240 liters of water that was transferred to Tank 112 and to Tank 107. Additional water volumes
15 (ranging from five to 30 liters) were added during each transfer due to jet dilution. On June 3
16 and 4, 1996, the contents of Tank 107 (444 liters) were transferred to the empty Tank 104, and
17 the contents of Tank 104 (446 liters) were transferred to Tank 112. These contents were sampled
18 and returned to Tank 107. The empty Tank 104 was rinsed with 168 liters of 0.01M nitric acid.
19 This dilute acid was transferred to Tank 112 and to Tank 107. Tank 104 was rinsed again with
20 153 liters of 0.01M nitric acid. This dilute acid was again transferred to Tank 112 and to Tank
21 107. The final volume in Tank 107 on June 4, 1996, was approximately 860 liters. On June 4,
22 1996, the contents of Tank 105 (2,130 liters) was transferred to an empty Tank 104. On June 5,
23 1996, approximately 784 liters were transferred from Tank 104 to Tank 112 and sampled. The
24 final volume in Tank 104 on June 5, 1996, was approximately 1,390 liters. The final volume of
25 Tank 112 on June 5, 1996, was approximately 820 liters.

26
27 Two samples were taken from Tank 112 during each sampling event. These samples
28 were combined in the laboratory before any sample preparation and analyses. The samples from
29 the Tank 104/105 composite were found to be colorless, clear liquids with a minute amount of
30 settled solids. The samples from Tank 107 were opaque brown liquids. The samples were
31 transferred to the PNNL 325 Laboratory for analyses.

32
33 The samples were analyzed by ICP for metals and by IC for anions. Because of the high
34 radioactivity dose rates, both samples needed significant dilution to ensure that worker exposure
35 was ALARA. The reported results are corrected for these dilutions.

36
37 For the anion analyses, the samples were diluted 1,140-fold so the radioactivity dose level
38 fell within the allowable levels for personnel safety. The diluted sample aliquots were analyzed
39 by IC for fluoride, chloride, bromide, nitrate, nitrite, phosphate, and sulfate. All quality control
40 requirements were met. Both samples showed significant concentrations of nitrate. The Tank
41 104/105 composite averaged 13,000 $\mu\text{g/mL}$ nitrate; Tank 107 waste averaged 56,000 $\mu\text{g/mL}$
42 nitrate. The Tank 104/105 composite also showed detectable levels of sulfate (average 850
43 $\mu\text{g/mL}$). All other anion analyses were below detection limits. Results are summarized in
44 Table 4-10.

1 Analyses by ICP/mass spectroscopy (ICP/MS) took place on July 29, 1996. Because of
2 the high instrument background, sodium and potassium results were not obtained. A process
3 blank and blank spike were analyzed along with samples. (Process blank was the PNNL 325
4 Laboratory term for method blank. Reagents without the sample were processed through the
5 entire digestion process and analyzed in the same manner as the samples.) The ICP/MS detected
6 some contamination in the process blank. The process blank results for aluminum, calcium, iron,
7 magnesium, lead, and zinc were comparable in some cases to the results reported for the samples.
8 In addition, silicon was detected in the nitric acid blank at approximately 40 to 60 percent of the
9 sample results. The ICP analysis of the process blank also indicated the presence of aluminum,
10 iron, zinc, and calcium at similar concentrations in the process blank. As a result, it is believed
11 that the contamination of aluminum, iron, zinc, and calcium most likely came from the
12 preparation method. It is likely that analytes detected in the blanks at levels equal to the samples
13 show a false positive for the sample results. The uncertainty associated with manganese, zinc,
14 and technetium results were high, indicating a potential instability in the instrument. Both the
15 Tank 104/105 composite waste sample and the Tank 107 waste sample were run in duplicate and
16 all results and an average are presented in Table 4.11.

17
18 The ICP/MS analyses showed relatively high levels of cadmium, chromium, lead, and
19 selenium for both samples. Also, the Tank 107 sample waste is high for barium. This is
20 consistent with the 1990 sampling results, even though direct comparisons are difficult because
21 of the evaporation and addition of water during the intervening years, and the mixing of Tank
22 104 and -105 contents.

23
24 On July 1, 1996, before analyses by ICP/MS, the Tank 104/105 composite also was
25 analyzed by ICP/Atomic Emission Spectroscopy (ICP/AES). Because of limited quality control
26 samples, the ICP/AES uncertainty is greater than normal. The results should be used with
27 caution. The Tank 104/105 composite was acid digested and diluted to approximately 125-fold
28 to bring the radioactivity levels to a safe level. Matrix spike, serial dilution, and post-digestion
29 spike were not performed because the concentration of the analytes were expected to be at the
30 detection limits and the analyst would have been unnecessarily exposed to high radioactivity
31 levels. The blank spike was not performed because the dilution applied would have resulted in
32 the analytes not being detectable above the ICP estimated quantitation limit (EQL).

33
34 The results for the ICP/AES analyses showed chromium and lead exceeding the TC
35 regulatory limits. The measured lead concentrations were within a factor of two times the
36 detection limit, and therefore, actually might not have been present. The lead measurement
37 results might be due to interference from high concentration of lanthanum. The samples did not
38 show levels of silver, arsenic, barium, cadmium, or selenium above TC regulatory limits.

39
40 Potential contaminants of concern based on this 1996 sampling event are lead, barium,
41 chromium, cadmium, and selenium.

4.2.2.2 High-Level Vault Interim Removal Action Project Rinsate Sampling and Analyses

As part of the HLV Interim Waste Removal Action Project, in September 1996, the HLV tanks were rinsed three times, twice with a dilute nitric acid solution and finally with a dilute sodium carbonate solution (described in Chapter 3.0, Section 3.3.9). A sample of the rinse solution was collected from Tank 112. The sample was analyzed by the PNNL 325 Laboratory. The rinse sample was filtered and found to be 0.3 percent solids by weight. The sample was acid digested and was analyzed by ICP/MS. The matrix spike and the blank spike were within acceptable recoveries. The method blank contained lead at concentration greater than five percent of that found in the sample, and showed a relative percent difference (RPD) for chromium of 33 percent. The results of these analyses are in Table 4.12.

These analyses might indicate constituents remaining in the tanks and piping after the HLV Interim Waste Removal Action Project activities were complete. Potential contaminants of concern based on the rinsate analyses include arsenic, chromium, and lead.

4.3.3 Tank Contents Summary

The LLV tanks 101, 102, and 103 stored process condensates and decontamination solutions (e.g., from decontamination of the airlock, cells manipulators, fume hoods). During the WSEP and NWVP, tank 108 was reported not to have been used extensively, partly due to its limited size and transfer capabilities. However, during the FRG Program, tank 108 was used routinely to receive clean acids from the acid fractionator. The 1990 results indicate that the concentrations of halides (e.g. fluorides, chlorides) were higher in tank 108 than in the other LLV tanks. It is expected that the concentration of halides was higher in the acids than that of the process condensates due to these constituents being concentrated in the fractionator bottoms.

For the HLV, tanks 104 and 105 analytical results are most representative of waste generated during the FRG Program. The solution in Tank 104 was essentially the HLV tank heel of cesium-137 feedstock for the FRG canister fill activities. Likewise, solution in Tank 105 was the HLV tank heel of strontium-90 feedstock for the FRG canister fill activities. The FRG Program feed material contained residual fluorides and chlorides from the conversion performed in the 200 Areas of original feed material to nitrates. The 1990 analytical results indicated fairly high levels of chloride and fluoride concentrations for Tank 105. High nitrates were noted for both tanks in 1990 and for the composite in 1996.

Tank 107 was used routinely during the WSEP and NWVP to contain feed materials before the materials were sent to the melter-feed makeup tank 114 in B-Cell. The feed material for the NWVP was stored in Tank 107 when the contents were declared waste. Tank 106 was used during the NWVP to accept high-level liquid waste from the 325 Building. The 1990 analyses results indicate that Tank 106 contents were more typical of the process condensates such as those stored in the LLV tanks.

1 **4.4 Constituents of Concern for Closure**

2
3 The constituents of concern for closure are those constituents that have been found in the
4 waste or are expected in the waste material based on process knowledge. The original HLV and
5 LLV tank waste was designated as dangerous waste due to concentrations of lead, barium,
6 chromium, arsenic (at near detection limits), and also due to corrosivity. The 1996 sampling and
7 analyses event showed concentrations of lead, barium, chromium, cadmium, and selenium at
8 high levels. During waste designation of the collected B-Cell floor dispersible debris, cadmium,
9 chromium, and lead were found in concentrations that designate as dangerous waste.

10
11 Based on these results, lead, chromium, barium, cadmium, and possibly selenium and
12 arsenic are considered to be constituents of concern for closure. This list could be revised as
13 more information is obtained through additional sampling and/or waste designation activities.

14
15 Organic substances are not expected to be of concern during closure. History of the HLV
16 and LLV indicates that the addition of organic substances to the tanks was limited to cell
17 cleaning activities or as contaminants. The organic substances were present only during the
18 WSEP program that completed activities in 1972. The high temperatures and constant airflow
19 would make retention of volatile organics improbable. The high radiation field in the tanks is
20 expected to have degraded any organic molecules that might have been left in the tanks following
21 the last program use in 1987.

22
23 Process history identifies the primary radioactive substances used in the REC/HLV as
24 strontium-90 and cesium-137. While these are not considered constituents of concern for
25 closure, the waste from the 324 Building can be a mixed waste. It is not expected that the
26 dangerous waste components and radioactive components will separate, therefore, in the event a
27 liner has failed and soils are potentially impacted the strontium-90 and cesium-137 might be
28 useful as tracers in indicating the location of waste materials.

29
30 It is expected that the majority of the unit will be closed using 'debris rule standards,'
31 which allows for the use of an approved treatment technology and a clean debris surface as a
32 performance standard. Therefore the closure performance standards for the portions of the unit
33 being closed by the 'debris rule standard' do not depend directly on knowledge of constituents of
34 concern. However, sampling is expected on rinsates from the piping and tanks and, if necessary,
35 post-closure activities could be conducted that do require more information on constituents of
36 concern. In addition, if necessary to coordinate any future closure activities with the operable
37 unit, as discussed in Chapter 8.0, this information on the constituents of concern for closure will
38 be used in the clean up of areas of the operable unit associated with the 324 Building.

Table 4-1. Radiochemical Engineering Cells Waste Dangerous Waste Characteristics.

Waste type	Location	Waste designation	Dangerous constituents/ characteristic	Estimated quantity (cubic meters)
Floor debris ^a	B-Cell	D006, D007, D008, WT02	Cadmium, chromium, lead, toxic	2.5
Elemental lead	B-Cell	D008, WT01	Lead, toxic	1.0
Dried melter feed heels	B-Cell	D007, D008, WT01	Chromium, lead, toxic	0.17
Liquid metal seal	B-Cell	D006, D008, WT01	Cadmium, lead, toxic	<0.2
Window oil and oil absorption material	D-Cell	WT02	Toxic	<0.2

^a Includes dispersible material, tools, equipment, and pieces of metal.

1
2
3

Table 4-2. Designation of Waste in Vault Tanks.

Tank ^a	Waste type	Waste designation	Dangerous constituents/ characteristic	Estimated Volume 1990 (liters)
High-Level Vault Tanks				
104	Dilute strontium-90 nitrate and cesium-137 nitrate solutions	D002, D008, WT02	Corrosive, lead, toxic, pH 1.4	5,500
105	Dilute strontium-90 nitrate and cesium-137 nitrate solutions	D002, D008, WT02	Corrosive, lead, toxic, pH 1.5	2,060
106	Low-level waste process solution	None	None	1,020
107	NWVP liquid process feedstock solution	D005, D006, D007, D002, WT02	Barium, cadmium, chromium, corrosive, toxic	740 ^b
Low-Level Vault Tanks				
101	Low-level condensate	None	None	5,580
102	Low-level condensate	D004, D005, D008	Arsenic, Barium, Lead	7,100
103	Low-level condensate	D005	Barium	5,640
108	Contaminated nitric acid	D007	Chromium	7,100

4

^a Location of waste before removal from the tanks.

^b Material was being stored in Tank 112 in B-Cell at the time sampling.

Table 4-3. Feedstock Compositions (Kg Oxide/MTU)^c

		As Defined PW-4b	PW-4b-1	PW-4b-2	PW-4b-3	PW-4b-4	PW-4b-5	PW-4b-6	As Defined PW-7a	PW-7a-1	PW-7a-2	As Defined PW-8a	PW-8a-1	PW-8a-2	
Inerts	Na ₂ O	--	--	--	--	--	--	--	6.872	6.872	6.872	14.057	14.057	14.057	
	Fe ₂ O ₃	1.511	3.294	3.294	1.511	1.511	1.511	1.511	3.022	3.022	3.022	27.225	27.225	27.225	
	Cr ₂ O ₃	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	1.151	1.151	1.151	
	NiO	0.141	1.049	1.049	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.566	0.566	0.566	
	P ₂ O ₅	0.672	0.672	0.672	0.672	0.672	0.672	0.672	0.672	6.339	6.339	6.339	1.342	1.342	1.342
	Gd ₂ O ₃	--	--	--	--	--	--	--	--	10.360	10.360	---(RE)	--	--	--
Fission Products	Rb ₂ O	0.354	0.354	0.178	0.354	0.354	0.354	0.354	0.354	0.354	0.178	0.354	0.354	0.178	
	SrO	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	1.059	
	Y ₂ O ₃	0.598	0.027(RE) ^(a, b)	0.027(RE)	0.598	0.027(RE)	0.027(RE)	0.027(RE)	0.598	0.598	0.027(RE)	0.427	0.598	0.027(RE)	0.427
	ZrO ₂	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	4.944	
	MoO ₃	5.176	6.375	6.375	6.375	6.375	6.375	6.375	5.176	6.375	6.375	5.176	6.375	6.375	
	Ti ₂ O ₃	1.291	---(Mo)	---(Mo)	---(Mo)	---(Mo)	---(Mo)	---(Mo)	---(Mo)	1.291	---(Mo)	---(Mo)	1.291	---(Mo)	---(Mo)
	RuO ₂	2.972	---(Fe)	---(Fe)	2.972	2.972	2.972	2.972	2.972	2.972	2.972	---(Fe)	2.972	2.972	---(Fe)
	Rh ₂ O ₃	0.480	0.304(Co)	0.304(Co)	0.304(Co)	0.480	0.480	0.480	0.480	0.480	0.304(Co)	0.304(Co)	0.480	0.304(Co)	0.304(Co)
	PdO	1.483	---(Ni)	---(Ni)	---(Ni)	1.483	1.483	1.483	1.483	1.483	---(Ni)	---(Ni)	1.483	---(Ni)	---(Ni)
	Ag ₂ O	0.088	0.038	---	0.088	0.088	0.088	0.088	0.088	0.088	0.088	0.088	0.088	0.088	0.088
	CdO	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097	0.097
	TeO ₂	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725
	Cs ₂ O	2.880	2.880	0.963(K)	2.880	2.880	2.880	2.880	2.880	2.880	2.880	0.963(K)	2.880	2.880	0.963(K)
	BaO	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567	1.567
	La ₂ O ₃	1.480	3.213(RE)	3.213(RE)	1.480	3.213(RE)	3.213(RE)	1.480	1.480	1.480	3.213(RE)	8.756(RE)	1.480	3.213(RE)	5.114(RE)
	CeO ₂	3.323	6.426(RE)	6.426(RE)	3.323	6.426(RE)	6.426(RE)	3.323	3.323	3.323	6.426(RE)	10.489(RE)	3.323	6.426(RE)	10.228(RE)
	Pr ₆ O ₁₁	1.482	0.669(RE)	0.669(RE)	1.482	0.669(RE)	0.669(RE)	1.482	1.482	1.482	0.669(RE)	1.998(RE)	1.482	0.669(RE)	1.065(RE)
	Nd ₂ O ₃	4.522	2.276(RE)	2.276(RE)	4.662	2.276(RE)	2.276(RE)	4.522	4.522	4.522	2.276(RE)	6.496(RE)	4.522	2.276(RE)	3.622(RE)
	Pm ₂ O ₃	0.123	---(RE)	---(RE)	0.123	---(RE)	---(RE)	---	0.123	0.123	---(RE)	---(RE)	0.123	---(RE)	---(RE)
	Sm ₂ O ₃	0.924	0.402(RE)	0.402(RE)	0.924	0.402(RE)	0.402(RE)	0.924	0.924	0.924	0.402(RE)	1.056(RE)	0.924	0.402(RE)	0.639(RE)
Eu ₂ O ₃	0.200	0.107(RE)	0.107(RE)	0.200	0.107(RE)	0.107(RE)	0.200	0.200	0.200	0.107(RE)	0.200(RE)	0.200	0.107(RE)	0.170(RE)	
Gd ₂ O ₃	0.137	0.268(RE)	0.268(RE)	0.137	0.268(RE)	0.268(RE)	0.137	0.137	0.137	0.268(RE)	0.821(RE)	0.137	0.268(RE)	0.426(RE)	
Actinides	U ₃ O ₈	1.169	2.078	---	---	---(Cm)	---	2.078	11.689	12.701	---(Ce)	11.689	12.772	---(RE)	
	NpO ₂	0.865	---(U)	---	---	---(Cm)	---	---(U)	0.865	---(U)	---(RE)	0.865	---(U)	---(RE)	
	PuO ₂	0.010	---(U)	---	---	---(Cm)	---	---(U)	0.103	---(U)	---(RE)	0.174	---(U)	---(RE)	
	Am ₂ O ₃	0.181	---(RE)	---(RE)	---(Nd)	---(Cm)	---(RE)	---(Nd)	0.181	---(RE)	---(RE)	0.181	---(RE)	---(RE)	
	Cm ₂ O ₃	0.040	---(RE)	---(RE)	---(Nd)	---(Cm)	---(RE)	---(Nd)	0.040	---(RE)	---(RE)	0.040	---(RE)	---(RE)	
Total		40.8	39.2	35.0	37.9	40.7	39.0	40.6	75.9	75.4	66.0	93.2	92.8	84.6	

^a Where used, chemical substitutes are shown in parentheses. Values listed represent actual amount present. If no value shown the weight included with substitute.

^b RE = commercial rare earth mixture nominally containing wt% 0.2 Y₂O₃, 24.0 La₂O₃, 48.0 CeO₂, 5.0 Pr₆O₁₁, 17.0 Nd₂O₃, 3.0 Sm₂O₃, 0.8 Eu₂O₃, and 2.0 Gd₂O₃.

^c MTU = metric ton uranium.

Table 4-4. Feedstocks for the RLFCM Program.

Element (present as oxides)	Nonradioactive slurry concentration (grams/liter)	Radioactive slurry concentration (grams/liter)
Al	0.59	1.48
B	5.10	21.8
Ba	0.40	3.78
Ca	0.91	6.25
Ce	0.14	-
Cr	0.29	0.73
Fe	2.10	6.87
K	0.80	--
La	0.40	5.36
Mg	0.29	2.62
Mn	0.12	0.99
Na	7.30	43.2
Nd	0.20	1.5
Ni	0.09	0.57
Si	0.37	23.2
Sr	2.90	9.28
Ti	0.32	0.3
Zn	0.04	0.19
Zr	0.04	0.11
Pb	--	2.6

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Table 4-5. Chemical Composition of Strontium and Cesium Waste Feedstocks
for the FRG Program.

Oxide	Strontium-90 solution (grams/liter)	Cesium-137 solution (grams/liter)
Al ₂ O ₃	1.35	--
B ₂ O ₃	6.91	10.19
BaO	2.79	0.57
CaO	6.35	2.62
Ce ₂ O ₃	--	--
Cr ₂ O ₃	0.78	0.65
Cs ₂ O	--	45.99
Fe ₂ O ₃	4.95	3.23
La ₂ O ₃	10.08	0.62
MgO	1.23	0.72
MnO ₂	0.98	0.18
Na ₂ O	40.92	31.33
Na ₂ SO ₃	--	--
Nd ₂ SO ₃	2.04	--
NiO	--	0.53
PbO	--	--
SiO ₂	3.01	1.42
TiO ₂	0.36	0.18
ZrO	0.46	--

1 Table 4-6. Dangerous Waste Constituent Concentrations in Collected B-Cell Floor
2 Dispersible Material (in ppm)

Constituent	run*	EC-14	EC-15	EC-16	EC-17	EC-19	EC-21	EC-22	EC-23	EC-24	EC-25	TC Limits
Arsenic	A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	average	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Barium	A	0.70	ND	1.60	1.10	ND	1.50	1.70	0.96	1.20	1.00	
	B	0.58	ND	2.00	0.97	ND	1.50	1.20	1.10	0.74	1.00	
	average	0.64	ND	1.80	1.04	ND	1.50	1.45	1.03	0.97	1.00	100
Cadmium	A	0.38	ND	0.99	0.74	ND	0.90	0.62	0.62	0.36	0.60	
	B	0.31	ND	1.00	0.72	ND	0.90	0.56	0.78	0.37	0.60	
	average	0.35	ND	<u>1.00</u>	0.73	ND	0.90	0.59	0.70	0.37	0.60	1
Chromium	A	0.10	ND	0.92	1.20	ND	0.40	0.28	0.29	6.4	0.30	
	B	0.08	ND	0.82	1.00	ND	0.30	0.25	0.31	6.1	0.30	
	average	0.09	ND	0.87	1.10	ND	0.35	0.27	0.30	<u>6.3</u>	0.30	5
Lead	A	ND	ND	7.2	2.9	ND	15	54	5.4	54	6.9	
	B	0.18	ND	62	4.6	ND	11	1.7	22	15	3.0	
	average	0.09	ND	<u>34.6</u>	3.8	ND	<u>13</u>	<u>27.9</u>	<u>13.7</u>	<u>34.5</u>	5.0	5
Selenium	A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	average	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Silver	A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	average	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5

3 Legend:

4 EC = engineered container

5 ICP/AES = inductively coupled plasma/atomic emission spectroscopy

6 ND = not detected

7 ppm = parts per million

8 TC = toxicity characteristic

9 TCLP = toxicity characteristic leaching procedure

10
11 * Results from duplicate runs (A & B) and the average values are presented.12
13 NOTES: Samples were analyzed by ICP/AES. Analyses were performed on an acid digest of a TCLP extract.

14 Designation was based on the average values; underlined values are above TC regulatory limits.

Table 4-7. Analytical Results of Low-Level Vault Tanks 1990 Sampling.

Analyses	Tank 101	Tank 102	Tank 103	Tank 108
pH	6.3	7.3	8.4	<1
Total uranium, g/mL	0.17	0.11	0.30	<0.19
Fluoride*, ppm	<20	1.5	7.6	146
Chloride*, ppm	143	65	166	218
Nitrate*, ppm	60	<0.8	0.8	27,900
Nitrite*, ppm	<40	<0.8	<0.8	1,000
Phosphate*, ppm	1630	405	55	<40
Sulfate*, ppm	204	115	188	152
⁹⁰ Sr, d/m-mL	1.38 E6	3.65 E5	1.76 E6	2.16 E7
¹³⁷ Cs, d/m-mL	6.54 E6	1.81 E6	6.80 E6	5.25 E8
¹³⁴ Cs, d/m-mL	2.41 E3	1.10 E3	3.83 E3	NA
¹⁵⁴ Eu d/m-mL	3.11 E4	NA	NA	NA
²⁴¹ Am d/m-mL	NA	NA	NA	NA
Total alpha d/m-mL	5.04 E5	2.31 E3	8.83 E3	5.41 E3

Key

* = performed by ion chromatography

Isotopes:

⁹⁰Sr = strontium-90¹³⁷Cs = cesium-137¹³⁴Cs = cesium-134¹⁵⁴Eu = europium-154²⁴¹Am = americium-241

d/m-mL = disintegrations per minute per milliliter

µg/mL = micrograms per milliliter

ppm = parts per million

NA = not available

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Table 4-8. Analytical Results of High-Level Vault Tanks, 1990 Sampling.

Analyses	Tank 104	Tank 105	Tank 106	Tank 107
pH	1.4	1.5	6.19	0.7
Total uranium, g/mL	0.17	0.96	4E-2	4.9
Fluoride*, ppm	NA	648	34	NA
Chloride*, ppm	<500	3,678	152	<15
Nitrate*, ppm	6,287	38,650	NA	123,600
Nitrite*, ppm	NA	300	89	NA
Phosphate*, ppm	NA	<0.4	<40	NA
Sulfate*, ppm	NA	1976	<40	NA
⁹⁰ Sr, d/m-mL	1.52 E9	1.40 E10	3.54 E6	9.23 E10
¹³⁷ Cs, d/m-mL	1.09 E9	2.64 E10	5.22 E6	1.42 E11
¹³⁴ Cs, d/m-mL	NA	NA	4.22 E4	6.47 E8
¹⁵⁴ Eu d/m-mL	NA	NA	5.69 E4	1.50 E9
²⁴¹ Am d/m-mL	NA	1.55 E5	NA	NA
Total alpha d/m-mL	1.65 E4	NA	9.00 E4	2.32 E9

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Key

* = performed by ion chromatography.

Isotopes:

⁹⁰Sr = strontium-90

¹³⁷Cs = cesium-137

¹³⁴Cs = cesium-134

¹⁵⁴Eu = europium-154

²⁴¹Am = americium-241

d/m-mL = disintegrations per minute per milliliter

ppm = parts per million

NA = not available

µg/mL = micrograms per milliliter

g/mL = grams per milliliter

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Table 4-9. Vault Tanks Inductively Coupled Plasma
Mass Spectroscopy Analytical Results, 1990 Sampling (in $\mu\text{g/mL}$).

Constituent	Low-Level Vault Tanks				High-Level Vault Tanks		
	Tank 101	Tank 102	Tank 103	Tank 108	Tank 104	Tank 106	Tank 107
Aluminum	478	2000	379	23.5	3.0	367	175
Arsenic	NA	24	NA	NA	NA	4.9	NA
Boron	396.4	176	281	42	5.47	262	131
Barium	97.5	404	822	70	1.90	78.6	1074
Beryllium	NA	NA	NA	NA	NA	NA	NA
Calcium	204.3	734	172	25.0	12.6	165	394
Cadmium	NA	NA	NA	NA	NA	NA	44
Cobalt	NA	NA	NA	NA	NA	NA	NA
Chromium	4.87	1.1	0.6	27	0.48	.43	405
Copper	NA	1.7	0.79	NA	5.04	26.8	NA
Dysprosium	NA	NA	NA	NA	NA	NA	NA
Iron	40.4	237	24.9	100	7.88	144	12,200
Potassium	79	99	79	NA	2.1	22	NA
Lanthanum	NA	NA	NA	NA	2.0	NA	820
Lithium	NA	NA	NA	NA	NA	NA	NA
Magnesium	10.3	25	11.2	NA	2.84	13	44
Manganese	2.66	1.6	1.1	645	2.42	0.51	220
Sodium	1,477	3,950	1,497	NA	45.9	731	NA
Nickel	8.22	1.5	NA	30	1.49	3.6	NA
Phosphorus	477	162	29	NA	11.5	NA	360
Lead	NA	7.4	4.4	NA	15.6	2.10	NA
Rhodium	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA
Silicon	310	1,650	429	28	19.6	190.8	390
Strontium	2	7.93	1.8	2.5	15.4	1.6	660
Tellurium	NA	NA	NA	NA	NA	NA	NA
Titanium	3.9	14.8	2.7	25	0.19	2.80	130
Vanadium	NA	NA	NA	NA	NA	NA	NA
Zinc	2.1	16.5	2.8	12	1.2	5.2	93
Zirconium	2.0	6.55	1.6	740	2.78	1.4	620

3 NA = not available

1 Table 4-10. High-Level Vault Tanks Ion Chromatography Analytical Results,
2 1996 Sampling (in $\mu\text{g/g}$)
3

	Tank 104/105 composition			Tank 107 contents		
	Sample	Duplicate	Average	Sample	Duplicate	Average
Fluoride	<290	<290	<290	<290	<290	<290
Chloride	<290	<290	<290	<290	<290	<290
Bromide	<290	<290	<290	<290	<290	<290
Nitrite	<570	<570	<570	<570	<570	<570
Nitrate	12,300	13,700	13,000	54,000	58,000	56,000
Phosphate	<570	<570	<570	<570	<570	<570
Sulfate	800	900	850	<570	<570	<570

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Table 4-11. High-Level Vault Tanks Inductively Coupled Plasma/Mass Spectroscopy Analytical Results, 1996 Sampling

Constituent	Tank 104/105 composite			Tank 107 contents		
	sample	duplicate	average	sample	Duplicate	average
Specific Gravity:			1.007			1.076
ICP, in $\mu\text{g/g}$	sample	duplicate	average	sample	Duplicate	average
Aluminum	74	80	77	164	166	165
Cadmium	5	6	6	30	27	29
Calcium	1,930	1,700	1,815	2,850	2,480	2,,665
Cesium	145	158	152	517	575	546
Chromium	120	110	115	357	390	374
Copper	10	18	14	30	27	29
Dysprosium	<5	<5	<5	15	10	13
Iron	1,500	1,490	1,495	9,990	8,440	9,215
Lanthanum	253	265	259	760	827	794
Lead	170	162	166	109	77	93
Magnesium	65	51	58	90	84	87
Manganese	87	79	83	220	240	230
Molybdenum	43	47	45	767	847	807
Neodmium	44	41	43	2,480	2,630	2,555
Nickel	84	79	82	320	324	322
Selenium	80	<50	65	<50	150	100
Silicon	537	405	471	335	532	434
Strontium	159	156	158	362	383	373
Tellurium	<5	25	15	30	41	36
Titanium	9	9	9	15	13	14
Uranium	44	41	43	2420	2620	2520
Vanadium	15	12	14	15	14	15
Zinc	110	120	115	100	120	110
Zirconium	13	15	14	150	120	135

4

1 Table 4-12. Rinsate Sample High-Level Vault Tanks Inductively Coupled Plasma/Mass
2 Spectroscopy Analyses, 1996 Sampling (in $\mu\text{g/g}$)
3

	Sample	Duplicate-1	Duplicate-2	Average
Antimony	<1	<1	<1	<1
Arsenic	10.9	12	8.1	10
Barium	1.2	<1	<1	1
Beryllium	4.4	6.2	4	5
Cadmium	<1	<1	<1	<1
Cerium	7.7	6.8	6.8	7
Cesium	22	24	16	21
Chromium	10	14	10	11
Cobalt	<1	<1	<1	<1
Copper	18	16.8	12	16
Dysprosium	<2	<2	<2	<2
Lanthanum	11	14	11	12
Lead	8.7	10	5.5	8
Magnesium	46	47	40	44
Manganese	8.7	8.2	6.4	8
Molybdenum	4	4	2.8	4
Neodmium	25	25	13	21
Niobium	<1	<1	<1	<1
Nickel	9	7	7	8
Palladium	2	4	4	3
Rhodium	10	10.4	9.3	10
Rubidium	<4	<4	<4	<4
Strontium	52	51	47	50
Tin	7	6	6	6
Uranium	37.8	20	25	28
Vanadium	48	49	41	46
Zinc	191	178	210	193
Zirconium	18	22	20	20

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5.0 GROUNDWATER MONITORING

Closure of the 324 Building closure unit depends upon demonstration that debris rule standards have been met and that there is evidence to indicate that dangerous waste constituents have not been transported into the adjacent soil or groundwater. The initial approach to demonstrating closure is to assess the integrity of the liners. If integrity of the liners cannot be demonstrated, soil sampling and remediation might be necessary.

Closure surveillance and maintenance of the 324 Building will be required if it is demonstrated that TSD operations performed in 324 Building closure unit contaminated the soil and/or groundwater. Additionally, if it cannot be demonstrated that all contaminated soil can be practicably removed or decontaminated, groundwater monitoring and reporting will be included in postclosure care {WAC 173-303-610(7)(a)(I)}. Closure surveillance and maintenance requirements are addressed in Chapter 8.0.

5.1 Background

Information on the groundwater monitoring for the Hanford Site is provided in annual reports (e.g., PNNL-11470). The geologic and hydrogeologic information provided in this chapter is summarized from the PNNL report.

The geology and hydrogeology of the 300 Area is well characterized and the groundwater is monitored through an extensive well network collecting data to meet the requirements of the RCRA, CERCLA, and Atomic Energy Act. Groundwater monitoring is conducted by PNNL and Bechtel Hanford, Inc. (BHI) for RL. In accordance with the Tri-Party Agreement, groundwater in the 300 Area is included in the 300-FF-5 operable unit (OU) and is being investigated as part of the CERCLA Remedial Investigation/Feasibility Study process. The only constituents detected in the groundwater beneath the 324 Building in levels greater than the proposed interim drinking water standards are uranium and sometimes strontium-90. The 300-FF-5 OU consists of the aquifers beneath the 300-FF-01 and 300-FF-2 source OU and is bounded by the Columbia River on the east (Figure 5-1).

Groundwater for the 324 Building is addressed in the 300-FF-5 groundwater OU (Figure 5-1). A combined Record of Decision was issued in July 1996 for the 300-FF-1 OU (final) and the 300-FF-5 OU (interim). Actual or threatened releases from the 300-FF-2 OU waste sites to the groundwater will be addressed in a future Record of Decision and will include coordination between CERCLA and RCRA (DOE/RL-89-14, DOE/RL-93-21, DOE/RL-94-85).

RCRA groundwater monitoring is governed by 40 CFR 265, Subpart F. There are no RCRA groundwater activities currently occurring in the vicinity (within 305 meters) of the 324 Building. The only RCRA groundwater monitoring program in the 300 Area is the 300 Area Process Trenches (316-5), located north of the 324 Building (Figure 5-1). However, within the

1 300 Area there are 39 active monitoring wells. These wells are part of the groundwater
2 monitoring program for CERCLA, RCRA, and Atomic Energy Act. A number of these wells are
3 located in the vicinity of the 324 Building (see Section 5.3).

4 5 **5.2 Geology, Hydrology, and Land Use History**

6
7 An overview of the geology, hydrology, and land use history is provided in the following
8 sections. The land use history is specific to the 324 Building.

9 10 **5.2.1 Geology**

11
12 The Hanford Site is a part of the Pasco Basin that lies in the Columbia Plateau, a broad
13 plain situated between the Cascade Range to the west and the Rocky Mountains to the east. The
14 Columbia Plateau was formed by a thick sequence of Miocene Age tholeiitic basalt flows. The
15 basalt and sedimentary rocks have been folded and faulted over the past 17 million years,
16 creating broad structural and topographic basins separated by asymmetric anticlinal ridges. The
17 stratigraphic units underlying the Hanford Site include, in ascending order, the Columbia River
18 Basalt Group, Ringold Formation, Plio-Pleistocene unit, early Palouse soil, and the Hanford
19 formation. A regionally discontinuous veneer of Holocene alluvium, colluvium, and/or eolian
20 sediments overlies the principal geologic units.

21
22 There are thin, intermittent Eolian deposits in the 300 Area on top of the Hanford
23 formation. Beneath the Hanford formation lies the Ringold Formation and then the Saddle
24 Mountain Basalts (Figure 5-2).

25
26 The soil immediately underlying the 324 Building is wind-deposited sand and the upper
27 portion of the Hanford formation. The Hanford formation consists of sandy gravel with silt and
28 sand stringers. The soils underlying the HLV, at an approximate depth of six meters below
29 surface grade, lie in the upper portion of the Hanford formation. This part of the formation
30 consists of the pebble-to-boulder gravel growing finer with depth to very fine-to-medium gravel.

31 32 **5.2.2 Hydrogeology**

33
34 Groundwater is present in both unconfined and confined aquifers at the Hanford Site.
35 The unconfined aquifer generally is located in the unconsolidated to semiconsolidated Ringold
36 and Hanford formations that overlie the basalt bedrock. The saturated thickness of the
37 unconfined aquifer system is greater than 180 meters in some areas but pinches out along the
38 flanks of the basalt ridges.

39
40 The unsaturated zone beneath the 324 Building receives no direct precipitation and
41 provides no natural infiltration to the water table other than that provided from outside the
42 structure's shadow. The shadow reduces, but does not completely prohibit, natural gravity flow
43 of infiltrated water beneath the structure. The water content in the unsaturated zone ranges from

1 two to seven percent. The floor of the HLV is approximately six meters below grade and greater
2 than six meters above the average water table.
3

4 The uppermost unconfined aquifer in the 300 Area consists of Hanford formation gravels
5 and sands and Ringold Formation gravels and sands with varying amounts of silt and clay. The
6 water table is within the Hanford formation in most of the 300 Area. Depth to the water table in
7 the 300 Area varies from <1 meter near the Columbia River to approximately 17 meters, and
8 groundwater generally flows eastward toward the Columbia River (Figure 5-3a).
9

10 The water in the unconfined aquifer travels through the sands and gravels of the Hanford
11 formation and more consolidated materials of the Ringold Formation. The unconfined aquifer
12 beneath the 324 Building has an average water table depth of 13.1 meters below grade and flows
13 from the northwest to the southeast to the Columbia River during normal river stage heights
14 (Figure 5-3b). The shallow portion of the aquifer is primarily in the porous Hanford formation
15 where the flow rate ranges from 0.5 to 107 meters per day, depending on the stage height of the
16 river and the location within the 300 Area. The portion of the aquifer beneath the 324 Building
17 is in the slower moving region. The pH of the aquifer environment is neutral (5 to 9), with very
18 low composition of clay and organic materials.
19

20 The water table fluctuates approximately 0.9 to 1.2 meters with the river stages as the
21 river forms a hydraulic barrier to groundwater flow, flattening the gradient during high flow
22 periods. This physical characteristic influences the direction of flow, flow rate of water and
23 constituents, and dispersion of constituents. The potential for groundwater flow in varying (and
24 sometimes opposite) directions makes selection of up- and downgradient wells more complex.
25 During high flow periods, the groundwater flows more toward the south (Figure 5-3c) creating a
26 pathway for uranium and other contaminants to flow from the 316- and 316-2 Process Ponds and
27 nearby trenches toward the 324 Building and to be sampled via the 399-3-11 well. However, the
28 ultimate flow direction from the 324 Building remains toward the Columbia River to the
29 southeast. Figures 5-3a, 5-3b, and 5-3c show groundwater flow directions for the 300 Area and
30 the 324 Building.
31

32 **5.2.3 Land Use History**

33

34 The eastern portion of the 324 Building is built over the 618-6 Burial Ground. The
35 618-6 Burial Ground was established in 1943 for the disposition of uranium contaminated solid
36 waste. The material from this burial ground was moved several times during its active history.
37 In 1962, the 618-6 Burial Ground contents were removed to the 618-10 Burial Ground. The
38 618-10 Burial Ground is located in the 600 Area, approximately 12 kilometers north of the
39 300 Area and east of Route 4S. The groundwater monitoring well 399-3-11 is situated in the old
40 618-6 Burial Ground (Figure 5-4).
41

42 In addition to the 618-6 Burial Ground, there are the north (316-2) and south (316-1)
43 process ponds to the north of the 324 Building (Figure 5-1). These waste facilities discharged
44 uranium and fission products to the vadose zone.

5.3 Groundwater Assessment/Monitoring Information

Two contaminant plumes migrating within the 300 Area affect the groundwater quality in the vicinity of the 324 Building (Figure 5-5). A tritium plume is migrating south from the 200 Areas and is present near the 324 Building. A second plume, originating from the 300 Area process trenches and flowing under the 324 Building, contains uranium, strontium, nickel, copper, trichloroethene, and dichloroethene. A third plume migrating in the 300 Area, consisting of technetium and nitrate, is not affecting the groundwater in the vicinity of the 324 Building. The plumes are monitored for natural attenuation under the Record of Decision for the 300-FF-5 OU.

Within the 300 Area, there are 39 wells. These wells are a part of the groundwater monitoring program for CERCLA, RCRA, and Atomic Energy Act. The existing contaminant plumes would interfere with monitoring of the HLW to a limited extent because strontium-90, a constituent identified in the HLW, is present in the existing plumes at a significant concentration. Strontium concentrations in the well nearest the 324 Building (well 399-3-11) have remained consistently near the interim drinking water standard level of 0.31 Bq/L. Uranium concentrations in well 399-3-11 have exceeded the proposed interim drinking water standard of 20 µg/L (approximately 0.53 Bq/L) for the past three years. Other constituents identified as associated with the HLW tank contents include barium, chromium, lead, and selenium. These constituents were previously monitored for under the CERCLA program and were found to be below the drinking water standard levels in the groundwater, and in some cases, below background concentrations.

There are two groundwater monitoring wells associated with the 324 Building that are currently sampled under the existing groundwater monitoring program. The wells can adequately monitor the 324 Building for potential migration of constituents of concern during normal river height. Well 399-3-12 is located upgradient, approximately 180 meters northwest of the HLW. Well 399-3-11 is located downgradient, 40 meters southeast of the HLW, less than 31 meters from the eastern edge of the 324 Building. Table 5.1 lists these wells and all wells within 305 meters of the 324 Building (Also reference Figure 5-1.). Table 5-2 lists the RCRA groundwater monitoring wells installed in the 300 Area.

The data show uranium and strontium-90 exceeded the proposed interim drinking water standards (20 µg /L and 0.31 Bq/L, respectively) for 1995, 1996, and 1997 for well 399-3-11 and for wells upgradient and downgradient; these contaminants reside in the lower portions of the vadose zone from past practices. Cesium-137, barium, cadmium, chromium, and lead are not detected in routine groundwater sampling.

There appears to be a correlation between the higher than normal water levels in the wells and the higher concentrations of uranium and strontium-90 detected in groundwater samples. During the higher than normal water table levels associated with the higher than normal river

1 level stages in 1995 to 1997, the uranium and strontium-90 trapped in the vadose zone might
2 have been remobilized and transported in the groundwater.
3

4 **5.4 Conclusion**

5
6 There are soil and groundwater contamination from past-practice activities in the vicinity
7 of the 324 Building (e.g., the 618-6 Burial Ground). Past-practice activities have contributed to
8 contamination throughout the Hanford Site. Because of overlapping authorities, the TPA
9 requires coordination by regulatory authorities. Specifically, in cases where TSD units are
10 located within an existing operable unit to be remediated pursuant to either CERCLA or RCRA
11 corrective action, integration is to be accomplished through coordination of some or all aspects of
12 closure as might be appropriate.
13

14 It is recommended to coordinate cleanup of any contaminated soil and groundwater as a
15 result of the TSD activities in this closure plan with the TPA past-practice process because:
16 (1) integration of cleanup is required by the TPA to prevent duplication of work and to
17 economically and effectively address contamination, (2) applicable standards would not be
18 circumvented by coordination, (3) Ecology would not lose authority over coordination,
19 (4) protection of human health and the environment would not be jeopardized by coordination,
20 (5) the approach is legally defensible, and (6) there is no evidence of and limited potential for soil
21 or groundwater contamination from TSD activities at the 324 Building. This coordination of
22 cleanup activities is described in Chapter 7.0, Section 7.5 and Chapter 8.0, Section 8.3.
23

24 Section 6.3.1 of the Tri-Party Agreement states, "Any demonstration for clean closure of
25 a disposal unit, or selected treatment or storage units as determined by the lead regulatory agency,
26 must include documentation that groundwater and soils have not been adversely impacted by that
27 TSD group/unit, as described in WAC 173-303-645 (Ecology, et al., 1996). The 324 Building
28 housed mixed waste in the REC, HLV, and LLV; however, it is believed that none of this
29 dangerous waste escaped the 324 Building to reach the soil or groundwater. If closure of the soil
30 and groundwater cannot be accomplished as described in Chapter 7.0. Surveillance and
31 maintenance requirements will be established (as described in Chapter 8.0) prior to coordination
32 of final cleanup with the TPA past-practice operable unit.

1

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Table 5-1. Wells Within 305 Meters of the 324 Building.

Well	Function
399-3-1	Site surveillance
399-3-2	Site surveillance
399-3-3	Site surveillance
399-3-4	No data
399-3-6	Site surveillance
399-3-7	Site surveillance
399-3-8	Site surveillance
399-3-9	Site surveillance
399-3-10	Site surveillance
399-3-11	Site surveillance
399-3-12	CERCLA
399-4-1	CERCLA
399-4-2	No data
399-4-3	No data
399-4-5	Site surveillance
399-4-9	CERCLA
399-4-10	Site surveillance
399-4-11	Site surveillance

Table 5-2. RCRA Groundwater Monitoring Wells in the 300 Area

Well	Function*
399-1-10A	RCRA
399-1-10B	RCRA
399-1-16A	RCRA
399-1-16B	RCRA
399-1-17A	RCRA
399-1-17B	RCRA
399-1-18A	RCRA
399-1-18B	RCRA

*RCRA wells ere installed to support monitoring for the 300 Area Process Trenches

1

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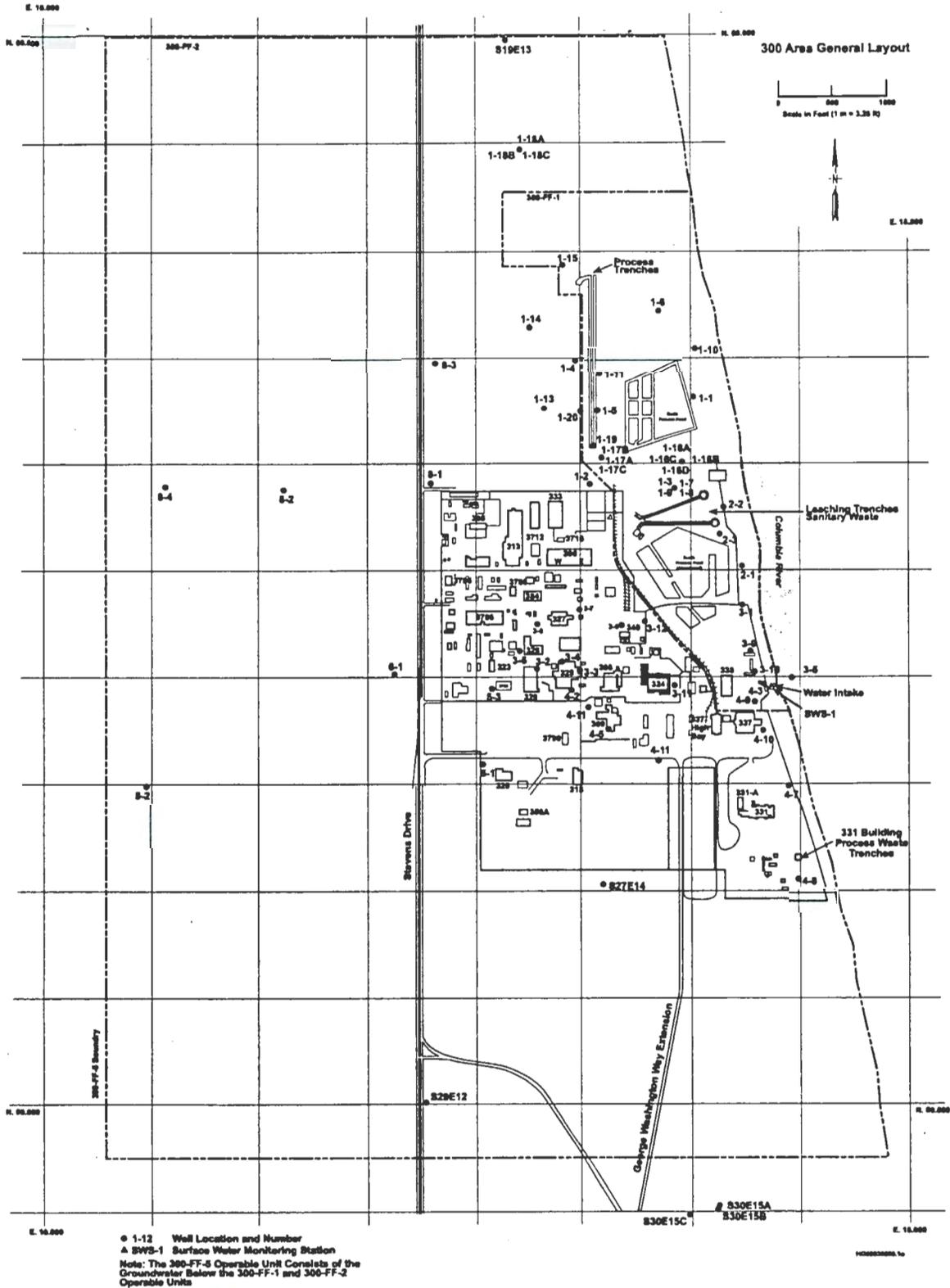
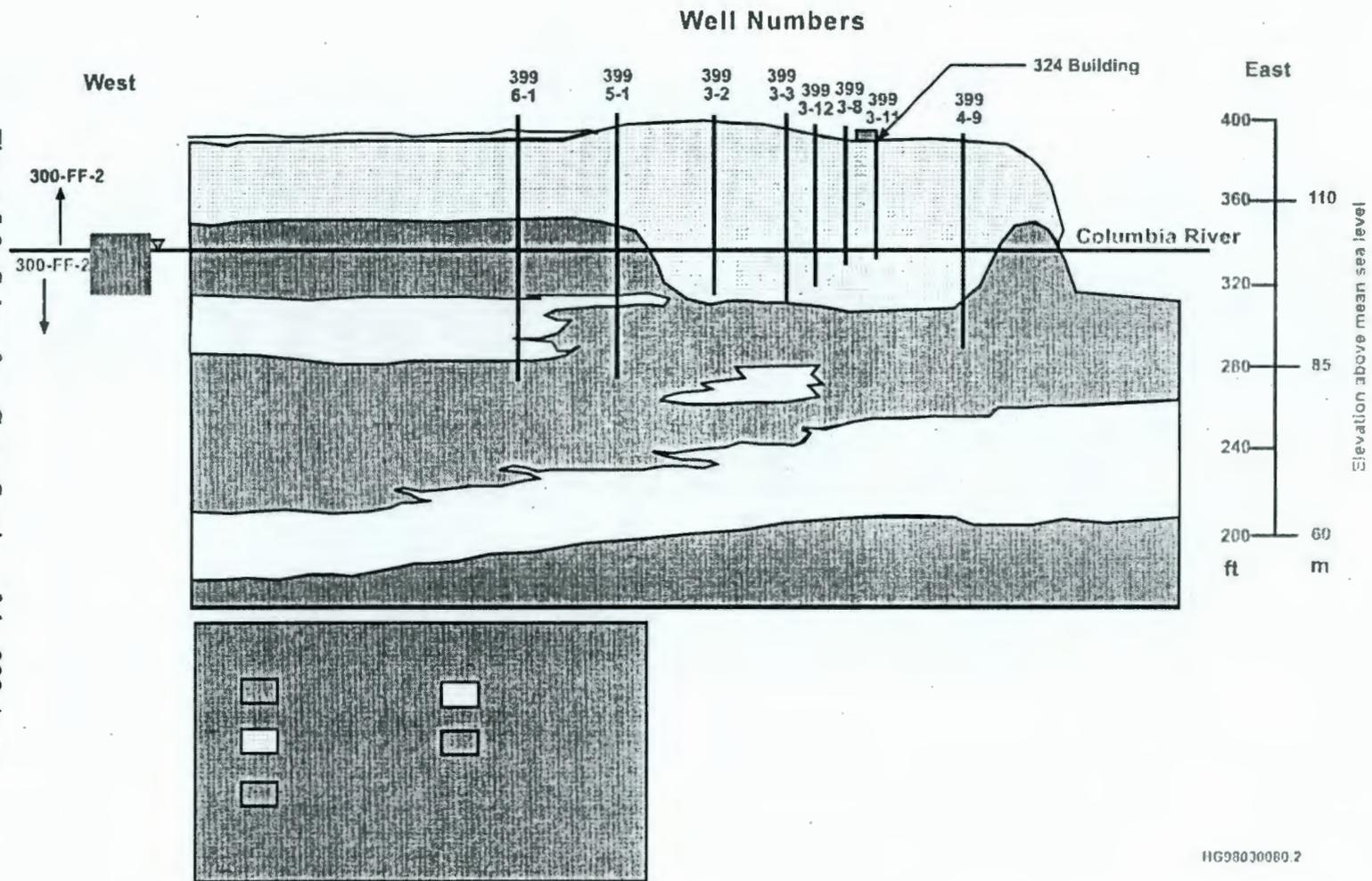


Figure 5-1. 300 Area General Lay out, Location of Operable Units, Facilities, Groundwater Monitoring Wells, and Areas in which there may be a Source of Uranium Upgradient (groundwater) of the Well 399-3-11

Figure 5-2. Subsurface Cross-Section of the 300 Area



HG980J0080.2

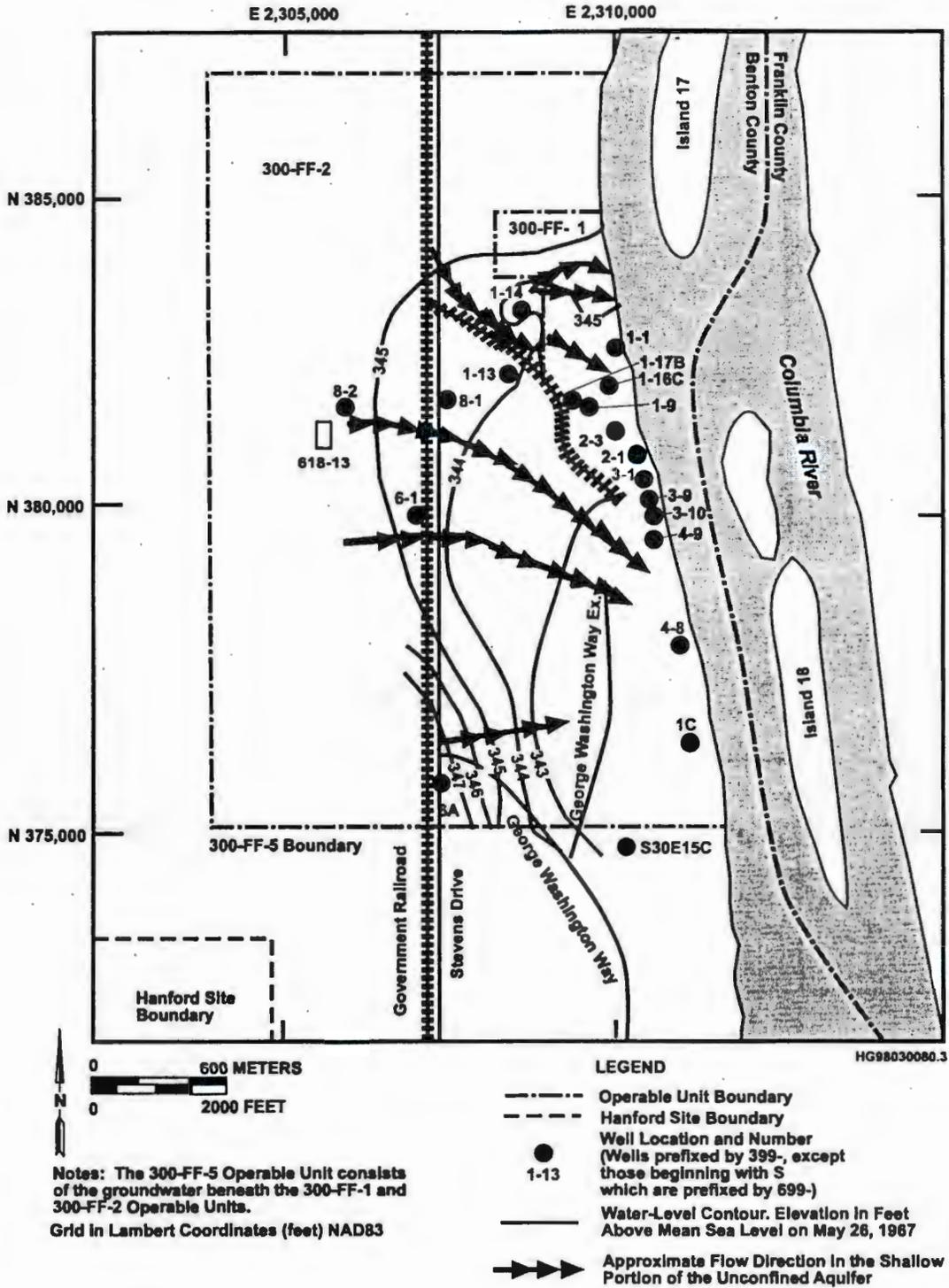


Figure 5-3a. Water-Table Elevation-Contour Map of 300 Richland Areas, June 1996.

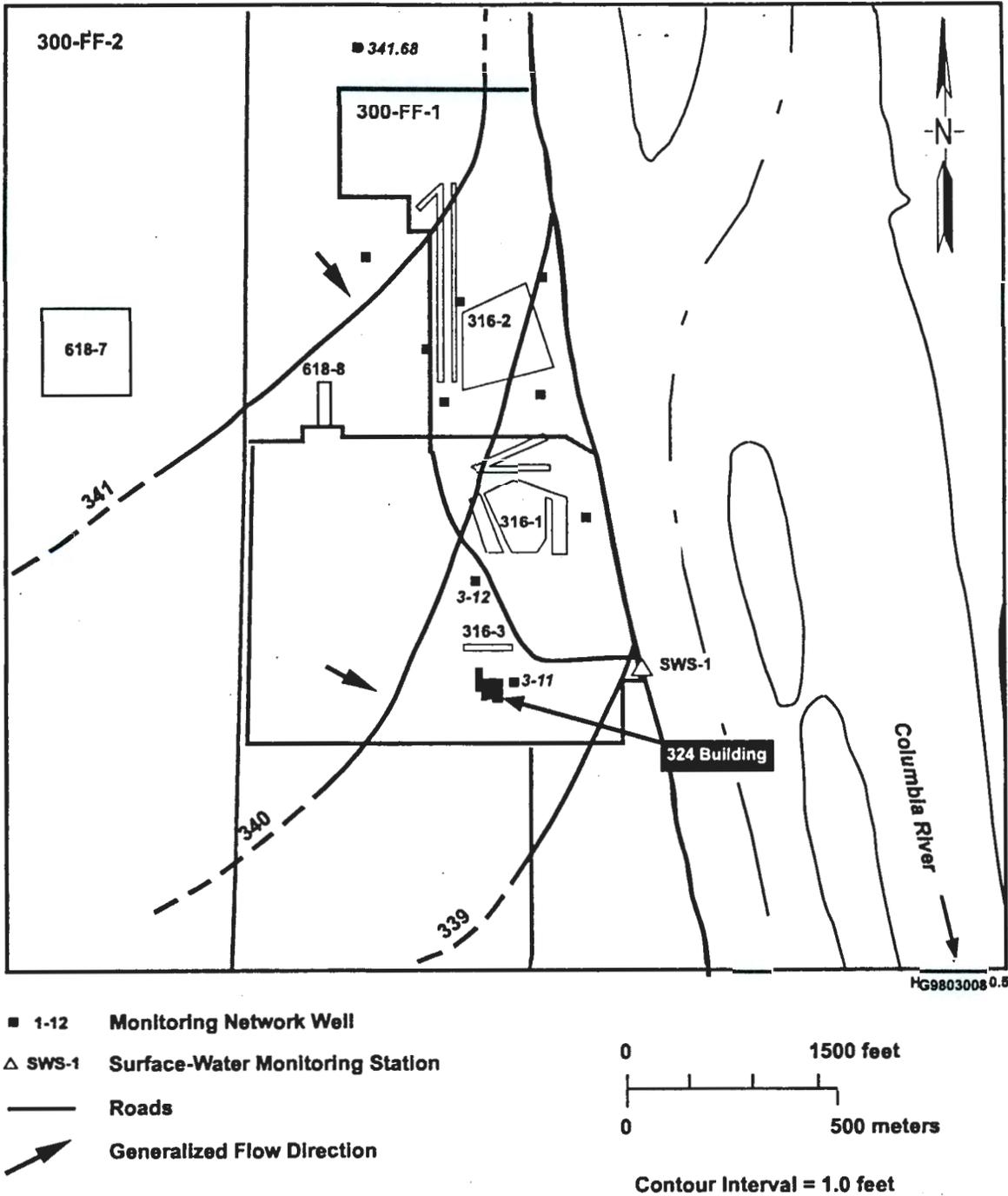


Figure 5-3b. General Groundwater Flow Direction in the Unconfined Aquifer of the 300 Area Normal River Stage, September 27, 1993.

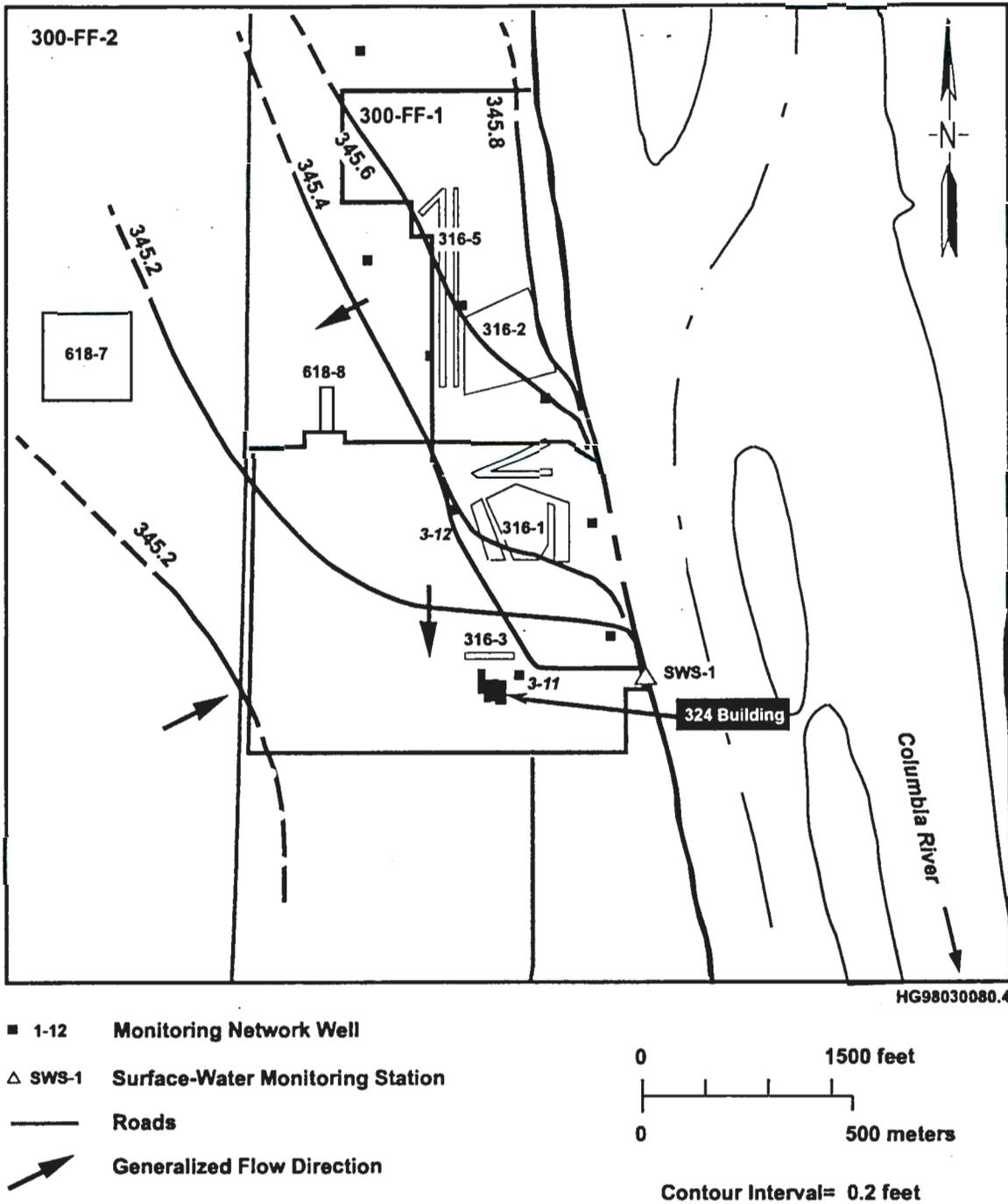


Figure 5-3c. General Groundwater Flow Direction in the Unconfined Aquifer of the 300 Area (High River Stage, May 26, 1993).

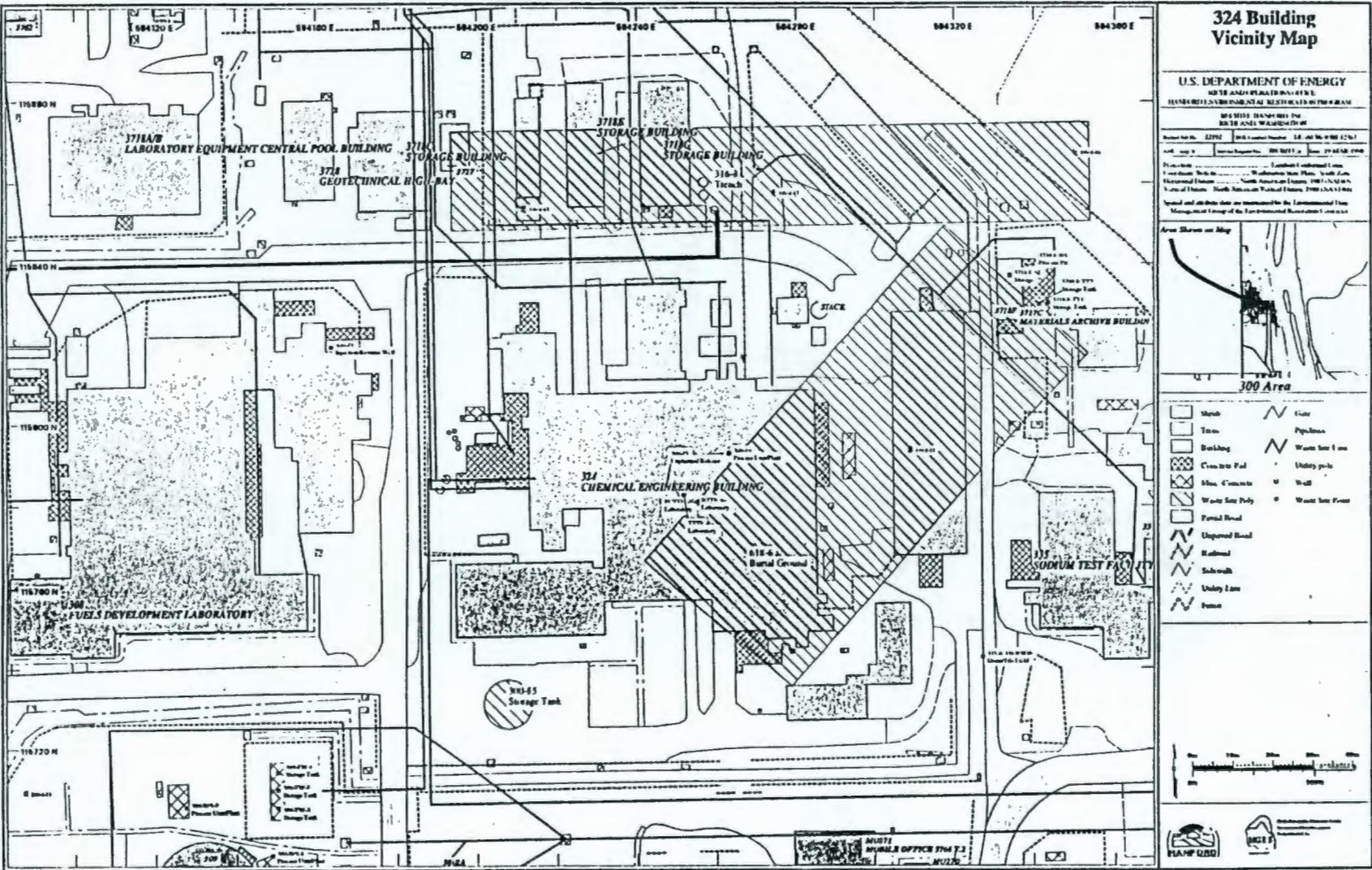
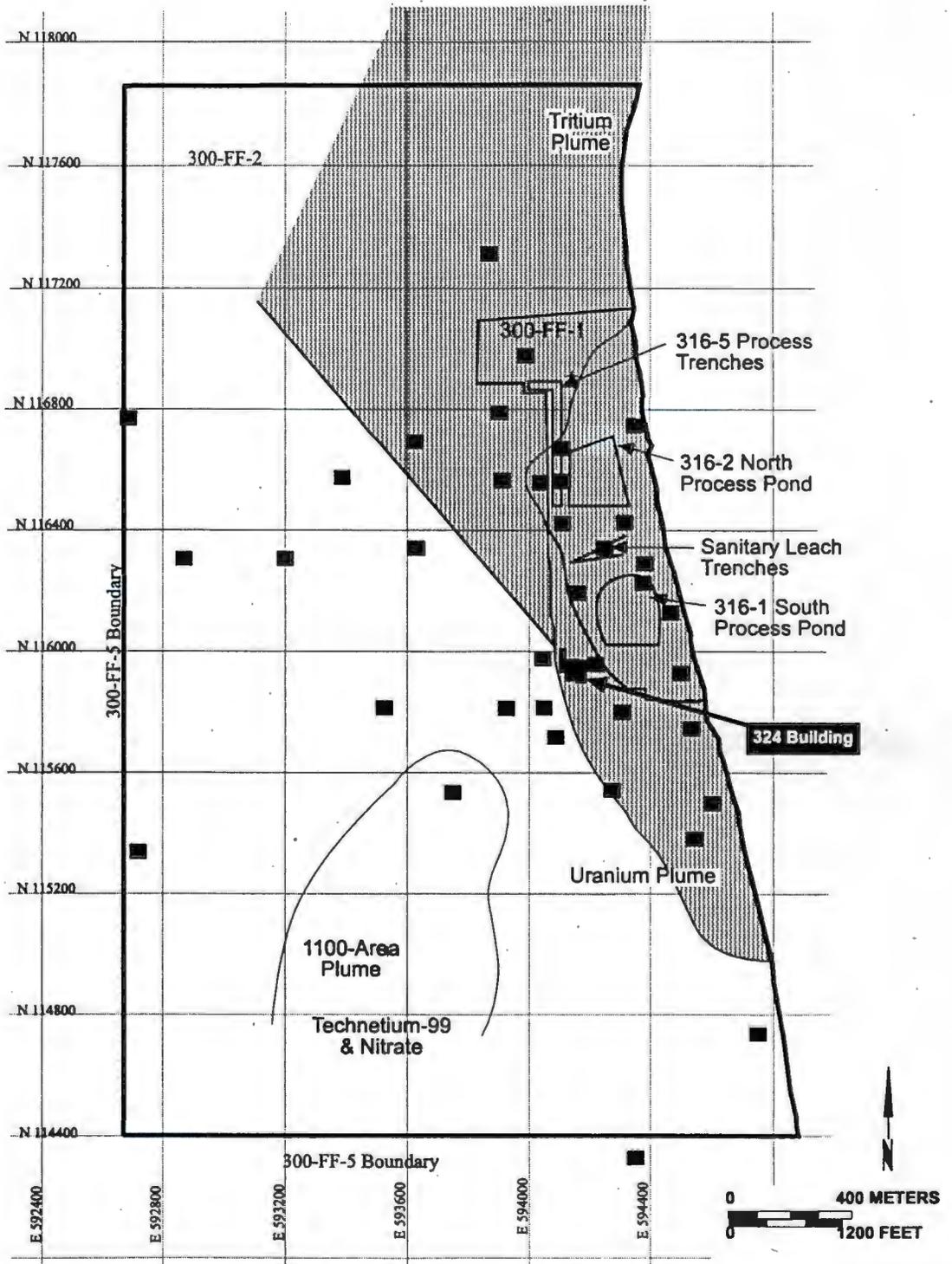


Figure S-4. 324 Building Vicinity Map

F5-6



Grid based on Lambert
Coordinates System, NAD83 (Meters)

HG98030080.6

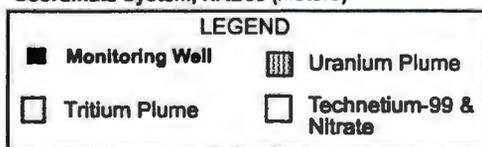


Figure 5-5. Existing Contaminant Plumes in the Vicinity of the 324 Building.

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1

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6.0 CLOSURE STRATEGY AND PERFORMANCE STANDARDS

This chapter discusses the closure strategy and performance standards that will be used to close the 324 REC HLV/LLV.

Because of the complexity and significant radiological contamination of the 324 Building closure unit, closure actions will be closely integrated with the overall facility deactivation activities. This integration process is described in detail in Chapter 1.0, Section 1.5. The approach illustrated in Chapter 7.0 provides a mechanism for quickly and efficiently addressing issues as they arise during the implementation of closure activities, to minimize the overall impact to the closure schedule. This approach to contingency planning may lead to amending the closure plan and is discussed in greater detail in Chapter 7.0, Section 7.8. This approach provides a proactive method for identifying, evaluating, and acting on necessary changes that could affect closure activities. Such changes could occur, based on changing site conditions that affect personnel protection and safety, nuclear safety, waste generation rates, and/or technology limitations or advances. These changing site conditions will become apparent as work progresses and individual closure actions are accomplished.

6.1 Closure Strategy

Closure actions described in the following sections will involve the storage and treatment of dangerous waste during the waste removal and decontamination steps. After the areas within the 324 Building have been closed, these areas will no longer be used for treatment and storage of dangerous waste. However, these areas may be used as necessary to support deactivation activities. These potential future uses could include nondangerous waste activities and generator status dangerous waste activities.

After final building disposition, the appearance of the land where the 324 Building is located will be consistent with the appearance and future use of the surrounding land areas. The 324 Building will remain at the site until final disposition is determined and implemented. Future land use decisions will be considered during the 324 Building decommissioning process. The final disposition of the building and the appearance and use of the land areas will be integrated with the surrounding 300 Area.

The closure performance standards and closure activities for each of the closure areas and components are described in the following sections. Table 6-1 provides a summary of these standards and actions for each closure area. The closure actions follow the overall logic provided in the closure strategy flow diagrams (Figures 6-1 through 6-5). Figure 6-1 provides the closure strategy for the areas in which nonpermitted TSD operations occurred, beginning with waste removal and ending with integrity assessments to demonstrate that no leaks occurred from these units to the underlying soil. Figure 6-2 provides the closure strategy for the piping systems associated with the TSD operations and the support areas. Figure 6-3 describes the strategy for

1 conducting cell and vault liner integrity assessments. Figure 6-4 provides the closure strategy for
2 dealing with new actions (scope) that might be required if dangerous waste contamination is
3 identified in new areas during execution of the closure actions. Figure 6-5 describes the closure
4 strategy for the soils and/or groundwater.
5

6 Clean closure will be pursued for the TSD portions of the 324 Building. If clean closure is
7 not attainable, then closure surveillance and maintenance will be implemented per Chapter 8.0.
8 The portions of the 324 Building comprising the closure unit include the REC (B-Cell, D-Cell,
9 airlock, pipe trench, cell cubicles, and pass-through ports); HLV and tanks; LLV and tanks;
10 piping; and associated building areas (HLV sample room, EDL-146, truck lock, cask handling
11 area, galleries, and room 18).
12

13 Future actions for building areas outside the closure unit boundary (as defined in Chapter
14 2.0) or within the boundary (with respect to contamination that was not a result of use of these
15 areas for treatment or storage of dangerous waste) are outside the scope of this closure plan and
16 will be performed as part of the building deactivation process. Components which meet the
17 closure requirements but may have residual radiological contamination (e.g., liners, embedded
18 piping, structures, etc.) will be formally disposed during building deactivation on final
19 building D&D.
20

21 After the waste inventory and equipment is removed, closure of the REC, HLV and LLV,
22 piping, and miscellaneous areas will be accomplished by decontamination, using alternative
23 treatment standards for hazardous debris (as promulgated by EPA in the August 18, 1992,
24 Federal Register [57 FR 37194]) as necessary, and demonstrating that these components meet the
25 closure performance standards.
26

27 In addition to the actions described above, the closure of this unit will be completed by
28 demonstrating (through performing integrity assessments) that the liners, and/or piping had kept
29 dangerous waste contaminants generated or managed as a result of nonpermitted TSD activities
30 from reaching the soil. Unless assessments identify conditions that indicate containment failure
31 and a subsequent potential for soil contamination from the identified nonpermitted TSD
32 operations, the soil would not be subject to closure. However, if inspections identify lack-of-
33 integrity cracks, investigation into potential soil contamination will be conducted. Based on
34 investigation results, an interim measure or CERCLA remedial action will occur with the
35 CERCLA remedial action process for the OU.
36

37 This chapter discusses the strategy for closure of the 324 REC/HLV. However, if a change
38 in strategy occurs before closure is completed and is agreed to and approved by Ecology, the
39 closure plan will be revised and the new strategy will be employed and documented as described
40 in Chapter 7.0, Section 7.8.
41

6.2 Closure Performance Standards

Closure, as provided for in this plan, will be conducted in accordance with WAC 173-303-610. For all structures, equipment, bases, liners, etc., clean closure standards are set by Ecology on a case-by-case basis in accordance with the closure performance standards of WAC 173-303-610(2) and in a manner that minimizes or eliminates postclosure escape of dangerous waste constituents. Closure performance standards require the owner or operator to close the building in a manner that: minimizes the need for further maintenance; controls, minimizes, or eliminates (to the extent necessary to protect human health and the environment) postclosure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere; and return the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity. Closure performance standards for the actions proposed for each of the areas and components identified in the closure boundary are provided in the succeeding sections.

The primary closure standards for cell liners (left in place) and concrete (where applicable) are the decontamination standards for closure that are contained in the "Alternative Treatment Standards for Hazardous Debris." Materials are considered decontaminated if the materials: have been treated using an appropriate extraction or destruction technology as specified in the "Ecology Guidance for Clean Closure of Dangerous Waste Facilities" (Ecology 1994b); and in 40 CFR 268.45, meet the technology-specific performance, design, and/or operating standards; or, if intended for disposal, the materials do not exhibit a dangerous waste characteristic or criteria.

Visual inspections will be performed either through manned entries into the areas (if safety and radiological conditions allow) or by using remote video cameras. If remote cameras are used, the cameras must be capable of examining the entire surface of concern and must provide sufficient resolution to discern that the following performance criteria are met.

- Attainment of a clean metal debris surface using physical or chemical extraction technologies can be verified visually in accordance with the "treatment to clean debris surface" standard that states, "A clean debris surface means the surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no more than 5% of each square inch of surface area" (Ecology 1994b).
- Decontamination of concrete, per the 'Debris Rule' is based on a physical extraction method. The performance standard for physical extraction technologies is based on removal of the contaminated layer of debris. The physical extraction performance standard for concrete is removal of 0.6 centimeter of the surface layer and treatment to a clean debris surface as defined previously.

1
2 Closure performance standards for various components are discussed in the following
3 sections.
4

5 **6.2.1 Radiochemical Engineering Cells**

6
7 The closure strategy for the REC Cells is provided in a logic flow diagram (Figure 6-1).
8

9 **6.2.1.1 A-Cell**

10
11 A-Cell was not used for TSD activities; therefore, there are no specific closure activities
12 required. However, piping between B-Cell and the HLV tanks passes under A-Cell in a crawl
13 space and piping will be removed or isolated as described in Section 6.2.3. Closure of the soils is
14 addressed in Section 6.2.5.
15

16 **6.2.1.2 B-Cell**

17
18 Components requiring closure within B-Cell include the cell contents (excess equipment,
19 debris, and dispersibles) and the liner. The concrete may require closure if liner integrity is not
20 proven. The following closure activities must be performed to close B-Cell.

- 21 • All dangerous and mixed waste inventory will be removed.
- 22 • All in-cell excess equipment will be removed, designated, and disposed.
- 23 • Piping will be closed as described in Section 6.2.3.
- 24 • A stepwise process for determining the integrity of the B-Cell stainless steel liner
25 following the removal of dispersible and equipment from the cell will be used
26 (Figure 6-3). If the proposed process proves untenable, alternatives will be proposed
27 and change to the approved closure plan requested as described in Section 7.8. Initial
28 examination of the cell liner will utilize two independent inspection methods.
29 Following analysis of data from these methods, more detailed nondestructive
30 examination will be used to further characterize areas that are suspected to have liner
31 flaws or damage. The following process will be employed:
32
33 - Perform a total visual inspection of the liner using camera equipment with
34 sufficient resolution to view surface stains or discoloration and gross surface
35 flaws or damage. A coordinate system will be established to reference the video
36 data. The inspection will include all surfaces of the walls and floor, including
37 wall penetrations.
38
39
40
41

- 1
- 2 - Perform an inspection of the liner (minimum 1 meter above the floor) using the
- 3 'Gamma Camera System.' The 'Gamma Camera System' is a gamma radiation
- 4 detection instrument that displays data in two dimensions. A coordinate system
- 5 will be established to reference the video data.
- 6
- 7 - Analyze the results of both examinations.
- 8
- 9 - Identify suspect areas.
- 10
- 11 - In suspect areas identified by one or both of the visual and Gamma camera
- 12 methods, verify or negate the presence of a liner breach using an independent
- 13 inspection technique. The independent technique will involve one or more
- 14 nondestructive examination methods, such as (1) dye penetrant testing, (2) eddy
- 15 current testing, or (3) ultrasonic testing.
- 16
- 17 - Seal identified suspect flaws and defects to prevent the escape of decontamination
- 18 fluids.
- 19
- 20 • The liner will be decontaminated using method(s) specified in the Alternative
- 21 Treatment Standards for Hazardous Debris. For metal surfaces, chemical or physical
- 22 extraction techniques will be used; for concrete surfaces, physical extraction will be
- 23 used. The best available decontamination method, or combination of methods, will be
- 24 selected for the cleaning of the liners and other surfaces. As the cleaning of the
- 25 interior surface is for both the closure of the unit and the deactivation of the building,
- 26 the selection of decontamination methods and techniques must consider the following
- 27 criteria: (1) the chemical and radiological nature of the residual contamination, (2) the
- 28 effectiveness of the technique (decontamination factor), (3) personnel protection,
- 29 (4) waste minimization, (5) protection of the environment, (6) ease of use, (7) support
- 30 equipment requirements, and (8) costs.
- 31
- 32 • The stepwise process for determining the integrity of the B-Cell stainless steel liner
- 33 will continue, following decontamination to the Alternative Treatment Standards for
- 34 Hazardous Debris (Figure 6-3). Assessment of the cell liner will use two independent
- 35 inspection methods. Following analysis of the data from these methods, more detailed
- 36 nondestructive examination will be used to further characterize areas that are suspected
- 37 to have liner flaws or damage. The following process will be employed:
- 38
- 39 - Perform cell inspection with 'Gamma Camera System' (minimum 1 meter above
- 40 the floor) and around all cell penetrations.
- 41
- 42 - Verify the defect areas by additional visual and approved nondestructive
- 43 examination methods, as described previously for the initial assessments.
- 44

1 - If a liner breach is identified, remove, designate, and dispose the affected portions
2 of the liner.

- 3
- 4 • Visual inspection of the liner and/or concrete will be performed and compared to the
5 'debris rule' performance standard as a clean closure performance standard.
 - 6
 - 7 • Decontamination of the liner and concrete will be repeated, as necessary, and re-
8 examined visually until the performance standard is met. If decontamination of the
9 liner is not possible or if the liner has failed, the affected portions of the liner will be
10 removed and decontamination of the base concrete surface will be performed as
11 described previously.
 - 12

13 6.2.1.3 C-Cell

14 C-Cell was not used for the TSD activities; therefore there are no specific closure activities
15 required.
16
17

18 6.2.1.4 D-Cell

19
20 General closure activities for the REC D-Cell will be as follows:

- 21
- 22 • Remove, designate, and dispose of all HLV clean-out equipment, associated utilities,
23 and residual waste (after the equipment and materials are no longer being used to
24 support the closure and deactivation activities).
- 25
- 26 • Close piping as described in Section 6.2.3.
- 27
- 28 • Visually inspect the portions of the cell that were used to manage dangerous waste
29 (i.e., mixed waste storage and treatment areas) to determine if there is any evidence of
30 spills, discoloration, or other indications of dangerous wastes.
- 31
- 32 - If no dangerous waste contamination is evident, D-Cell will be considered clean
33 closed.
- 34
- 35 • If dangerous waste contamination potentially is present, perform the following
36 additional actions:
 - 37
 - 38 - Visual inspection of the walls and floors for obvious breaches or cracks. If such
39 breaches are identified, the affected portions of the liner will be removed,
40 designated, and disposed. Radiological and waste management considerations may
41 require the liner to be decontaminated (as described in the following bullet) before

1 removal. In this case any breaches or cracks must be filled to prevent the escape of
2 decontamination fluids under the liner.

- 3
4 - Decontamination of the liner and/or concrete, conducting integrity assessments,
5 and performing visual inspections in the same manner as specified for B-Cell
6 (Section 6.2.1.2).
7

8 **6.2.1.5 Airlock**

9
10 The closure component for the airlock is the dangerous waste piping. Dangerous waste
11 piping will be closed in accordance with the closure standards discussed in Section 6.2.3.
12

13 **6.2.1.6 Pipe Trench**

14
15 Components requiring closure within the pipe trench include the piping in the trench, any
16 potentially mixed waste debris in the trench, and potentially the concrete. The following closure
17 activities must be performed to close the pipe trench.
18

- 19 • All debris and sludge will be removed, designated and disposed.
20
21 • Piping will be closed as described in Section 6.2.3.
22
23 • If dangerous or mixed waste was present in the pipe trench, the following additional
24 actions will be performed:
25
26 - Perform visual inspection of the sides and bottom for obvious breaches or cracks.
27 If such breaches are identified, the affected portions of the liner will be removed,
28 designated, and dispositioned. The liner will be decontaminated (as described in
29 the following bullet) prior to removal (in the same manner described for B-Cell,
30 Section 6.2.1.2). In this case any breaches or cracks will be filled to prevent the
31 escape of decontamination fluids under the liner.
32
33 - Decontaminate the pipe trench in the same manner described for B-Cell
34 (Section 6.2.1.2).
35
36 - Conduct an integrity assessment (in the manner described for the B-Cell) of the
37 pipe trench to identify cracks and potential pathways for dangerous waste to the
38 concrete and soil (Section 6.2.1.2).
39
40 - Perform visual inspection of the liner and/or concrete and compare to the 'debris
41 rule' performance standard as a clean closure performance standard (in the manner
42 described for B-Cell, Section 6.2.1.2).

- 1
2 - Repeat decontamination of the liner and concrete as necessary and visually re-
3 examine until the performance standard is met. If decontamination of the liner is
4 not possible or if the liner has failed, the affected portions of the liner will be
5 removed and decontamination of the base concrete surface will be performed (in
6 the manner described for B-Cell, Section 6.2.1.2).
7

8 **6.2.1.7 Other Radiochemical Engineering Cell Components**

9
10 The closure component for the cell cubicles and pass-through ports is the dangerous waste
11 piping. Dangerous waste piping will be closed in accordance with the closure standards
12 discussed in Section 6.2.3.
13

14 **6.2.2 High-Level Vault and Low-Level Vault**

15
16 The tanks within the HLV and LLV will be removed and disposed. Current planning
17 assumes such actions are possible. However, because of the high-radiation levels associated with
18 the tanks, alternative removal methods and/or closure actions may be required. Chapter 7.0
19 provides a process for contingency planning that will be used to deal with changing conditions as
20 they develop.
21

22 The HLV will be opened and the tanks will be removed. The LLV and tanks will remain
23 operational, as necessary, to support closure deactivation activities, and then will be removed and
24 disposed to achieve closure. The closure schedule is provided in Chapter 7.0, Section 7.7. The
25 closure strategy for the HLV and LLV is provided in Figure 6-1.
26

27 The vault liners will remain in place if the integrity assessments show no potential for loss
28 of containment. This will allow the ultimate removal of the vaults to coincide with the later
29 decommissioning of the entire building. If a loss of containment is indicated, the vault liners will
30 be removed and the debris rule standards will be met for the concrete as part of the closure
31 actions.
32

33 **6.2.2.1 High-Level Vault**

34
35 Components requiring closure within the HLV include the vault contents (tanks, ancillary
36 equipment, piping, and residual wastes), the liner, and potentially the concrete. Following are
37 the closure activities for the HLV:
38

- 39 • Any remaining dangerous and mixed waste inventory (i.e., tank heels) will be
40 removed. The mixed waste tank liquid inventory that was removed in 1996 as part of
41 the 324 HLV interim waste removal action is described in Chapter 3.0, Section 3.3.1.5.

- 1
- 2 • The vaults will be opened (cover blocks will be removed).
- 3
- 4 • The tanks and ancillary equipment will be removed; size reduced as necessary;
- 5 designated as waste; and disposed at an appropriate waste management and/or TSD
- 6 unit.
- 7
- 8 • Piping will be closed as described in Section 6.2.3.
- 9
- 10 • Preliminary visual inspection will be performed on the walls and floor of the vault for
- 11 obvious breaches or cracks. If such breaches are identified, the affected portions of the
- 12 liner will be removed, designated, and disposed. Radiological and waste management
- 13 considerations may require the liner to be decontaminated (as described in the
- 14 following bullet) before removal. In this case, any breaches or cracks must be filled to
- 15 prevent the escape of decontamination fluids under the liner.
- 16
- 17 • Walls and floor of the vault will be decontaminated using a method(s) specified in the
- 18 Alternative Treatment Standards for Hazardous Debris Rule.
- 19
- 20 • The liner will be inspected for cracks and potential pathways for dangerous waste to
- 21 reach concrete and soils. Integrity assessment will be performed in the same manner
- 22 specified for B-Cell (Section 6.2.1.2).
- 23
- 24 • Visual inspection will be performed on the liner and/or concrete and will be compared
- 25 to the 'debris rule' performance standard as a clean closure performance standard in the
- 26 same manner described for B-Cell (Section 6.2.1.2).
- 27
- 28 • Decontamination of the liner and concrete will be repeated, as necessary, and will be
- 29 re-examined visually until the performance standard is met. If decontamination of the
- 30 liner is not possible or if the liner has failed, the affected portions of the liner will be
- 31 removed and decontamination of the base concrete surface will be performed as
- 32 described previously.
- 33
- 34 • Potentially contaminated soils (if present) will be closed as described in Section 6.2.5.
- 35

36 **6.2.2.2 Low-Level Vault**

37
38 Components requiring closure within the LLV include the vault contents (tanks, ancillary
39 equipment, piping, and residual waste), the liner, and potentially the concrete. The closure
40 activities planned for the LLV are the same as those required for the HLV (Section 6.2.2.1), from
41 tank and waste removal through vault decontamination, integrity assessments, and liner removal,
42 if needed.
43

1 **6.2.2.3 Sample Room (Room 145)**
2

3 The closure component for the sample room (room 145) is the dangerous waste piping.
4 Dangerous waste piping will be closed in accordance with the closure standards discussed in
5 Section 6.2.3.
6

7 **6.2.3 Piping Systems**
8

9 Components requiring closure within the piping system include all piping runs used to
10 carry dangerous wastes between the REC Cells and vault tanks. The closure strategy for the
11 piping system is provided in Figure 6-2. Following are the closure activities for the piping
12 system:
13

- 14 • Identify piping that could have transported dangerous waste. Only piping that
15 transported dangerous waste to or from an area within the closure boundary is within
16 the scope of this closure plan.
- 17
- 18 • Decontaminate piping using a chemical extraction method(s) specified in the
19 Alternative Treatment Standards for Hazardous Debris Rule.
- 20
- 21 • Remove accessible piping in vaults and cells.
- 22
- 23 • Perform piping integrity test (i.e., pressure testing and visual inspections) on pipe runs
24 to determine if there is a potential for soil contamination from the piping. If pipe
25 integrity cannot be demonstrated, a plan will be prepared to determine dangerous waste
26 constituents and paths (Figure 6-3).
- 27
- 28 • Eventually, the closure process will lead to removal of all accessible piping, which is
29 proposed as the ultimate disposition per the closure schedule (Chapter 7.0,
30 Section 7.7). The sequence of piping removal will be closely integrated with all
31 closure and deactivation activities so that piping needed to support closure and
32 decontamination operations is left in place until such operations are completed. The
33 piping then would be removed. The closure performance standard shall be the
34 removal of all reasonably accessible ancillary equipment and piping. Such piping will
35 be removed and size reduced, and the resulting waste will be designated and sent to an
36 appropriate waste management or TSD unit. The piping will be removed, except for
37 piping embedded in a wall or floor. Removed piping will be inspected visually to
38 assess the general condition of the piping and to determine the effectiveness of the
39 decontamination flushes. Because the piping is stainless steel and the process fluids
40 generally were acidic solutions, it is believed that the piping will be clean and free of
41 visible obstructions or contamination.
42

- 1 - For the limited amount of piping that feasibly cannot be removed, conduct a final
2 rinse and collect the first two liters of rinsate for sampling. Collect the remainder
3 of the rinsate for disposal.
- 4
- 5 - Sample and analyze the rinsate. Designate and dispose of the rinsate at an
6 appropriate waste management or TSD unit. Repeat the flushing, sampling, and
7 analysis until the rinsate no longer designates as dangerous waste per WAC 173-
8 303. The lines will be considered clean closed.
- 9
- 10 - If it is not possible to completely remove all dangerous wastes from the remaining
11 piping and meet the performance standard, it will be necessary to immobilize the
12 pipes by using a sealing or encapsulation technology specified in the Alternative
13 Treatment Standards for Hazardous Debris Rule. The performance standard will
14 be to use a sealant that “avoids exposure of the debris surface to potential leaching
15 media and must be resistant to degradation by the debris and its contaminants and
16 materials into which it may come in to contact after placement” (40 CFR 268.45).
17 As a result of such action, it will be necessary to document the location and
18 condition of all such piping runs to ensure that the piping is disposed at an
19 appropriate TSD unit when removed during final decommissioning activities. In
20 addition, limited surveillance and maintenance activities will be necessary to
21 ensure the status of the piping does not change during the time pending final
22 removal.
- 23
- 24 - Isolate (crimp or blank) piping where practical.
- 25
- 26 • Potentially contaminated soils (if present) will be closed as described in Section 6.2.5.
- 27

28 **6.2.4 Other 324 Building Areas within the Closure Boundary**

29
30 General closure activities for the miscellaneous associated building areas will be to
31 decontaminate, remove, and/or isolate (crimp or blank) all piping runs that were used to carry
32 dangerous waste between the REC Cells and vault tanks. The closure strategy for the piping
33 system is provided in Figure 6-2 and is described in detail in Section 6.2.3.

35 **6.2.4.1 Cask Handling Area**

36
37 The cask handling area was not used for TSD activities; therefore there are no specific
38 closure activities required.

1 **6.2.4.2 Truck Lock**

2
3 The closure component for the Truck Lock is the dangerous waste piping. Dangerous
4 waste piping will be closed in accordance with the closure standards discussed in Section 6.2.3.
5

6 **6.2.4.3 Engineering Department Laboratory-146**

7
8 The closure component for the EDL-146 is the dangerous waste piping. Dangerous waste
9 piping will be closed in accordance with the closure standards discussed in Section 6.2.3.
10

11 **6.2.4.4 Operating Galleries**

12
13 The closure component for the galleries is the dangerous waste piping. Dangerous waste
14 piping will be closed in accordance with the closure standards discussed in Section 6.2.3.
15

16 **6.2.4.5 Room 18**

17
18 The closure components for Room 18 are the dangerous waste piping and the
19 potential concrete surrounding the B-Cell service plugs. General closure activities for Room 18
20 will be as follows:

- 21
- 22 • Close dangerous waste piping in accordance with the closure standards discussed in
23 Section 6.2.3.
 - 24
 - 25 • Visually inspect the portion of Room 18 adjacent to the B-Cell service plugs that have
26 a history of leaks to determine if there is any evidence of further spills, discoloration,
27 or other indications of hazardous wastes.
 - 28
 - 29 - If no dangerous waste contamination is evident, Room 18 will be considered clean
30 closed.
 - 31
 - 32 • If dangerous waste contamination is potentially present, perform the following
33 additional actions:
 - 34
 - 35 - Prepare a sampling and analysis plan to determine the nature and extent of
36 dangerous waste contamination.
 - 37
 - 38 - Decontaminate the affected concrete in the same manner specified for B-Cell
39 (Section 6.2.1.2) to meet the debris rule performance standard.
40

1 **6.2.5 Underlying Soils and Groundwater**

2
3 The closure strategy for the soils and/or groundwater potentially contaminated with
4 dangerous wastes from TSD operations is provided in Figure 6-5. The following closure
5 activities will be performed to close the unit with respect to soils and groundwater:
6

- 7 • Identify if soils are potentially contaminated with dangerous wastes from TSD
8 operations (based on liner/concrete and piping assessments).
- 9 • If potentially contaminated soils are identified for accessible areas, prepare a
10 sampling and analysis plan to define the nature and extent of dangerous waste
11 contamination.
- 12 • Clean closure standards for soil are the numeric cleanup levels calculated using the
13 residential exposure assumptions according to the Model Toxics Control Act
14 (MTCA) Method B (WAC 173-340). Where no cleanup values can be calculated
15 using MTCA Method B, the values in the MTCA Method A table can be used, as
16 appropriate.
- 17 • If no dangerous waste is found above MTCA levels, the area can be closed with
18 respect to the closure of this unit. If dangerous waste is identified above the standard,
19 the following actions will be taken.
 - 20 - If concentrations or conditions warrant an interim measure for soil removal, an
21 Interim Measures Plan will be prepared and submitted to ecology for the
22 removal.
 - 23
 - 24 - If an interim measure is not warranted, or if the potential dangerous waste
25 contamination is in an area that is not accessible (i.e., no crawlspace access), soil
26 investigations and remediation will be scheduled and coordinated with the
27 CERCLA operable unit, identifying the contaminants of concern, cleanup levels
28 and specifying RCRA as an ARAR. (Note: The current 300-FF-2 operable unit
29 remediation strategy is to use industrial cleanup standards [MTCA Method C]
30 consistent with the 300-FF-1 Final Record of Decision.)

1

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Table 6-1. Closure Performance Standards and Activities for Areas Undergoing Closure.

Area	Components	Closure Performance Standard	Closure Activities*
A-Cell	No closure activities required.	<ul style="list-style-type: none"> • Piping removed (under A-Cell). • Piping in place has been decontaminated and is physically isolated (blanked off/crimped) 	<p>Note:</p> <ul style="list-style-type: none"> • HLV piping in A-Cell crawl space will be removed and/or isolated as described for the piping system. • Closure of soil in the crawlspace below the piping is covered under Soil/Groundwater (below).
B-Cell	Cell contents (excess equipment, debris, and dispersibles), liner, and concrete (if required)	<ul style="list-style-type: none"> • Removal of all mixed waste and excess equipment • Inspect Liner for Containment • Implement Debris Rule Alternative Treatment Standards • Close B-Cell Based on Debris Rule 'clean debris surface' standard <p>Note: HLV piping in B-Cell will be removed and/or isolated as described for the piping system.</p> <p>Soil under B-Cell is covered under Soils/Groundwater (below).</p>	<ul style="list-style-type: none"> • In-cell excess equipment, debris, and dispersibles (including all mixed waste) will be removed • Decontaminate and inspect liner and concrete to meet debris rule. <p>Note: Integrity assessments performed to determine if a pathway to the soil exists.</p>
C-Cell	No closure activities required.	N/A	N/A
D-Cell	Waste container storage area; HLV liquid treatment process equipment area	<ul style="list-style-type: none"> • Removal of all mixed waste and equipment (Chapter 3.0, Section 3.3) • Inspect liner for containment • Implement Debris Rule alternative treatment standards (if needed) • Close D-Cell based on Debris Rule 'clean debris surface' standard <p>Note: HLV piping in D-Cell will be removed and/or isolated as described for piping system</p> <p>Soil under D-Cell is covered under Soil/Groundwater (below).</p>	<ul style="list-style-type: none"> • Document visual inspection of waste container storage area. • Document visual inspection of equipment area. • Remove all equipment following any use during closure activities. • Decontaminate and inspect liner and concrete to meet debris rule (if needed). <p>Note: In-cell HLV processing equipment and debris (including all mixed waste) will be treated to meet debris rule standards or will be handled as mixed waste.</p> <p>Integrity assessments will be performed to determine if a pathway to the soil exists.</p>

T6-1

<p>Airlock</p>	<p>Piping from HLV</p>	<ul style="list-style-type: none"> Remove or isolate piping. <p>Note: HLV piping in the airlock will be removed and/or isolated as described for the piping system.</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
<p>Pipe trench</p>	<p>Piping from HLV</p>	<ul style="list-style-type: none"> Remove or isolate piping. Removal of all mixed waste (if present) Inspect Pipe Trench for Containment Implement Debris Rule Alternative Treatment Standards (if needed) Close Pipe Trench Based on Debris Rule 'clean debris surface' standard <p>Note: HLV piping in the Pipe Trench will be removed and/or isolated as described for the piping system.</p> <p>Soil under the pipe trench is covered under Soils/Groundwater (below).</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) prior to blanking (isolation) Clean close remaining piping in place Isolate remaining piping Remove all waste/debris Decontaminate and inspect pipe trench and concrete to meet debris rule standards (if needed). <p>Note: In-cell debris will be designated and disposed of appropriately as either (mixed waste of low-level waste).</p> <p>Integrity assessments will be performed to determine if a pathway to the soils exist.</p>

Other REC components	Piping from HLV	<ul style="list-style-type: none"> Remove or isolate piping. <p>Note: HLV piping in the cell cubicles and pass-through ports will be removed and/or isolated as described for the piping system.</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
HLV	Four tanks, piping, liner, concrete	<ul style="list-style-type: none"> Removal of all mixed waste and equipment Inspect Liner for Containment Implement Debris Rule Alternative Treatment Standards Close HLV based on Debris Rule 'clean debris surface' standard <p>Note: HLV piping will be removed and/or isolated as described in piping system.</p> <p>Soil under HLV is covered under Soil/Groundwater (below).</p>	<ul style="list-style-type: none"> Tank heels, ancillary equipment, and the tanks will be removed Decontaminate and inspect vault liner and concrete to meet debris rule standards <p>Note: Integrity assessments performed to determine if a pathway to the soil exists.</p>
LLV	Four tanks, piping, liner, concrete	<ul style="list-style-type: none"> Removal of all potential mixed waste and equipment Inspect liner for containment Implement Debris Rule alternative treatment standards Close LLV based on Debris Rule 'clean debris surface' standard <p>Note: Low-level vault (LLV) piping will be removed and/or isolated as described for the piping system.</p> <p>Soil under the LLV is covered under Soil/Groundwater (below).</p>	<ul style="list-style-type: none"> Tank heels, ancillary equipment, and the tanks will be removed Decontaminate and inspect vault liner and concrete to meet debris rule standards <p>Note: Integrity assessments will be performed to determine if a pathway to the soil exists.</p>

HLV sample room (room 145)	Piping from HLV and LLV	<ul style="list-style-type: none"> Remove or isolate piping. <p>Note: HLV piping in the HLV sample room will be removed and/or isolated as described for the piping System.</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
Piping systems	Piping from REC Cells and the HLV and LLV	<ul style="list-style-type: none"> Remove all accessible piping Implement Debris Rule alternative treatment standards to clean piping Designate rinsate for dangerous waste to ensure removal Visually inspect accessible pipe runs to confirm clean debris standard is met 	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
Cask handling area	None	N/A	N/A
Truck lock	None	N/A	N/A
EDL-146	Piping from HLV and LLV	<ul style="list-style-type: none"> Remove or isolate piping. <p>Note: HLV/LLV piping in EDL-146 will be removed and/or isolated as described for the piping system.</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping

Galleries	Piping from HLV and LLV	<ul style="list-style-type: none"> Remove or isolate piping. <p>Note: HLV piping in the HLV sample room will be removed and/or isolated as described for the piping system.</p>	<ul style="list-style-type: none"> Remove all accessible piping Removed piping will be treated to meet the debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
Room 18	Piping from HLV/LLV and potentially contaminated concrete	<ul style="list-style-type: none"> Remove or isolate piping Prepare sampling and analysis plan (if needed) Implement debris rule alternative treatment standards (if needed) Close Room 18, based on debris rule 'clean debris surface' standard <p>Note: HLV/LLV piping in Room 18 will be removed and/or isolated as described for the piping system.</p>	<ul style="list-style-type: none"> Document visual inspection of Room 18, B-Cell service plug area Sample to define nature and extent of contamination Decontaminate and inspect concrete to meet debris rule (if needed) Remove all accessible piping Removed piping will be treated to meet the debris rule standards or will be handled as mixed waste Flush remaining piping Ensure remaining piping is free from liquids Sample piping (rinsate) before blanking (isolation) Clean close remaining piping in place Isolate remaining piping
Soil/Groundwater	Potentially contaminated soil	<ul style="list-style-type: none"> Localized soil contamination (if any) will be removed to clean closure standards. Wide-spread soil contamination will be coordinated with the soil and groundwater remediation planned for the CERCLA operable units. 	<ul style="list-style-type: none"> Integrity assessments will be used to define potentially contaminated soil. Potentially contaminated soil will be characterized to define nature and extent of contamination. Localized contamination will be removed and disposed of as mixed waste. For wide-spread contamination, a contaminant of concern list will be developed so that future CERCLA investigation and cleanup actions can be coordinated.

2 * Detailed description of the closure actions and activities are included in Chapter 7.0.

1

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Legend: CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
 D&D - Decontamination & Decommissioning
 Decon - Decontamination
 LLW - low level waste
 MW - mixed waste

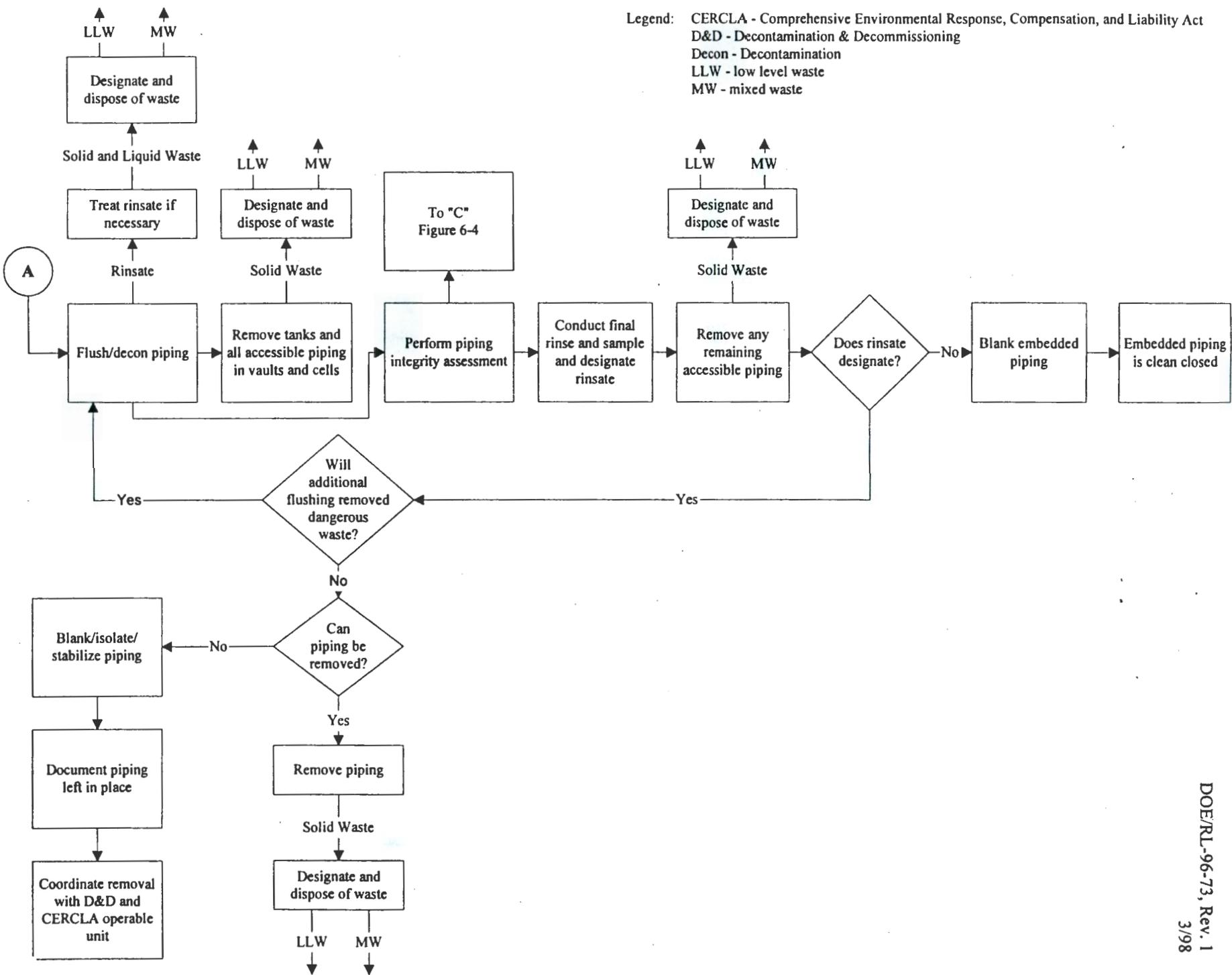


Figure 6-2. Closure Strategy Flowchart for Dangerous Waste Piping.

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Legend: ATS - Alternative Treatment Standards
Decon - Decontaminate
NDE - Non-Destructive Evaluation

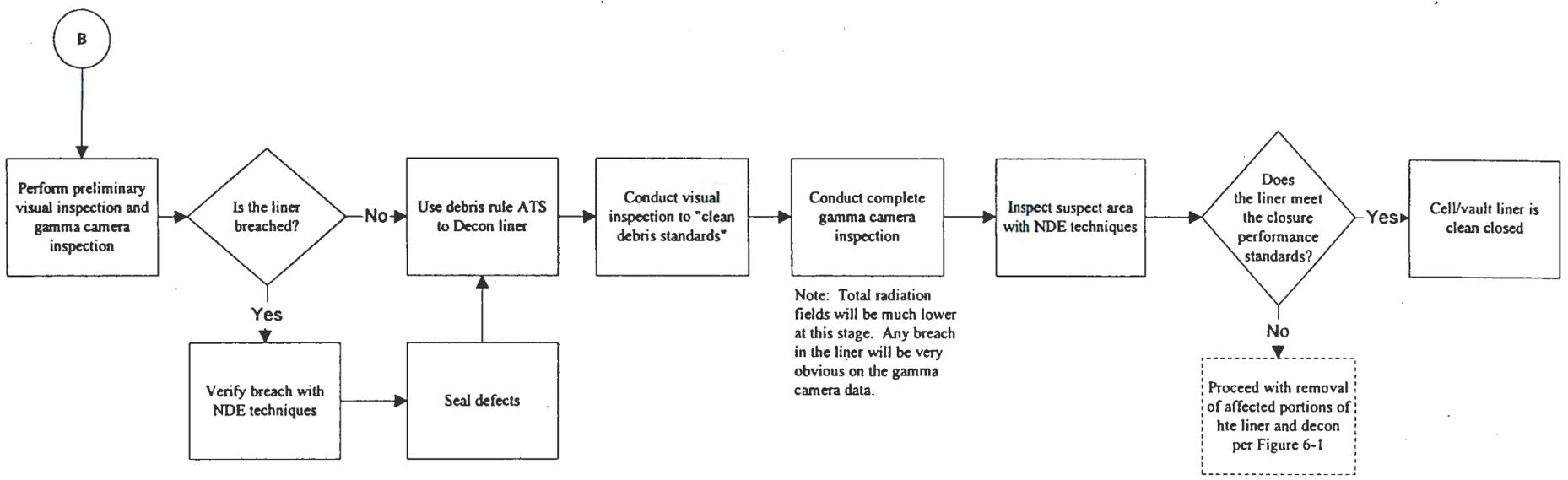


Figure 6-3. Closure Strategy Flowchart for Cell/Vault Liner Integrity Assessments.

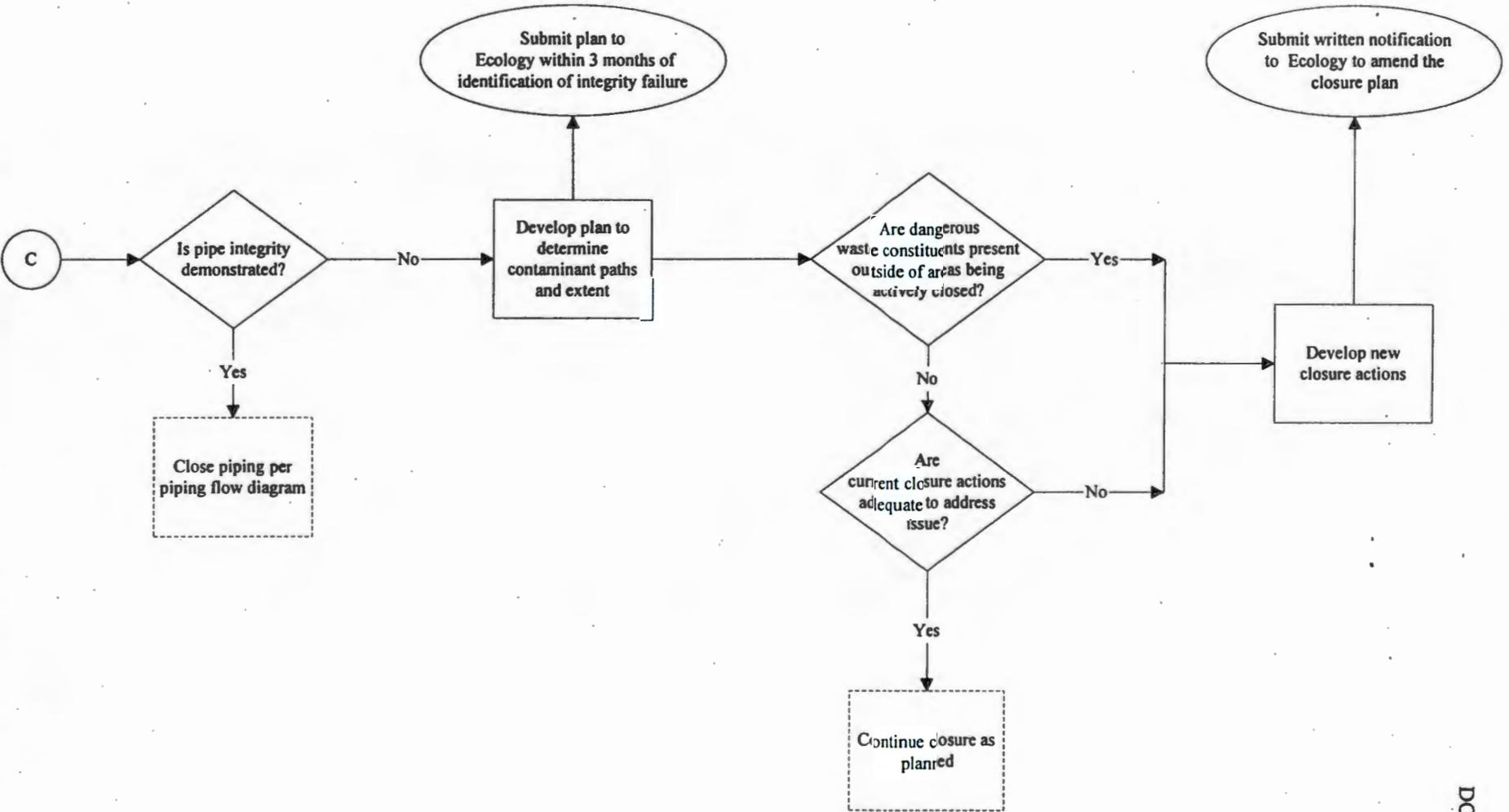


Figure 6-4. Closure Strategy Logic for Potential Releases from REC/HLV/LLV Dangerous Waste Piping.

Legend: CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC - Constituents of Concern
TSD - Treatment Storage and Disposal

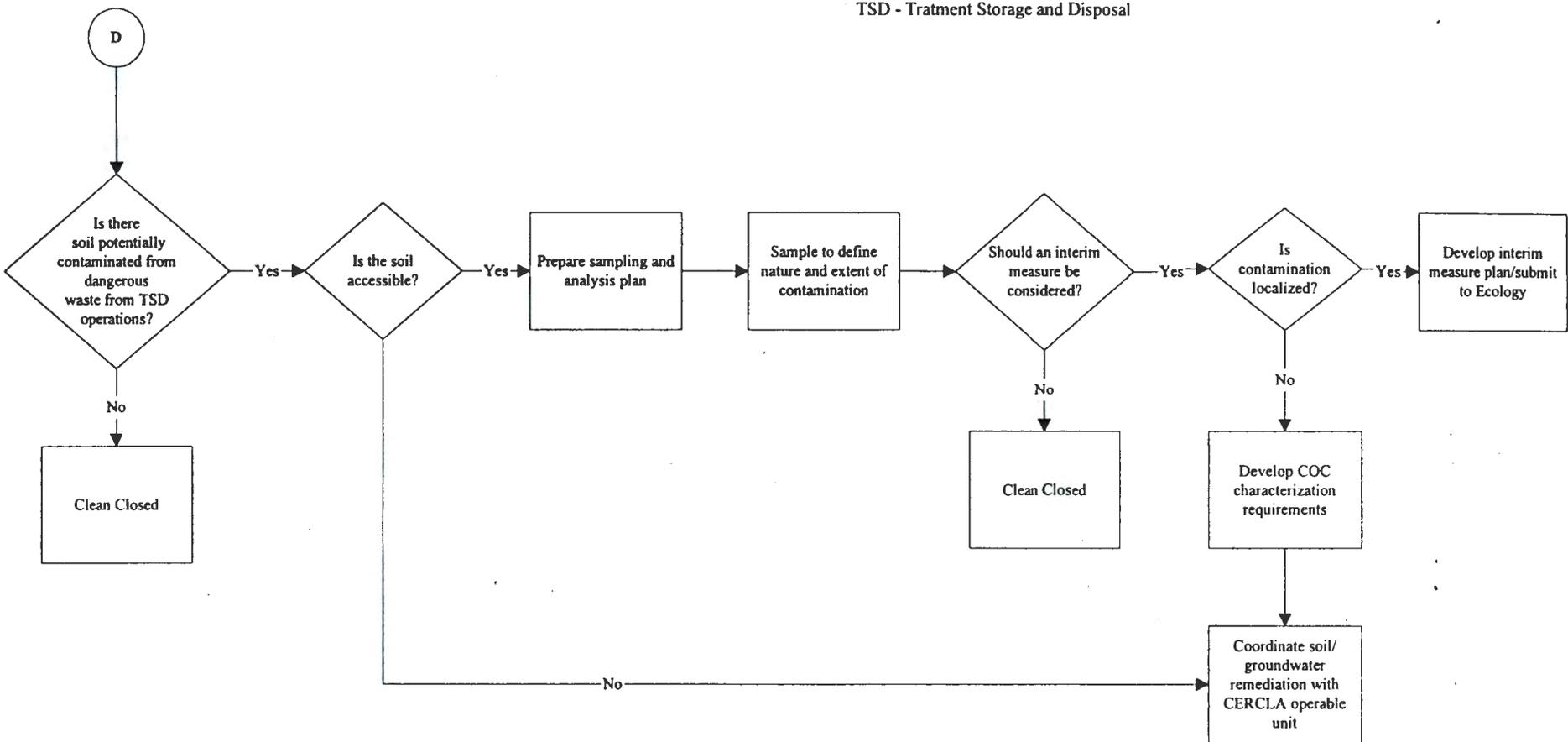


Figure 6-5. Closure Strategy Flowchart Soils/Groundwater.

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7.0 CLOSURE ACTIVITIES

Closure will be pursued for the TSD portions of the 324 Building. If closure to the planned closure performance standards is not attainable, closure surveillance and maintenance will be implemented in accordance with Chapter 8.0. This chapter discusses the activities that are necessary to implement this closure strategy. Figure 7-1 provides the approach for dealing with changing site conditions, including potential contingency plans.

Waste removal activities conducted, in accordance with the consent order of M-89-01 and M-89-02, are described in Chapter 3.0.

All work will be performed to maintain personnel exposure to dangerous and/or mixed waste, radioactivity, hazardous chemicals, or any other workplace hazard ALARA. Some work activities will be performed remotely because of ALARA concerns. Detailed records, including daily log books, and in some activities video logs, will be maintained for closure actions, including waste removal and management activities, component decontamination, and all other activities proceeding to closure of the unit.

Because of the complexity and significant radiological contamination of the 324 Building closure unit, closure actions will be closely integrated with the overall deactivation activities. This integration process is described in detail in Chapter 1.0, Section 1.5. The approach, illustrated in Chapter 7.0, provides a mechanism during the implementation of closure activities to quickly and efficiently address issues as they arise, thereby minimizing the overall impact to the closure schedule. This approach to contingency planning could lead to amending the closure plan discussed in greater detail in Section 7.7. This approach provides a proactive method for identifying, evaluating, and acting on necessary changes that could affect closure activities. Such changes could occur, based on changing site conditions that affect personnel protection and safety, nuclear safety, waste generation rates, and/or technology limitations or advances. These changing site conditions will become apparent as work progresses and individual closure actions are accomplished.

7.1 Closure Activities For Radiochemical Engineering Cells

The REC consists of the A-Cell, B-Cell, C-Cell, D-Cell, the airlock, the pipe trench, and the cell cubicles and pass-through ports. Closure of B-Cell, D-Cell, and potentially the pipe trench will entail cleaning to a clean debris surface standard as defined by the 'debris rule,' 40 CFR 268.45 (Chapter 6.0, Section 6.2.1). The airlock, cell cubicles, and pass-through ports will be closed by removing and/or isolating dangerous waste pipes from the HLV. A-Cell and C-Cell were not used for TSD activities, and therefore, no closure activities are identified for these areas.

1 **7.1.1 Closure Activities for A-Cell**

2
3 A-Cell was not used for TSD activities; therefore, there are no specific closure activities
4 identified for A-Cell in this closure plan.

5 **7.1.2 Closure Activities for B-Cell**

6
7 B-Cell Closure Activities include, (1) Removal of equipment and radiological
8 contaminated dispersible debris in B-Cell (2) B-Cell cleaning (decontamination to remove
9 residual material), (3) visual inspection of the floor and liner surface and integrity assessment of
10 the liner, and (4) if required, removal of the affected portions of the liner and concrete
11 remediation. Decontamination waste will be collected, designated, and managed as described in
12 Section 7.6.

13
14 If the integrity assessments demonstrate that B-Cell met the performance standards
15 specified in Chapter 6.0, Section 6.2.1.2 (i.e., activities did not cause liquid waste leakage to the
16 environment), B-Cell will be considered closed and it will be concluded that the underlying soil
17 and groundwater were not adversely impacted by the waste treatment and storage activities
18 covered by this closure plan and the underlying soil will not be included as part of this closure.
19 However, if cracks are found in the liner and the concrete that might have resulted in
20 contamination of the soil, any necessary soil characterization and potential cleanup will be
21 coordinated with the CERCLA remedial action process for the OU as described in Section 7.5
22 and Chapter 8.0, Section 8.3.

23
24 **7.1.2.1 B-Cell Equipment and Waste Removal**

25
26 The B-Cell waste removal activities include removing and disposing of the equipment and
27 racks within B-Cell, including handling equipment, such as cell bridge cranes and in-cell ends of
28 the manipulators; and solid waste collection vessels, such as 208-liter waste containers; Tank
29 119, and engineered containers. Equipment and racks are rinsed as appropriate to remove
30 dispersible material, size reduced, and loaded into steel liners. The liners are filled with grout
31 before disposal as Contact-Handled Category 3 LLW (DOE Order 5820). Some material will
32 require disposal as SCW because of anticipated high dose rates that put the waste outside of
33 conventional disposal pathway parameters. (SCW is waste that does not have an identified
34 management pathway for removal from the 324 Building and other 300 Area facilities, such as
35 collected dispersible radioactive materials, remote-handled transuranic materials, and items that
36 exceed LLW Category 3 radiological limits.)

37
38 After equipment racks are removed, the potentially dispersible material on the floor is
39 collected and containerized. This material, which is considered mixed waste and special-case
40 waste, is sampled, characterized, and removed from B-Cell to an appropriate TSD unit.

1 Closure of dangerous waste issues associated with B-Cell requires removal of materials and
2 equipment from B-Cell. Most of the material and equipment in the cell, with the exception of
3 process auxiliary tanks and piping systems, are not dangerous waste or dangerous waste
4 components. Effective mitigation of dangerous waste hazards in B-Cell depends upon
5 completion of the waste removal activities.

6 **7.1.2.2 B-Cell Cleaning**

7
8 The B-Cell cleaning task includes activities required to decontaminate internal surfaces to
9 meet the criteria for deactivation and closure. There are four primary cleaning methods that
10 could be used to clean the surface of B-Cell: (1) wet wipe down of walls and floors, (2) dry
11 alkaline foam wash, (3) water wash and hot spot cleaning, and (4) oxidation coating removal
12 using chemical extraction processes. Each of these methods are addressed in the Alternative
13 Treatment Standards for Hazardous Debris, chemical extraction technologies. Each method or
14 process could be used more than once or discontinued if proven ineffective. In addition, other
15 methods included under the Alternative Treatment Standards for Hazardous Debris (such as
16 abrasive blasting or high pressure steam and water sprays) also might be considered if shown to
17 be advantageous from an effectiveness, personnel protection, or waste minimization standpoint
18 (refer to Chapter 6.0, Section 6.2.1.2).

19
20 To minimize the potential for contamination to migrate during the liquid decontamination
21 activities, all liner penetrations will be sealed. As described in Chapter 6.0, Section 6.2.1.2, a
22 preliminary liner assessment will be performed prior to cell cleaning. Liquid pathways from the
23 cell through access doors will be sealed. Shields will be put in place over the ventilation ducts to
24 prevent migration of cleaning fluids into the exhaust system. Preparation activities will include
25 the remote installation of a submersible pump in the sump (located in the northeast corner of the
26 cell), and the necessary piping to allow transport of liquid from the sump to a temporary shielded
27 processing system or to a liquid waste treatment system installed in D-Cell. This
28 pump/processing system will be used as required for all cleaning steps. Solid waste produced
29 (i.e., metal filters and ion exchange columns) will be appropriately designated and disposed. The
30 treated waste water will be transferred to the loadout station and transported via tanker truck to
31 the DST system or other appropriate liquid waste management system. After all decontamination
32 washes are complete, the tanks and piping of the treatment system will be rinsed with water to
33 remove residual decontamination solutions. When no longer needed to support closure activities
34 or to potentially process decontamination fluids from the other areas, this equipment will be
35 removed, designated, and disposed (Section 7.1.4).

36
37 As a general rule, if physically possible, all cleaning operations will start at the top of the
38 cell (assumed area of lowest contamination) and work towards the floor (assumed area of highest
39 contamination).

1 **7.1.2.3 B-Cell Floor Liner Inspection**

2
3 After B-Cell has been decontaminated per the debris rule alternative treatment standards,
4 the cell liner will be inspected to determine whether the surface meets the closure performance
5 standard for metal surfaces and concrete characterized as a 'clean debris surface' (Chapter 6.0,
6 Section 6.2.1). This inspection could be conducted using a remote camera (if ALARA planning
7 makes it necessary) by using commercially available closed-circuit television (CCTV). If it is
8 not possible to meet the closure performance standard (Chapter 6.0), the affected portions of the
9 liner will be removed, designated, and appropriately disposed. The inspections for a clean debris
10 surface will be documented on an inspection checklist similar to Figure 7-2.

11
12 Visual inspection also will be used to identify cracks in the liner. In addition to visual
13 inspection at least one of following techniques, [eddy current, high-resolution gamma surveys
14 (gamma camera), or ultrasonic] will be used to assess the integrity of the liner. It is likely that a
15 combination of these techniques will be used (based on the conditions of the cell liner and
16 personnel safety/exposure considerations) in the conduct of the integrity assessment. An
17 evaluation will be performed to select the appropriate NDE technique(s) for the condition of the
18 surface and to meet the closure performance criteria (Section 6.2.1.2).

19
20 Any cracks or breaches in the integrity of liner will be noted in log books, will be
21 identified as to location and size on sketches, and will be documented on video and still camera
22 photographs.

23
24 Liquid penetrant testing could be used to detect defects that break the surface of the
25 B-Cell liner. Liquid penetrant testing is used to reveal such defects as cracks, laminations, laps,
26 and zones of surface porosity. To achieve good visibility, the liquid is colored with a bright and
27 persistent (usually red) dye or tagged with a fluorescent marker. This method has been proven to
28 be effective in C-Cell decontamination (Chapter 3.0, Section 3.1.3) when liquid-penetrant testing
29 revealed that no macroscopic cracks breached the liner, but it did show that pitting had occurred.
30 However, in C-Cell the method did not require remote operation. Personnel were able to enter
31 C-Cell. B-Cell activities will likely require remote operation of the testing equipment and
32 materials.

33
34 Potential assessment techniques include ultrasonic testing, two dimensional gamma
35 surveys, and electrical eddy current analysis. Ultrasonic inspection should detect internal defects
36 and small surface cracks. A transducer introduces an ultrasonic impulse to the substance being
37 tested, and then measures the return signal to detect discontinuities in the material. The nature of
38 the discontinuity is related directly to the differences between in the initial and measured signals.

39
40 Gamma surveys (gamma camera) have the ability to detect gamma radiation from
41 contamination that would have migrated through and accumulated in a crack in the liner or below
42 the liner. The gamma camera provides a two dimensional picture of gamma energy intensities.
43 Local area (hot spots) of higher intensity are easily seen in an area of generally lower intensities.
44

1 Electrical eddy currents can be induced in a material and an assessment of the effects can
2 lead to conclusions concerning the nature and condition of the material being examined. Eddy
3 current has been used remotely and in high-radiation areas.
4

5 If the liner meets the closure performance standard, B-Cell will be clean closed.
6 Documentation of this assessment will include an independent professional engineer or
7 equivalent certificate of integrity assessment completion. If visual inspection and/or integrity
8 assessment indicates a possible crack in the liner, the affected portions of the liner will be
9 removed. As a minimum at least one square meter of the liner will be removed surrounding any
10 liner breach.
11

12 **7.1.2.4 Remove the Affected Portions of the Liner and Remediate Concrete Surfaces** 13 **(Contingency Plan)**

14
15 If defects, cracks, or penetrations are present in the liner, the affected portions of the liner
16 will be removed, designated, and disposed. The floor liner will be removed in pieces appropriate
17 for packaging as waste material. At least one square meter of the liner will be removed
18 surrounding any liner breach. The floor liner will be cut with a plasma arc, mechanical saws, or
19 other cutting tool, and will be removed by shearing the anchors from their embedments.
20

21 After the affected portions of the liner are removed and properly managed and disposed of,
22 the concrete will be decontaminated using a physical extraction technique specified in the
23 Alternative Treatment Standards for Hazardous Debris (e.g., scabbling). After treatment, internal
24 surfaces will be inspected against the closure performance standard through a visual inspection.
25 If the cell meets these standards, B-Cell can be clean closed. If the concrete floor cannot meet
26 the performance standards, the soil is potentially contaminated with dangerous waste and will
27 managed in accordance with Section 7.5.
28

29 **7.1.3 Closure Activities for C-Cell**

30
31 C-Cell was not used for TSD activities; therefore, there are no specific closure activities
32 identified for C-Cell in this closure plan.
33

34 **7.1.4 Closure Activities for D-Cell**

35
36 The initial step for closure of D-Cell will be removal of the waste inventory and the
37 equipment used for the processing of the HLV tank liquid waste.
38

39 The HLV liquid waste treatment equipment has been emptied and rinsed. The equipment
40 in D-Cell will remain operable for possible use in treating REC and HLV/LLV decontamination
41 solutions. After decontamination activities are complete, or as soon as it is determined that this

1 equipment is no longer needed (as shown on the closure schedule, Section 7.7) to support closure
2 activities or to potentially process decontamination fluids from other areas within the
3 324 Building Deactivation Project, the equipment will be cleaned, dismantled, and removed from
4 D-Cell for reuse or designated and disposed as waste.
5

6 After removal of all the waste and HLV liquid waste treatment equipment, the portions of
7 the cell that were used to manage the waste and equipment will be inspected visually to
8 determine whether there are indications of dangerous waste contamination or spills. Such
9 indications would be staining or discoloration on the floors and debris or material on floor. If
10 such conditions do not exist, D-Cell will be considered closed. If there is evidence of dangerous
11 waste contamination on the floor, the floor will be decontaminated, similar to actions described
12 for B-Cell, and re-inspected until the clean debris surface performance standard is met.
13 Contingency plans have been developed (as described in the following Sections 7.1.4.1 through
14 7.1.4.3) to address these possible actions.
15

16 **7.1.4.1 D-Cell Cleaning (Contingency Plan)**

17
18 If necessary to meet the closure performance standards (based on a positive indication of
19 dangerous waste contamination), D-Cell will be decontaminated by conducting the following
20 activities. To minimize the potential for contamination to migrate during bulk liquid application,
21 all liner penetrations (to the outside of the cell) will be sealed. In addition, those penetrations
22 that were made postconstruction and never sealed at the liner/penetration interface will be
23 covered inside the cell to prevent liquid migrating behind the liner. Liquid pathways from the
24 cell through access doors will be sealed. Shields will be put in place over the ventilation ducts to
25 prevent migration of cleaning fluids into the exhaust system. A pump will be located in the cell
26 and the necessary piping to allow transport of liquid from the sump to a shielded processing
27 system will be connected.
28

29 The D-Cell cleaning task includes activities required to decontaminate the internal
30 surfaces of the D-Cell to meet the criteria for closure (debris rule standards) as specified in
31 Section 7.1.2.1 for B-Cell.
32

33 **7.1.4.2 D-Cell Floor Liner Inspection (Contingency Plan)**

34
35 After D-Cell has been decontaminated, the cell liner will be inspected to determine
36 whether the surface meets the closure performance standard for metal surfaces and concrete of
37 using the debris rule standard (Chapter 6.0, Section 6.2.1). The inspection for a clean debris
38 surface will be documented on an inspection checklist similar to Figure 7-2 and will be done in
39 the same manner as described for B-Cell (Section 7.1.2.2).
40

1 **7.1.4.3 Remove the Liner and Remediate Concrete Surfaces (Contingency Plan)**

2
3 If the liner fails the assessment, the affected portions of the liner will be removed. The
4 removal operations will proceed in the same manner as described for B-Cell in Section 7.1.2.3.
5 For the portions of the liner requiring removal, underlying concrete surfaces will be
6 decontaminated using a physical extraction technique as described for B-Cell in Section 7.1.2.3.
7

8 **7.1.5 Closure Activities for the Airlock**

9
10 The closure activities for the airlock are all associated with the dangerous waste piping.
11 Dangerous waste piping closure activities are addressed under the closure activities for the
12 piping, Section 7.3.
13

14 **7.1.6 Closure Activities for the Pipe Trench**

15
16 The pipe trench closure activities includes pipe flushing and integrity assessment, and
17 pipe removal. In addition, if dangerous waste constituents are found in the trench, the trench will
18 undergo decontamination and sludge removal, and liner integrity assessment. Waste materials
19 generated during these activities will be properly designated and dispositioned at an acceptable
20 waste management facility.

21 **7.1.6.1 Piping Rinse and Integrity Assessment**

22
23 Piping passing through the pipe trench and will be flushed and decontaminated (as
24 described in Section 7.3.2) and will be subject to integrity assessments (as described in Section
25 7.3.1)

26 **7.1.6.2 Pipe Trench Pipe Removal**

27
28 Several steps will be required to remove piping from the pipe trench. As described in
29 Section 6.2.3, the sequence of piping removal will be closely integrated with all closure and
30 deactivation activities so that piping needed to support closure and decontamination operations is
31 left in place until such operations are completed.
32

33 Piping will be removed as practicable, designated, and packaged. Other piping will be
34 segmented into sections using available cutting techniques (i.e., shears, plasma arc torch, and
35 abrasive cutting tools). Inaccessible piping or piping penetrating concrete walls will be crimped,
36 sealed with poly sheet and tape, or seal welded. Cut piping and equipment will be designated
37 and packaged for storage or disposal at a permitted onsite TSD unit or offsite TSD facility. Line
38 and piping penetrations into the pipe trench will be sealed with process planks, plugs, caps, or

1 equivalent. Embedded piping that cannot be removed will be closed in accordance with Section
2 7.3.
3

4 **7.1.6.3 Pipe Trench Initial Cleanout and Decontamination**

5

6 Sludge and debris in the pipe trench will be collected, designated, and transferred to a
7 Hanford Site waste management facility. The trench will be decontaminated using an
8 appropriate water wash or chemical extraction process to remove the bulk of the sludge.
9 Decontamination residues will be collected, designated, and managed as described in Section 7.6
10 or will be processed in the D-Cell liquid effluent treatment system. Sludge samples will be taken
11 to determine if dangerous waste constituents are present in the pipe trench.
12

13 **7.1.6.4 Pipe Trench Final Decontamination**

14

15 Final pipe trench decontamination will be performed. If it has been shown that dangerous
16 waste constituents are present in the pipe trench, the decontamination will proceed in the same
17 manner described for B-Cell in Section 7.1.2.1. In addition, the integrity of the pipe trench liner
18 will be assessed in the same manner described for B-Cell in Section 7.1.2.2, i.e., visual
19 inspection and integrity assessment. If necessary, affected areas of the liner will be removed as
20 described in Section 7.1.2.3, in which case additional waste removal and concrete
21 decontamination will be required.
22

23 **7.1.7 Closure Activities for other REC Components**

24

25 The closure activities for the other REC components, such as the cell cubicles and pass-
26 through ports are all associated with the dangerous waste piping. Dangerous waste piping
27 closure activities are described in Section 7.3.
28

29 **7.2 Closure Activities for the High-Level Vault and Low-Level Vault**

30

31 The HLV and LLV each consist of four tanks, the vault liner and concrete, and the piping
32 and ancillary equipment in the vault. All dangerous and mixed waste inventory will be removed
33 from the HLV tank system through flushing, decontamination, and tank removal. In 1996, the
34 HLV and LLV tanks were emptied and the HLV tanks flushed to satisfy Tri-Party Agreement
35 Milestone M-89-01 (Chapter 3.0, Section 3.3). Closure of the HLV and LLV entails final
36 cleaning of the tanks and piping to remove waste residuals, removing the tanks, removing the
37 piping where possible, and cleaning the liner (and concrete if necessary) to meet the clean debris
38 surface standard in the same manner as described for B-Cell in Section 7.1.2.2. Closure
39 activities for the HLV are described in Section 7.2.1. The LLV and tanks will remain

1 operational, as necessary, to support deactivation and closure activities, and then will be removed
2 and disposed to achieve closure.
3

4 **7.2.1 Closure Activities for the High-Level Vault**

5
6 Waste removal and flushing activities that were performed in accordance with the M-89-01
7 Milestone are described in Chapter 3.0, Section 3.3.9.
8

9 **7.2.1.1 Tank and Piping Cleaning**

10
11 Piping integrity will be confirmed using pressure tests before tank cleanout operations
12 for piping that is to be used during this operation (Section 7.3). The performance standard for the
13 tanks is removal. Residual mixed waste in the tanks and piping systems will be removed using a
14 multi-step decontamination process using chemical extraction solutions for the purpose of
15 reducing the dose rates. The precise decontamination solutions to be used will be selected based
16 on additional characterization data on the tank heels. All chemical extraction technologies being
17 considered are included the Alternative Treatment Standards for Hazardous Debris rule. The
18 effectiveness of each decontamination step will be verified by measuring the radioactivity level
19 in the discharged decontamination solution and by measuring external radiation levels outside the
20 tanks and piping. Decontamination waste solutions will be processed through a temporary
21 effluent processing system (treatment skid) or the D-Cell liquid effluent treatment system (as was
22 done in the 1996 M-89-01 HLV waste removal project). Solid waste produced (i.e., metal filters
23 and ion exchange columns) will be designated and disposed at an acceptable waste management
24 facility. Decontamination solutions and treated waste water will be sampled and/or analyzed to
25 ensure the effectiveness of the decontamination operations and to designate the waste. After all
26 decontamination washes are complete, the tanks and piping will be rinsed with water to remove
27 residual decontamination solutions. The treated waste water will transferred to loadout tank (to
28 be constructed or possibly tank 102 in the LLV) and on to a tanker truck for transport to the DST
29 System or other permitted TSD.
30

31 **7.2.1.2 Tank and Piping Removal**

32
33 Following cleaning, the removal of the HLV tanks and piping will entail opening the vault
34 by removing the cover blocks. The tanks will be removed from the vault, designated, and size
35 reduced, as necessary, for disposal. Piping in the vault also will be removed, designated, and
36 disposed of accordingly. All accessible piping will be removed from the vaults (Section 7.3).
37 Tanks, piping, and ducting will be removed and size reduced using a variety of cutting tools,
38 including mechanical shears and saws, circular cutters, abrasive cutters, and plasma arc cutting.
39 Control of debris and process fumes will be necessary during cutting operations. The following
40 vault contents will be removed to meet closure performance standards and deactivation end-
41 points:

- 1
- 2 • Accessible piping
- 3 • Process tanks
- 4 • Remaining piping
- 5 • Ventilation ducting
- 6 • Pass-through piping.
- 7

8 After the tanks and piping have been removed, the vault liner and exposed concrete will be
9 visually inspected to identify any potentially contaminated areas and obvious cracks or breaches
10 in the containment.
11

12 **7.2.1.3 Decontamination of the Vault Liner**

13
14 Potentially contaminated areas of the liner or concrete areas will undergo
15 decontamination to meet the closure performance standards identified in Chapter 6.0. To
16 minimize the potential for contamination to migrate behind the liner during bulk liquid
17 application, all liner penetrations, cracks, or other openings will be sealed. If it is evident that the
18 liner is breached, i.e., visible holes/penetrations or cracks, the liner will be sealed or affected
19 portions removed and the decontamination process applied to the concrete surface. A
20 submersible pump will be placed in the sump and attached to necessary piping to remove the
21 decontamination fluids to either a temporary effluent processing system or to the installed system
22 in D-Cell. Depending on contamination levels and chemical composition of the decontamination
23 fluid, it might be appropriate to send the decontamination fluid to the LLV tank 102 for loadout
24 via tanker truck to the DST or other permitted TSD unit.
25

26 Metal surfaces will be decontaminated using a chemical or physical extraction process as
27 specified in the Alternative Treatment Standards for Hazardous Debris Surfaces in the same
28 manner as described for the B-Cell decontamination (Section 7.1.2.1).
29

30 **7.2.1.4 Inspection and Integrity Assessment of the Vault Liner**

31
32 Following decontamination of the vault floor and sides, a visual inspection will be
33 undertaken to determine if the closure performance standard for a clean debris surface is met.
34 This inspection and the integrity assessment will be performed in the same manner as described
35 in Section 7.1.2.2, except that personnel entry is assumed to be possible in the vaults. If the liner
36 meets the closure performance standard, the vault can be clean closed.

37 **7.2.1.5 Remove Liner and Decontaminate Concrete (Contingency Plan)**

38
39 If the liner fails to meet the closure performance standard, the affected portions of the
40 liner will be removed and the underlying concrete decontaminated using a physical extraction

1 technique specified in the Alternative Treatment Standards for Hazardous Debris (Section
2 7.2.1.3). Following decontamination of the underlying concrete, the inspection and integrity
3 assessment described in Section 7.2.1.4 will have to be re-performed. In this case, a visual
4 inspection will be conducted to determine if the closure performance standard is met. If the vault
5 floor and walls meet these standards, then the HLV can be clean closed. If through-wall cracks
6 contaminated with dangerous waste are identified in the liner and underlying concrete and cannot
7 be shown to meet the debris rule standard, the potential for soil contaminated with dangerous
8 waste exists and must be managed in accordance with the Section 7.5.
9

10 **7.2.2 Closure Activities for the Low-Level Vault**

11
12 The LLV tanks, piping, and liner will be deactivated and closed in the same manner as the
13 HLV tanks. The following steps will be taken in the same manner as described for the HLV in
14 Section 7.2.1:

- 15
- 16 • Tank and piping flushing and decontamination to remove any residual dangerous waste
17 contamination
- 18 • Tank and piping removal
- 19 • Vault decontamination
- 20 • Removal of affected portions of the liner and decontamination of underlying concrete
21 surface (if necessary)
- 22 • Coordination of soil characterization and remediation per Section 7.5 (if necessary)
23

24 **7.2.3 Closure Activities for the Sample Room (Room 145)**

25
26 The sample room (Room 145) has piping that connects to the tanks in the HLV and LLV.
27 The piping will be tested, decontaminated, removed, and/or isolated as described in Section 7.3.

28 **7.3 Closure Activities for the Piping**

29
30 Components requiring closure within the piping system include all piping runs that were
31 used to carry dangerous waste constituents between the REC and Vault tanks. Only piping that
32 might have carried dangerous waste constituents will undergo closure activities. These pipes are
33 referred to as 'dangerous waste piping'. However, the piping between the LLV and the Sodium
34 Removal Pilot Plant will be addressed in this closure plan for completeness. The closure strategy
35 for the piping system is provided in a logic flow diagram in Chapter 6.0 (Figure 6-2).
36

37 Piping that will undergo closure includes the piping identified in Tables 7-1 and 7-2.
38 Table 7-1 identifies all piping associated with the HLV and LLV tanks. This table also identifies
39 which piping requires closure based on their historical use. All other piping will be evaluated
40 during the 324 Building D&D process. Facility deactivation will proceed in parallel with the

1 closure activities as described in Chapter 1.0, Section 1.3. The pipes not used to carry dangerous
2 waste, but requiring decontamination because of residual radiological contamination, will be
3 flushed and cleaned to remove the radiological contamination. The pipes will be removed, if
4 possible, or isolated (ends crimped or blanked). All removed piping will be designated and
5 disposed in accordance with WAC 173-303 currently onsite methods. For the isolated pipes left
6 in place, the locations and current conditions will be documented and will remain in place until
7 the entire building undergoes final D&D as described in Section 8.0.
8

9 **7.3.1 Piping Decontamination**

10
11 Piping will be decontaminated in conjunction with the HLV and LLV tank
12 decontamination efforts. Chemical extraction techniques, as identified in the Alternative
13 Treatment Standard for Hazardous Debris Surfaces, will be used for the piping. The manner for
14 accomplishing the decontamination process is the same as that described for the HLV tanks in
15 Section 7.2.1.2.
16

17 **7.3.2 Piping Integrity Tests**

18
19 For accessible piping, visual inspections also will be performed to determine if breaches or
20 cracks in the pipes exist. Any cracks or breaches in the integrity of piping will be noted in the
21 log books, will be identified as to location and size on sketches, and will be documented on video
22 and still camera photographs if possible. For inaccessible piping, an integrity test (i.e., pressure
23 testing and/or visual inspections) will be performed on pipe runs to determine if there is a
24 potential for leaks from the piping that might have contaminated other areas within the building
25 or the soil below the unit. These tests will be performed by isolating sections of piping using
26 existing valves and jumpers, if possible, and using a pressure type test.
27

28 **7.3.3 Piping Removal**

29
30 Where possible, piping is to be removed. The closure performance standard will be the
31 removal of all feasible and reasonably accessible ancillary equipment and piping when that
32 piping is no longer needed to support closure or deactivation activities. Such piping will be
33 removed, size reduced, designated, and disposed of at an appropriate waste management and/or
34 TSD unit. Piping that is needed to support deactivation or closure activities will be maintained
35 until these closure activities are completed and then removed, if possible. Piping will be
36 removed and size reduced using a variety of cutting tools, including mechanical shears and saws,
37 circular cutters, abrasive cutters, and plasma arc cutting.
38

1 **7.3.4 Closure of embedded piping**
2

3 For the limited amount of piping that cannot be feasibly removed, a final rinse will be
4 conducted. The first two liters of rinsate will be collected for sampling and analysis. The
5 remainder of the rinsate will be collected for designation and disposal.
6

7 The rinsate will be analyzed for dangerous waste constituents. The rinsate will be
8 designated and disposed at an appropriate waste management and/or TSD unit. The flushing,
9 sampling, and analysis will be repeated until the rinsate no longer designates as a dangerous
10 waste. The lines will then be considered clean closed. A hazards characterization report
11 (described in Chapter 8.0, Section 8.1.1) will be used to document the chemical and radiological
12 status of these pipes to ensure proper personnel protection and waste management actions are
13 taken during final building disposition.
14

15 If it is not possible to remove dangerous waste constituents from the remaining piping and
16 meet the performance standard, it will be necessary to immobilize dangerous waste constituents
17 in the pipes by using a sealing or encapsulation technology, as specified in the Alternative
18 Treatment Standards for Hazardous Debris rule (described in Chapter 6.0, Section 6.2.3). As a
19 result of such action, it will be necessary to document the location and condition of all such
20 piping runs to ensure that the piping is disposed at an appropriate TSD unit when removed during
21 final decommissioning activities.
22

23 After flushing and/or encapsulation, actions the ends of the piping will be isolated
24 (crimped or blanked).
25

26 **7.4 Closure Activities for the Miscellaneous Building Areas**
27

28 Closure of the cask handling area, truck lock, EDL-146, and galleries are described in the
29 following sections. General closure activities for the miscellaneous associated building areas
30 will be to decontaminate, remove, and/or isolate (crimp or blank) all piping runs that were used
31 to carry dangerous waste between the REC and Vault tanks.
32

33 **7.4.1 Closure Activities for the Cask Handling Area**
34

35 The cask handling area was not used for TSD activities; therefore, there are no specific
36 closure activities required.
37

1 **7.4.2 Closure Activities for the Truck Lock**

2
3 The closure component for the truck lock is the dangerous waste piping. Dangerous waste
4 piping will be closed in accordance with the closure activities discussed in Section 7.3
5

6 **7.4.3 Closure Activities for the Engineering Laboratory (Room 146)**

7
8 The closure component for EDL-146 is the dangerous waste piping. Dangerous waste
9 piping will be closed in accordance with the closure activities discussed in Section 7.3.
10

11 **7.4.4 Closure Activities for the Operating Galleries**

12
13 The closure component for the galleries is the dangerous waste piping. Dangerous waste
14 piping will be closed in accordance with the closure activities discussed in Section 7.3.
15

16 **7.4.5 Closure Activities for Room 18**

17
18 The closure components for Room 18 are the dangerous waste piping and potentially the
19 concrete surrounding the B-Cell service plugs. Dangerous waste piping will be closed in
20 accordance with the closure activities discussed in Section 7.3.
21

22 **7.4.5.1 Room 18 Inspection**

23
24 The portions of Room 18 that were potentially contaminated with dangerous waste
25 constituents, i.e., the area surrounding the B-Cell service Plugs, will be visually inspected to
26 determine whether there are indications of dangerous waste contamination or spills. Such
27 indications would be staining or discoloration on the floors and debris or material on floor. If
28 such conditions do not exist, Room 18 will be considered closed. If there is evidence of past
29 dangerous waste contamination on the room floor, then a sampling and analysis plan will be
30 prepared to determine the nature and extent of dangerous waste residuals. The concrete in the
31 affected floor area will be decontaminated in the same manner specified for B-Cell (Section
32 7.1.2.1) to meet the debris rule performance standard.
33

34 **7.4.5.2 Sample Potentially Contaminated Areas (contingency Planning)**

35
36 For accessible areas, a sampling and analysis plan will be prepared to define the nature and
37 extent of dangerous waste contamination. The sampling and analysis plan must be prepared in

1 accordance with the requirements of WAC 173-303 and should identify COC based on the TSD
2 operations conducted adjacent to these areas.

3
4 If no dangerous waste constituents are found above clean closure standards (MTCA),
5 based on the COC for the TSD operations, the area can be closed with respect to the closure of
6 this unit. If dangerous waste from TSD operations are identified above the standard, the affected
7 area will be decontaminated to meet the debris rule performance standard.
8

9 **7.4.5.3 Room 18 Cleaning (Contingency Plan)**

10
11 The walls and floors will be decontaminated using a physical extraction technique to meet
12 the criteria for closure as specified in Section 7.1.2.1 for B-Cell. After the affected areas of
13 Room 18 have been decontaminated, the areas will be inspected to determine whether the surface
14 meets the closure performance standard for concrete (Chapter 6.0, Section 6.2.1). The inspection
15 to meet the debris rule performance standard will be documented on an inspection checklist
16 similar to Figure 7-2 and will be done in the same manner as described for B-Cell (Section
17 7.1.2.2).
18

19 **7.5 Closure Activities for Soil Directly Beneath the Building**

20
21 The B-Cell, HLV, and LLV vaults were designed and installed with a system to contain
22 and collect leaks or spills and to channel these to sumps from which the solutions were pumped
23 back into the tank system. The underlying soil could only be contaminated if the piping (or its
24 secondary containment, where applicable) or the cell liners and concrete failed. An integrity
25 assessment will be performed on these systems (in accordance with the closure performance
26 standards provided in Section 6 and the activities described in the proceeding Section 7.0) to
27 identify cracks (if any) that could provide a pathway for dangerous waste or dangerous waste
28 residues to the underlying soil. If the performance standards are met, it will be concluded that
29 these areas have maintained integrity and the unit, including underlying soil and groundwater,
30 will be considered uncontaminated. If integrity cannot be proven and soil contamination is
31 possible, the closure strategy provided in the logic flow diagram (Figure 6-3) will be followed.
32 The following closure activities will be performed to close the unit with respect to soil and
33 groundwater if the integrity of the TSD systems is shown to be breached. Contingency plans
34 have been developed (as described in the following Sections 7.5.1 through 7.5.4) to address these
35 possible actions.
36

37 **7.5.1 Identify Potentially Contaminated Soil (Contingency Plan)**

38
39 All soil potentially contaminated with dangerous waste constituents from TSD operations
40 (based on liner/concrete and piping integrity assessments and subsequent characterization) will
41 be documented.

1

2 **7.5.2 Sample Accessible Areas (Contingency Planning)**

3

4 For accessible areas, i.e., crawl space allows access, a sampling and analysis plan will be
5 prepared to define the nature and extent of contamination by dangerous waste constituents. The
6 sampling and analysis plan must be prepared in accordance with the requirements of WAC 173-
7 303 and should identify contaminants of concern, based on the TSD operations conducted over
8 these accessible soil areas. This sampling effort will be coordinated with the CERCLA OU
9 activities to ensure the needs of both programs are being met. In this manner, a more efficient
10 and comprehensive sampling effort can be performed addressing not only the TSD operation
11 COC, but the radiological aspects as well.

12

13 If no dangerous waste or waste residuals are found above clean closure standards
14 (Chapter 6.0, Section 6.2.5) based on the contaminants of concern for the TSD operations, the
15 area can be closed with respect to the closure of this unit. If dangerous waste constituents from
16 TSD operations are identified above the standard, an interim measure to remove the
17 contaminated soil will be evaluated. The remediation of the area will be coordinated with the
18 CERCLA operable unit activities (Section 7.5.4 and Chapter 8.0, Section 8.3).

19

20 **7.5.3 Interim Measure Planning for Soil Removal (Contingency Plan)**

21

22 If dangerous waste constituents from TSD operations are present in the soil, based on
23 sampling and analysis, a determination will be documented if near term removal activities are
24 required to be protective of human health and the environment. This determination will be based
25 on near-term and significant potential impact to groundwater, and economic considerations, i.e.,
26 near term removal actions versus complete remediation under CERCLA. If immediate removal
27 actions are required, an Interim Measures Plan will be prepared and submitted to Ecology. This
28 plan will describe how the removal will be done, provide cleanup standards (based on the MTCA
29 clean closure standards for TSD contaminants of concern or approved alternative), and specify
30 how sampling will be performed to verify cleanup objectives have been met. This plan will be
31 incorporated into the closure plan, as described in the closure modification requirements
32 contained in Section 7.8. If interim removal actions can be performed to meet the closure
33 performance standards, then the unit will be closed.

34

35 **7.5.4 Coordination of Soil Characterization and Remediation (Contingency Plan)**

36

37 If an interim measure is not selected per Section 7.5.3 or if the potential dangerous waste
38 constituents are in an area that is not accessible (i.e., no crawlspace access), soil investigations
39 and remediation will be scheduled and coordinated with the CERCLA operable unit, identifying
40 the contaminants of concern, cleanup levels, and specifying RCRA as an ARAR. This

1 coordination process is described in Chapter 8. This situation would also trigger monitoring and
2 care provisions that are also described in Chapter 8.0.
3

4 If dangerous waste is left in place after closure, the requirements for notice to local land
5 authority (WAC 173-303-610(9)) and for notice in deed to property (WAC 173-303-610(10))
6 will be identified as an ARAR for the CERCLA operable-unit remedial action process to ensure a
7 survey plat, deed notations (or other legal instrument), and final closure/remediation records are
8 prepared and submitted properly, after completion of all remedial actions at the site.
9

10 **7.6 Regulated Material Removed During Closure**

11
12 Materials that designate as dangerous waste, including decontamination waste, treatment
13 residue, and/or closure debris will be transferred to an onsite TSD unit or shipped offsite to a
14 TSD facility. Containers used for transfers of regulated materials to offsite TSD facilities will be
15 U.S. Department of Transportation-approved containers compatible with the waste being
16 transferred (e.g., 208-liter containers). The containers will be labeled and shipped offsite under
17 manifest according to WAC 173-303-180 and WAC 173-303-190 as applicable, or transferred to
18 an onsite TSD unit. After designation, waste could be disposed as follows:
19

- 20 • Dangerous waste will be transported offsite or to an onsite storage unit to await final
21 disposal or treatment.
22
- 23 • Low-level waste will be disposed onsite in the Low-Level Waste Burial Grounds.
24
- 25 • Solid mixed waste will be transferred to the Central Waste Complex, the PUREX Storage
26 Tunnels, or to another permitted TSD Unit.
27
- 28 • Liquid mixed waste could be transferred to the DST or to another permitted onsite storage
29 unit to await treatment before final disposal.
30
- 31 • Nondangerous and nonradioactive solid waste could be disposed offsite.

32 **7.7 Schedule for Closure**

33
34 A schedule for closure activities is presented in Appendix 7A. Removal of inventory from
35 B-Cell, D-Cell, and the HLV already has been completed or is being performed, in accordance
36 with Tri-Party Agreement milestones M-89-01 and the closure schedule provided in Appendix
37 7A. Because of the complexity and significant radiological contamination of the 324 Building,
38 the schedule proposed is greater than 180 days.
39

1 **7.8 Amendment of Closure Plan (Contingency Planning)**
2

3 If an amendment to the approved closure plan is required at any time before the
4 notification of partial or final closure, RL will submit a written request to Ecology asking for
5 authorization to change the approved plan. The written request will include a copy of the closure
6 plan amendment and will be submitted in accordance with WAC 173-303-610(3).
7

8 Because of the complexity and significant high levels of radiological contamination of the
9 324 Building, an approach has been developed to manage uncertainties and unknowns during
10 closure activities. Figure 7.1 provides a flow diagram illustrating this process. If unexpected
11 conditions are encountered that potentially impact personnel safety (including radiological
12 contamination, high-dose-rate areas, or industrial safety issues), nuclear safety (including
13 safeguards and security of materials), secondary waste generation, or environmental protection,
14 or in areas in which technology limitations exist, a change in approach might be warranted.
15

16 The initial step involves evaluating the condition to determine if a change to the planned
17 closure activities exists. If a potential change is warranted, the problem scope and boundary
18 conditions will be defined and a focused alternative analysis/feasibility study will be conducted
19 to develop a defensible path forward. The results of the study will be used to evaluate if the
20 closure performance standards can still be met and to determine if there are significant cost and
21 schedule impacts. If possible, closure actions will continue per the approved closure plan.
22 However, if the performance standards cannot be met, or if the cost and schedule impacts are
23 such that rescoping of closure activities are necessary, new closure actions will be developed and
24 the closure plan amended and submitted to Ecology for approval.

25 **7.9 Certification Of Closure**
26

27 Within 60 days of completing the closure activities, the RL will submit a certification of
28 closure to Ecology. The certification will be signed by the RL, the site contractor, and an
29 independent professional engineer registered in the State of Washington or approval equivalent.
30 Certification will state that the areas have been closed in accordance with the approved closure
31 plan (Figure 7-3). The certification will be submitted by registered mail or by an equivalent
32 delivery service. Documentation that supports the closure certification by the independent
33 registered professional engineer or approval equivalent also will be submitted to Ecology with
34 the certification for closure.

1
2

Table 7-1. HLV and LLV Piping that will Undergo Closure or Deactivation

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" MP-1-02	CH	Jet 02	Steam for TK 101(D) to Pot	LLV	No	Concrete	No
1" MP-2-03	CH	Jet 03	Steam for TK 102(A) to Pot	LLV	No	Concrete	No
1" MP-3-04	CH	Jet 04	Steam for TK 103(C) to Pot	LLV	No	Concrete	No
1" MP-3-05	CH	Jet 05	Steam for TK 103(D) to Pot	LLV	No	Concrete	No
1" MP-4-06	CH	Jet 06	Steam for TK 104(D) to Pot	HLV	No	Concrete	No
1" MP-4-07	CH	Jet 07	Steam for TK 104(E) to Pot	HLV	No	Concrete	No
1" MP-5-08	CH	Jet 08	Steam for TK 105(D) to Pot	HLV	No	Concrete	No
1" MP-5-09	CH	Jet 09	Steam for TK 105(E) to Pot	HLV	No	Concrete	No
1" MP-6-10	CH	Jet 10	Steam for TK 106(F) to Pot	HLV	No	Concrete	No
1" MP-6-11	CH	Jet 11	Steam for TK 106(J) to Pot	HLV	No	Concrete	No
1" MP-HLV-12	CH	Jet 12	Jet 12 for draining HLVS via 1" PT-29	HLV	No	Concrete	No
1" MP-LLV-13	CH	Jet 13	Jet 13 for draining LLVS via 1" PT-30	LLV	No	Concrete	No
1" MP-1-16	CH	Jet 16	Steam for TK 101(L) to 1" TK101-Jet-CBWS	LLV	No	Concrete	No
1" MP-2-17	CH	Jet 17	Steam for TK 102(P) to 1" TK102-Jet-CBWS	LLV	No	Concrete	No
1" MP-4-18	CH	Jet 18	TK 104 Spray Jet	HLV	No	Concrete	No
1" MP-5-19	CH	Jet 19	TK 105 Spray Jet	HLV	No	Concrete	No
1" MP-6-20	CH	Jet 20	TK 106 Spray Jet	HLV	No	Concrete	No
½" CA-3-21	CH	TK 103(R)	Air Lift	LLV	No	Concrete	No
½" CA-6-22	CH	HLV	Service to Vent Breather	HLV	No	Concrete	No
1" CA-1-23	CH	TK 101(J)	Sparger	LLV	No	Concrete	No
1" CA-2-24	CH	TK 102(G)	Sparger	LLV	No	Concrete	No
1" CA-3-25	CH	TK 103(J)	Sparger	LLV	No	Concrete	No
1" CA-4-26	CH	TK 104	Sparger	HLV	No	Concrete	No
1" CA-5-27	CH	TK 105	Sparger	HLV	No	Concrete	No
1" CA-6-28	CH	TK 106	Sparger	HLV	No	Concrete	No
1" PT-29	HLVS	PT	HLV Sump to PT via Jet 12	HLV	Yes	Concrete	Yes
1" PT-30	LLVS	PT	LLV Sump to PT via Jet 13	LLV	Yes	Concrete	Yes
1" TPS-1-34	TK 101(S)	LOS	TK 101 Pot to LOS	LLV	Yes	Concrete	Yes
1" TPS-2-35	LOS	TK 102(Q)	LOS to TK 102 Pot via J-42	LLV	Yes	Concrete	Yes

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" TPS-3-36	TK 103(T)	LOS	TK 103 Pot to LOS	LLV	Yes	Concrete	Yes
1" TPS-3-37	LOS	TK 103(Q)	Via Jet 43	LLV	Yes	Concrete	Yes
1" TPS-4-38	TK 104	LOS	TK 104 Pot to LOS	HLV	Yes	Concrete	Yes
1" TPS-5-39	LOS	TK 105	LOS to TK 105 Pot via Jet 45	HLV	Yes	Concrete	Yes
1" TPS-6-40	LOS	TK 106	LOS to TK 106 via Jet 46	HLV	Yes	Concrete	Yes
1" TPS-6-41	TK 106	LOS	TK 106 Pot to LOS	HLV	Yes	Concrete	Yes
1" TPS-1-42	PT	TK 101(M)	Dip Leg	LLV	Yes	Concrete	Yes
1" TPS-1-43	TK 108(D)	PT	Process Transfer leg	LLV	Yes	Concrete	Yes
1" TPS-2-44	PT	TK 102(J)	Dip Leg	LLV	Yes	Concrete	Yes
1" TPS-2-45	TK 102(S)	PT	(No Jumper in PT)	LLV	Yes	Concrete	Yes
1" TPS-3-46	PT	TK 103(E)	Dip Leg	LLV	Yes	Concrete	Yes
1" TPS-3-47	TK 103(S)	PT	Dip Leg	LLV	Yes	Concrete	Yes
1" TPS-4-48	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-4-49	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-5-50	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-5-51	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-6-52	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-6-53	PT	TK 106	Air Sweep	HLV	Yes	Concrete	Yes
2" TPS-1-54	A-11,21,31 A-12,22,32 B-12, B-14	TK 101(E)	Cubicle drains Header to TK 101	LLV	Yes	Concrete	Yes
2" TPS-1-55	EDL-146	TPS-1-56	EDL-146	LLV	Yes	Concrete	No
2" TPS-1-56	TPS-1-55	TK 108	Header	LLV	Yes	Concrete	No
1" TPS-1-57	A-31	TPS-1-54	A-Cell Cubicle Drain To TK 101	LLV	Yes	Concrete	No
1" TPS-1-58	A-11	TPS-1-54	A-Cell Cubicle Drain To TK 101	LLV	Yes	Concrete	No
1" TPS-1-59	A-21	TPS-1-57	A-Cell Cubicle Drain To TK 101	LLV	Yes	Concrete	No
1" TPS-1-61	B-14	TPS-1-54	B-Cell Cubicle Drain to TK 101	LLV	Yes	Concrete	No
1" TPS-1-62	A-11, A-12 B-12, B-14 C-11, C-12 D-21, D-22	TK 101(B)	Header to TK 101	LLV	Yes	Concrete	Yes
1" TPS-1-63	LOS	TK 101(A)	via Jet	LLV	Yes	Concrete	Yes
1" TPS-1-64	A-11	TPS-1-62	A-Cell to TK 101 via Header	LLV	Yes	Concrete	No

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" TPS-1-65	D-21, D-22	TPS-1-62	D-Cell to TK 101 via Header	LLV	Yes	Concrete	No
1" TPS-1-66	C-11, C-12	TPS-1-65	C-Cell to TK 101 via Header	LLV	Yes	Concrete	No
1" TPS-1-67	B-14	TPS-1-62	B-Cell to TK 101 Header	LLV	Yes	Concrete	No
2" TPS-2-68	A-11, A-12 B-12, B-14 C-11, C-12 D-21, D-22	TK 102(B)	Header to TK 102	LLV	Yes	Within Vault	Yes
2" TPS-2-69	TPS-2-70	TK 102(E)	Header to TK 102	LLV	Yes	Concrete	No
2" TPS-2-70	EDL-146	TPS-2-69	EDL-146	LLV	Yes	Concrete	No
1" TPS-2-72	A-11	TPS-2-68	A-Cell to TK 102 via Header	LLV	Yes	Concrete	No
1" TPS-2-73	D-21, D-22	TPS-2-68	D-Cell to TK 102	LLV	Yes	Concrete	No
1" TPS-2-74	C-12, C-11	TPS-2-73	C-Cell to TK 102	LLV	Yes	Concrete	No
1" TPS-2-75	B-14	TPS-2-68	B-Cell to TK 102	LLV	Yes	Concrete	No
2" TPS-4-76	A-11, A-12 B-12, B-14 C-11, C-12 D-21, D-22	TK 104(A)	Header to TK 104	HLV	Yes	Concrete	Yes
1" TPS-4-77	LOS	TK 104(R)	LOS to TK 104 via Jet 44	HLV	Yes	Concrete	Yes
1" TPS-4-78	A-11	TPS-4-76	A-Cell to TK 104	HLV	Yes	Concrete	No
1" TPS-4-79	D-21, D-22	TPS-4-76	D-Cell to TK 104	HLV	Yes	Concrete	No
1" TPS-4-80	C-11, C-12	TPS-4-79	C-Cell to TK 104	HLV	Yes	Concrete	No
1" TPS-4-81	B-14	TPS-4-76	B-Cell to TK 104	HLV	Yes	Concrete	No
1" TPS-5-82	A-11, A-12 B-12, B-14 Airlock	TK 105(A)	Header to TK 105	HLV	Yes	Concrete	Yes
1" TPS-5-83	A-11	TPS-5-82	A-Cell to TK 105	HLV	Yes	Concrete	No
1" TPS-5-84	B-14	TPS-5-82	B-Cell to TK 105	HLV	Yes	Concrete	No
1" TPS-5-85	Air Lock	TPS-5-82	Air Lock to TK 105	HLV	Yes	Concrete	No
1" TPS-6-86	C-11, C-12	TK 106(A)	(Dip Leg)	HLV	Yes	Concrete	Yes
1" TPS-6-87	B-12, B-14	TK 106(M)	Header B-Cell to TK 106	HLV	Yes	Concrete	Yes
½" TPS-3-117	TK 103	EDL-146	Air Lift	LLV	Yes	Concrete	No
½" TPS-6-118	PT	TK 106	Spare	HLV	Yes	Concrete	Yes
1" TPS-1-119	Rm 11	TK 101	SMF	LLV	Yes	Concrete	No
1" TPS-146	Spl Trench	TK 101	Sample Trench Drain	LLV	Yes	Concrete	No
1" RW-5-147	CH	TK 105	Jacket Water In	HLV	No	Concrete	No

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" RW-6-148	CH	TK 106	Jacket Water In	HLV	No	Concrete	No
1" PT-149	LLC	PT	Process Transfer	LLV	Yes	Concrete	Yes
1" TPS-5-155	PT	TK 105	B-Cell Sump Transfer Line	HLV	Yes	Sleeve	No
1" TPS-4-156	PT	TK 104	PT Sump Transfer Line	HLV	Yes	Sleeve	No
1" TPS-7-157	PT	TK 107	PT Sump Transfer Line	HLV	Yes	Sleeve	No
1" TPS-1-175	B-12	TPS-1-54	B-12 Cubicle Drain to TK 101	LLV	Yes	Concrete	No
1" TPS-1-176	B-12	TPS-1-62	B-Cell to 101	LLV	Yes	Concrete	No
1" TPS-2-177	B-12	TPS-2-68	B-Cell to TK 102	LLV	Yes	Concrete	No
1" TPS-2-178	B-12	TPS-4-76	B-Cell to 104 Drain	HLV	Yes	Concrete	No
1" TPS-5-179	B-12	TPS-5-82	B-Cell to TK 105	HLV	Yes	Concrete	No
1" TPS-1-186	A-32	TPS-1-57	CD to TK 101	LLV	Yes	Concrete	No
1" TPS-1-187	A-22	TPS-1-57	CD to TK 101	LLV	Yes	Concrete	No
1" TPS-1-188	A-12	TPS-1-54	CD to TK 101	LLV	Yes	Concrete	No
1" TPS-1-189	A-12	TPS-1-62	A-Cell to TK 101	LLV	Yes	Concrete	No
1" TPS-2-190	A-12	TPS-2-68	A-Cell to TK 102	LLV	Yes	Concrete	No
1" TPS-4-191	A-12	TPS-4-76	A-Cell to TK 104	HLV	Yes	Concrete	No
1" TPS-5-192	A-12	TPS-5-82	A-Cell to TK 105	HLV	Yes	Concrete	No
1" TPS-7-207	TK 107	LOS	TK 107 Pot to LOS	HLV	Yes	Concrete	Yes
1" TPS-7-209	LOS	TK 107	via Jet 47	HLV	Yes	Concrete	Yes
1" TPS-7-215	PT	HLV	Spare	HLV	Yes	Concrete	Yes
1" TPS-7-216	PT	TK 107	Air Sweep	HLV	Yes	Concrete	Yes
½" CH-HLV-268	CH	HLV	MP to J-29	HLV	Yes	Concrete	No
½" CH-HLV-269	CH	HLV	MP to J-40-107 to Pot	HLV	Yes	Concrete	No
½" CH-HLV-270	CH	HLV	T402	HLV	Yes	Concrete	No
½" CH-HLV-271	CH	HLV	Inst Line T401	HLV	Yes	Concrete	No
½" CH-HLV-272	CH	HLV	TE107-1	HLV	Yes	Concrete	No
½" CH-HLV-273	CH	HLV	Inst Line T403	HLV	Yes	Concrete	No
1" CH-LLV-274	CH	LLV	MP to LLVS J-37 LLVS to TK 102	LLV	Yes	Concrete	No
1" CH-LLV-275	CH	LLV	2 Radiation Elements	LLV	Yes	Concrete	No

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" CH-LLV-276	CH	LLV	To RPS Header	LLV	Yes	Concrete	No
1" CH-LLV-277	CH	LLV	Spare	LLV	No	Concrete	No
1" CH-LLV-278	CH	LLV	Spare	LLV	No	Concrete	No
1" CH-LLV-279	CH	LLV	Spare	LLV	No	Concrete	No
1" CH-HLV-280	CH	LLV	Radiation Element	LLV	No	Concrete	No
1" CH-HLV-281	CH	HLV	Spare	HLV	No	Concrete	No
1" CH-HLV-282	CH	HLV	Spare	HLV	No	Concrete	No
1" CH-HLV-283	CH	HLV	RW to TK 104 Jacket	HLV	No	Concrete	No
1" CH-HLV-284	CH	TK 107	MP to TK 107 Internal Jacket	HLV	No	Concrete	No
1" CH-HLV-285	CH	TK 107	RW to TK 107 Jacket	HLV	No	Concrete	No
1" CH-HLV-286	CH	TK 107	RW to TK 107 Coil	HLV	No	Concrete	No
1" CH-HLV-287	CH	TK 107	CH to TK 107 Sparger	HLV	No	Concrete	No
½" CH-HLV-288	CH	TK 107	Chem Add to TK 107	HLV	Yes	Concrete	No
½" CH-HLV-289	CH	HLV	MP to Jet 31 105 to 104	HLV	Yes	Concrete	No
½" CH-HLV-290	CH	HLV	MP to Jet 28 107(B) to 104(A)	HLV	Yes	Concrete	No
½" CH-HLV-291	CH	HLV	MP to Jet 36 (HLVS) to 104	HLV	Yes	Concrete	No
½" CH-HLV-292	CH	HLV	MP to Jet 54 104 to 105	HLV	Yes	Concrete	No
½" CH-HLV-293	CH	HLV	MP to Jet 39 107 to Pot	HLV	Yes	Concrete	No
½" CH-HLV-294	CH	HLV	TE 107-2 TK 107 Temp	HLV	Yes	Concrete	No
½" CH-HLV-295	CH	HLV	Spare	HLV	Yes	Concrete	No
½" CH-HLV-296	CH	HLV	MP to Jet 49 106 to 105	HLV	Yes	Concrete	No
½" CH-HLV-297	CH	HLV	MP to Jet 30 106 to 107	HLV	Yes	Concrete	No
½" CH-HLV-298	CH	HLV	Spare	HLV	Yes	Concrete	No
½" CH-HLV-299	CH	HLV	2 Radiation Elements	HLV	Yes	Concrete	No
1" CH-HLV-300	CH	HLV	Spare	HLV	Yes	Concrete	No
1" CH-HLV-301	CH	HLV	Spare	HLV	Yes	Concrete	No
1" CH-HLV-302	CH	HLV	Spare	HLV	Yes	Concrete	No
1" RS-LLV-303	RS	VV-109	Jet Station Vent T into VV-109	LLV	Yes	Concrete	No
1" RS-LLV-304	RS	LLV	To 101 Nozzle A	LLV	Yes	Concrete	No

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
½" RS-LLV-305	RS	LLV	Flush Line to VV-106	LLV	Yes	Concrete	No
½" RS-LLV-306	RS	LLV	MP to J-34 102 to 104	LLV	Yes	Concrete	No
½" RS-LLV-307	RS	LLV	MP to J-33 103 to 101	LLV	Yes	Concrete	No
½" RS-LLV-308	RS	LLV	MP to J-32 103 to 102	LLV	Yes	Concrete	No
½" RS-LLV-309	RS	LLV	MP to J-35 101 to 102	LLV	Yes	Concrete	No
½" RS-LLV-310	RS	LLV	MP to J-62 108 to 101	LLV	Yes	Concrete	No
½" RS-LLV-311	RS	LLV	TE 108	LLV	No	Concrete	No
½" RS-LLV-312	RS	LLV	MP to J-56 108 to 102	LLV	Yes	Concrete	No
1" RS-LLV-313	RS	LLV	Spare	LLV	No	Concrete	No
1" RS-LLV-314	RS	LLV	Air to TK 108	LLV	No	Concrete	No
1" RS-LLV-315	RS	LLV	Dip Tube to TK 108	LLV	Yes	Concrete	No
1" RS-LLV-316	RS	LLV	WF & SPG TK 108	LLV	Yes	Concrete	No
1" RS-LLV-317	RS	LLV	RW to E 105	LLV	No	Concrete	No
1" RS-LLV-318	RS	LLV	RW to E 103	LLV	No	Concrete	No
1" RS-LLV-319	RS	LLV	RW to E 101	LLV	No	Concrete	No
1" HLV-LLV-320	HLV	LLV	Spare	LLV	No	Concrete	No
1" HLV-LLV-321	HLV	LLV	Spare	LLV	No	Concrete	No
1" HLV-LLV-322	HLV	LLV	Spare	LLV	No	Concrete	No
1" HLV-LLV-323	HLV	LLV	Spare	LLV	No	Concrete	No
1" HLV-LLV-324	TK 102(N)	TK 104	Via Jet 34	LLV	Yes	Concrete	No
1" HLV-LLV-325	TK 102	TK 104	E 101, E102, E103, CNDs to TK 104	LLV	Yes	Concrete	No
½" CH-LLV-326	CH	TK 104	Decont'n to E 105	LLV	Yes	Concrete	No
½" CH-LLV-327	CH	TK 104	Decont'n to E 103	LLV	Yes	Concrete	No
½" CH-LLV-328	CH	TK 104	Decont'n to E 101	LLV	Yes	Concrete	No
1" TPS-7-329	PT	TK 107	TK 107 Pot	HLV	Yes	Sleeve	No
1" TPS-5-330	PT	TK 105	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-4-331	PT	TK 104	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-6-332	PT	TK 106	TK 106 Pot	HLV	Yes	Sleeve	No
½" TPS-6-333	PT	TK 106	Process Transfer	HLV	Yes	Sleeve	No

Line No.	From	To	Function	H/L	Include in Closure	Routing	Crawlspace
1" TPS-7-334	PT	TK 107	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-5-335	PT	TK 105	TK 105 Pot	HLV	Yes	Sleeve	No
1" TPS-4-336	PT	TK 104	TK 104 Pot	HLV	Yes	Sleeve	No
1" TPS-4-337	PT	TK 104	TK 104 Pot	HLV	Yes	Sleeve	No
1" TPS-4-338	PT	TK 104	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-5-339	PT	TK 105	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-5-340	PT	TK 105	Process Transfer	HLV	Yes	Sleeve	No
1" TPS-6-341	PT	TK 106	Process Transfer	HLV	Yes	Sleeve	No

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Legend:

- CA compressed air
- CBWS crib waste sewer
- CH cask handling
- HLV high-level vault
- HLVS high-level vault sump
- HP high pressure steam
- J jet
- LLI liquid level indicator line
- LLV low-level vault
- LOS load out stall
- LP LOS pressure steam (PSI)
- PT pipe trench
- RPS retention process sewer
- RW raw water
- S spare/sample
- SGI specific gravity indicator
- TE temperature element tube
- TPS tank process sewer
- VV vessel vent

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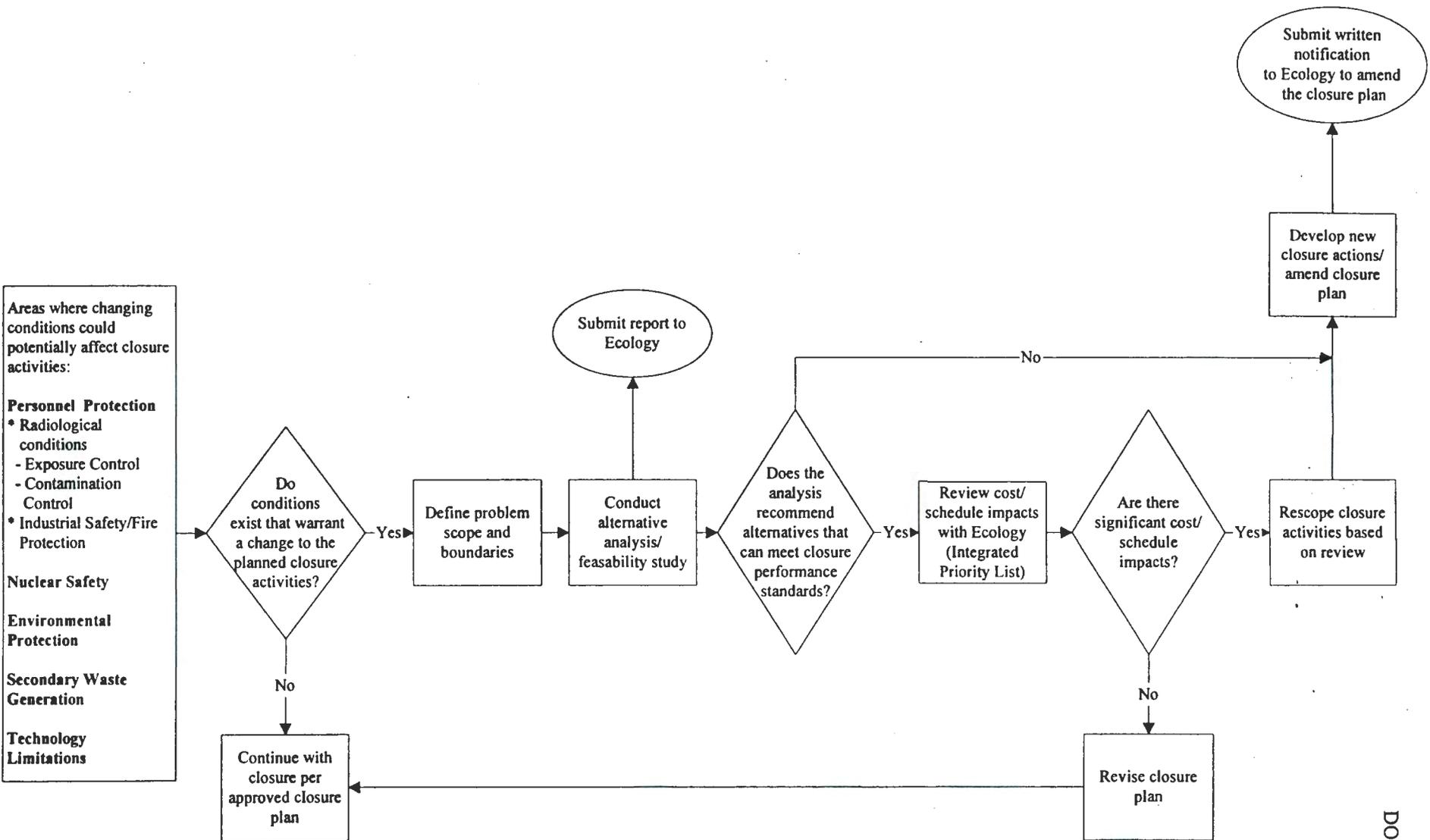


Figure 7-1. Closure Strategy for Dealing with Changing and/or Unknown Conditions (Contingency Planning)

CHECKLIST

This checklist is intended to document a 'clean debris surface' for the following components, structures, and/or materials.

- 1. Building/location: _____
- 2. Component(s)/Area(s): _____
- 3. Material (e.g., concrete, metal): _____
- 4. Decontamination/Treatment Method¹: _____
- 5. Decontamination/Treatment Parameters:
 - a. Temperature _____
 - b. Propellant _____
 - c. Solid Media (e.g., shot, grit, beads) _____
 - d. Pressure _____
 - e. Residence time _____
 - f. Surfactant(s) _____
 - g. Detergents _____
 - h. Grinding/striking media (e.g., wheels, piston heads) _____
 - i. Depth of surface layer removal (cm) (e.g., for concrete) _____
 - j. Other _____

The decontamination of the components/areas/materials identified in steps 1 through 3 was completed as specified at steps 4 and 5.

		/
Title	Signature	Date

6. Performance Standard:

I have visually inspected the above identified material before/after (circle one) decontamination/treatment in accordance with the closure plan. All dangerous waste residues have been removed to attain a clean debris surface².

	/
Signature	Date

Notes:

- 1. Decontamination/Treatment must use a Chemical or physical extraction method from Table 1, Alternative Treatment Standards for Hazardous Debris (40 CFR 268.45).
- 2. Clean debris surface as defined in Table 1, Alternative Treatment Standards for Hazardous Debris (40 CFR 268.45): "Clean debris surface' means the surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no more than 5% of each square inch of surface area."

Figure 7-2. Sample Clean Debris Surface Checklist.

**CLOSURE CERTIFICATION
FOR**

Hanford Site
U.S. Department of Energy, Richland Operations Office

We, the undersigned, hereby certify that all _____ closure activities were performed in accordance with the specifications in the approved closure plan.

Owner/Operator Signature RL Representative Date
(Typed Name)

Contractor Representative (Typed Name) Date

Signature Independent Registered Professional Engineer Date
(Typed Name, Washington State Professional Engineer license number, and date of signature)

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Figure 7-3. Typical Closure Certification Document.

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8.0 CLOSURE SURVEILLANCE AND MAINTENANCE ACTIVITIES

This closure plan is proposing closure of the nonpermitted TSD units within the 324 Building. If it is not possible to achieve the closure performance standards, actions will be required before building D&D and the final remediation of the associated OU. Figure 8-1 provides a flow diagram illustrating potential surveillance and maintenance scenarios and associated closure actions. Contingency plans have been developed for these actions. This chapter is organized as follows:

- Section 8.1 – Following closure, there are a number of administrative activities that must be taken, even if clean closure can be realized. These actions are described in Section 8.1.
- Section 8.2 – If closure performance standards cannot be met for certain areas of the building (i.e., tanks, piping, or structure), then additional surveillance and maintenance actions would be required. These contingency plans are presented in Section 8.2.
- Section 8.3 – If soil or groundwater is potentially impacted by TSD operations then contingency plans for the cleanup must be implemented. These actions are described in Section 8.3.

If it is determined to leave waste in place following closure (i.e., close as a landfill), a post-closure plan or approved equivalent will be submitted as an amendment of this closure plan that will meet the requirements of WAC 173-303-610 (7) - (11) (Section 8.1.3). However, if it is necessary to maintain the units in a stable state for an extended period of time during the closure process (due to coordination with deactivation activities), the surveillance and maintenance activities will be imposed. These surveillance and maintenance activities are described in Section 8.2.

8.1 General Administrative Actions

Following completion of the removal and decontamination closure actions a number of administrative steps will be necessary leading up to the D&D of the building and the final remediation of the associated operable units.

8.1.1 Hazards Characterization Report

After the closure actions are completed, a hazards characterization report will be prepared in accordance with the guidance provided in Section 8.0 if the TPA (Ecology, et al 1996). The hazards report is also one of the 324 Building proposed deactivation endpoints (Chapter 1.0, Section 1.4). This report will provide a record of the location, condition, and characteristics of any residual radioactive or mixed waste contamination within the building. This report will be used as input to the surveillance and maintenance (S&M) plan that will be prepared during facility deactivation for use during the intervening period leading up to final building decommissioning. The S&M plan will be used when planning facility disposition activities to

1 ensure that the remaining tanks, pipes, and structures are disposed of appropriately when
2 removed. The hazards characterization report will include or reference the following
3 information:

- 4
- 5 • Essential diagram drawings required to support S&M and D&D
- 6 • Chemical and hazardous substance inventory
- 7 • Description and photos of hazardous areas
- 8 • Final radiological surveys and maps
- 9 • Industrial space hazards identified
- 10 • Radioactive and mixed waste accumulation areas identified
- 11 • Waste characterization data
- 12 • Structural and roof studies
- 13 • Fire hazard analysis requirements
- 14 • Compliance with Hazards Communication, Asbestos Control, and Confined Space
15 Programs.
- 16

17 **8.1.2 Building Care, Use, and Security**

18
19 Due to the complexity and significant radiological contamination of the 324 Building,
20 closure actions will be closely integrated with the overall deactivation activities. This integration
21 process is described in detail in Chapter 1.0, Section 1.5. Following completion of the closure
22 actions and the deactivation process, a period of S&M actions will begin and will last until the
23 building undergoes final disposition. As discussed in Chapter 1.0, Section 1.3, no other use or
24 mission for the building following deactivation and closure is planned.

25
26 During the building disposition phase, any required actions for extensive or inaccessible
27 soil cleanup will be integrated with the CERCLA OU (300-FF-2). As described in the PMP
28 (Chapter 1.0, Section 1.4), a S&M plan will be prepared for this time period. The objectives of
29 the S&M phase are to ensure adequate containment of any contaminants left in place (both
30 dangerous wastes and radiological), to provide physical safety and security controls and maintain
31 the building in a manner that will present no significant risk to human health or the environment
32 until final disposition is complete. This approach is consistent with the requirements in the Tri-
33 Party Agreement, Section 8.0.

34
35 Even if all closure performance standards are met, and the entire unit is clean closed,
36 some S&M actions will be required because of the residual radiological contamination. The
37 S&M activities will be established during facility deactivation for use during the intervening
38 period leading up to final building decommissioning. These actions include:

- 39
- 40 • **Facility Maintenance** - Preventive maintenance activities for any remaining active
41 systems will be performed. In addition, the adequacy of the existing roof will be
42 evaluated periodically (i.e., five year maximum) and will be repaired as necessary.
- 43

- 1 • **Facility Surveillance** - Routine (i.e., quarterly) walkdowns will be performed to look at
2 general condition and the status of any remaining active systems (e.g., lighting,
3 emergency power, etc.).
4
- 5 • **Radiological Controls** - As part of the routine surveillances, radiological surveys will be
6 performed.
7
- 8 • **Hazards Protection** - Any remaining hazards (i.e., industrial, chemical, radiological) will
9 be confined and actions taken to ensure hazards are mitigated or managed throughout the
10 duration of the S&M phase. The contingent actions required by this closure plan if
11 dangerous waste constituents are left in place are addressed in Sections 8.2 and 8.3.
12
- 13 • **Safeguards and Security** - The 324 Building will be locked at all times with access
14 limited to S&M staff and emergency response personnel. Signs describing entry
15 requirements will be posted at the entry. These actions will ensure the
16 WAC 173-303-610(7) security requirements are met if dangerous waste residuals are also
17 left in place. General security requirements for the persons entering the 300 Area are
18 provided in Chapter 2.0, Section 2.4. These requirements are established by RL, and are
19 reviewed periodically and updated as needed to ensure an appropriate level of protection.
20
- 21 • **Cost and Schedule** - The S&M plan would include cost estimates and schedules to
22 ensure the objective of the program can be fully met until final facility disposition occurs
23 (meeting WAC 173-303-620 requirements).
24

25 In addition to the actions described, additional actions are included in Section 8.3, in the
26 event that closure standards are not attainable.
27

28 **8.1.3 Amendments**

29

30 If an amendment to the approved closure plan or the contingent post-closure plan is required at
31 any time prior to the notification of partial or final closure, RL will submit a written request to
32 Ecology as described in Chapter 7.0, Section 7.8. If the need for post-closure care beyond what
33 is described in Section 8.3 is identified, an updated post-closure plan will be prepared in
34 accordance with WAC 173-303-610(8) as an amendment to this closure plan.
35

36 **8.1.4 Land Authority and Deed Notice**

37

38 If dangerous waste is left in place after closure, the requirements for notice to local land authority
39 (WAC 173-303-610(9)) and for notice in deed to property (WAC 173-303-610(10)) will be
40 identified as ARAR for the CERCLA operable unit remedial action process. These notices are
41 to ensure a survey plat, deed notations, (or other legal instrument) and final closure/remediation
42 records are prepared and properly submitted.
43

1 **8.1.5 Certification of Completion**

2
3 Within 60 days of completing all the closure activities, RL will submit a certification of
4 closure (or post-closure care if applicable) to Ecology, as described in Chapter 7.0, Section 7.9.
5

6 **8.2 Closure Surveillance and Maintenance Scenarios**

7
8 Figure 8-1 provides a logic flow diagram used for identifying potential S&M
9 requirements for a number of potential closure scenarios. This process provides contingency
10 plans for dealing with those situations where the closure standards cannot be met.
11

12 **8.2.1 Tanks and Piping**

13
14 As described in Chapters 6.0 and 7.0, the objective of the closure plan is to decontaminate
15 and remove all dangerous waste tanks and associated ancillary equipment and piping. However,
16 if there are tanks or piping runs that cannot be removed or cannot be decontaminated to meet the
17 closure standard, actions will be taken to immobilize the residual dangerous and mixed waste
18 contamination. Following these actions, S&M activities will be performed until removal occurs
19 as part of the final building disposition. As part of the routine inspections and walk downs, the
20 location of these systems or areas will be noted and specific inspections performed to ensure the
21 integrity and status of the areas are being maintained as planned until final decommissioning.
22

23 In addition, the building roof surveillance also will include the requirements from
24 WAC 173-303-610 and -640(8), to ensure the building itself is being maintained as the
25 containment structure. These requirements include preventing any precipitation from entering
26 the building, as well as ensuring run-on/run-off is directed away from the building and the areas
27 with residual dangerous waste. The roof will undergo periodic maintenance to ensure it meets
28 the containment structure requirements. No preventive maintenance is planned for any of the
29 remaining tanks, piping, or structures during the S&M phase. However, if conditions are
30 identified during the inspections, which change the status of these items from the manner they are
31 documented in the hazards characterization report (i.e., piping breaks, spread of contamination,
32 etc.), these conditions will be promptly corrected, consistent with the original closure actions.
33

34 **8.2.2 Building Areas**

35
36 The objective of the closure plan is to decontaminate the REC cells, the HLV/LLV tanks
37 and ancillary piping that handled dangerous waste, and the HLV/LLV vaults using extraction
38 processes specified in the Alternative Treatment Standards of Hazardous Debris (40 CFR
39 268.45) so that these areas meet the clean debris surface closure performance standard. This
40 process is described in Chapters 6.0 and 7.0. However, if these standards cannot be attained
41 (e.g., liner removal is not achievable), actions will be taken, if necessary, to immobilize the
42 residual dangerous waste contamination. Following these actions, S&M activities will be

1 performed prior to removal of these components as part of the final building disposition and
2 completion of closure. These activities are the same as those needed for tanks and piping, as
3 described in Section 8.2.1.
4

5 **8.2.3 Soil**

6
7 The closure strategy for soil potentially contaminated with dangerous waste constituents
8 from TSD operations is provided in Chapter 6.0. This closure strategy is based on removing
9 dangerous waste constituents and waste residuals with no further operation of the waste handling
10 systems (i.e. tanks, piping, and ancillary equipment) following closure. If soil is potentially
11 contaminated with dangerous waste constituents from TSD operations (based on liner/concrete
12 and piping integrity assessments), sampling activities will be planned and performed to define
13 the nature and extent of dangerous waste contamination. If concentrations or conditions warrant
14 an action for soil removal, an Interim Measures Plan will be prepared and submitted to Ecology
15 for approval. However, if an interim measure is not warranted, or if the potential dangerous
16 waste constituents is in an area that is not accessible (i.e., no crawlspace access), soil
17 investigations and remediation will be scheduled and coordinated with the CERCLA OU (300-
18 FF-2) activities. To support this coordination, a number of actions will be needed. These actions
19 are described in Section 8.3.1.
20

21 **8.2.4 Groundwater**

22
23 The closure strategy for groundwater potentially contaminated with dangerous waste
24 constituents from TSD operations within the 324 Building closure unit is provided in Chapter
25 6.0; a discussion of groundwater is provided in Chapter 5.0. The closure strategy is based on
26 removing dangerous waste constituents and waste residuals from the 324 Building with no
27 further operation of the waste handling systems (i.e., tanks, piping, and ancillary equipment)
28 following closure. Groundwater closure requirements are governed by WAC 173-303-610. If
29 groundwater is potentially impacted with dangerous waste constituents from TSD operations
30 (based on assessments of the soil and building integrity), sampling activities will be performed to
31 define the nature and extent of the dangerous waste constituents in the soil. If concentrations or
32 conditions warrant groundwater monitoring, a plan will be prepared and submitted to Ecology,
33 which will include a description of the planned monitoring activities and frequencies at which
34 these will be performed. If groundwater monitoring or remediation is required, the groundwater
35 monitoring investigations and remediation will be scheduled and coordinated with the CERCLA
36 operable unit activities. To support this coordination, a number of actions will be needed. These
37 actions are described in Section 8.3.2.
38

39 **8.3 Contingent Plan for Soil/Groundwater**

40
41 If the closure performance standards cannot be met, and dangerous waste constituents
42 must be left in place until final disposition and the remediation of the OU, the following S&M
43 actions must be taken to ensure the requirements of WAC 173-303-610 and

1 WAC 173-303-640(8) are met. During the S&M phase, containment of the areas will be met by
2 maintaining the surrounding building roof and structure. The actions described in Sections 8.3.1
3 and 8.3.2 are in addition to those described in Section 8.1. In addition, if it is determined to leave
4 waste in place at closure (i.e., close as a landfill), a post-closure plan or approved alternative will
5 be submitted and will meet the requirements of WAC 173-303-610(7) - (11).
6

7 The ARAR development process is an ongoing CERLA OU activity leading up to the
8 selection of the remedy and the establishment of appropriate cleanup standards. It will be
9 essential that the requirements contained in WAC 173-303-610 and WA 173-303-640(8) be
10 integrated into this process early on. This will enable the development of complete constituents
11 of concern lists, ensure appropriate sampling and analysis strategies are developed and include
12 RCRA closure standards in defining and evaluating the feasibility of various remedial options
13 and cleanup levels. ARAR are usually classified as either contaminant specific, action specific,
14 or location specific. If it appears coordination of soil and/or groundwater remediation may be
15 necessary, it will be essential that early and frequent communication between the 324 Building
16 deactivation organization and the ER program are established. This will allow for close
17 coordination and execution of planned activities by both parties so that the common cleanup
18 objectives can be met in the most efficient way possible.
19

20 **8.3.1 Coordination of Soil Contamination**

21
22 If residual dangerous waste contamination is potentially left in the soil, the following
23 additional actions will be performed. These actions are in addition to those listed in Sections 8.1.
24

- 25 • **Contaminants of Concern** - A COC list will be developed for use in OU investigation
26 and feasibility study activities. The major COC identified to date are lead, barium,
27 cadmium, chromium, and the characteristic of corrosivity (refer to Chapter 4.0).
28
- 29 • **Cleanup Standards** - In developing remedial actions for the soil, RCRA will be
30 specified as an ARAR, so that applicable cleanup standards and remediation/closure
31 requirements are included.
32
- 33 • **Coordination of Remediation** - Remedial actions for the soil will be coordinated with
34 the building disposition and the CERCLA OU (300-FF-2) remediation. This coordination
35 will include an integration of schedules, development of a common approach for waste
36 disposition, and development of a detailed post-closure plan or approved equivalent if the
37 decision is made to leave waste in place after completion of the remedial actions.
38

39 **8.3.2 Coordination of Groundwater Monitoring**

40
41 If it is determined groundwater was contaminated by the 324 Building closure unit (or
42 there remains contamination within the soil or unit that potentially could enter the groundwater)
43 the following actions will be performed. These actions will be in addition to those listed in
44 Sections 8.1 and 8.3.1.

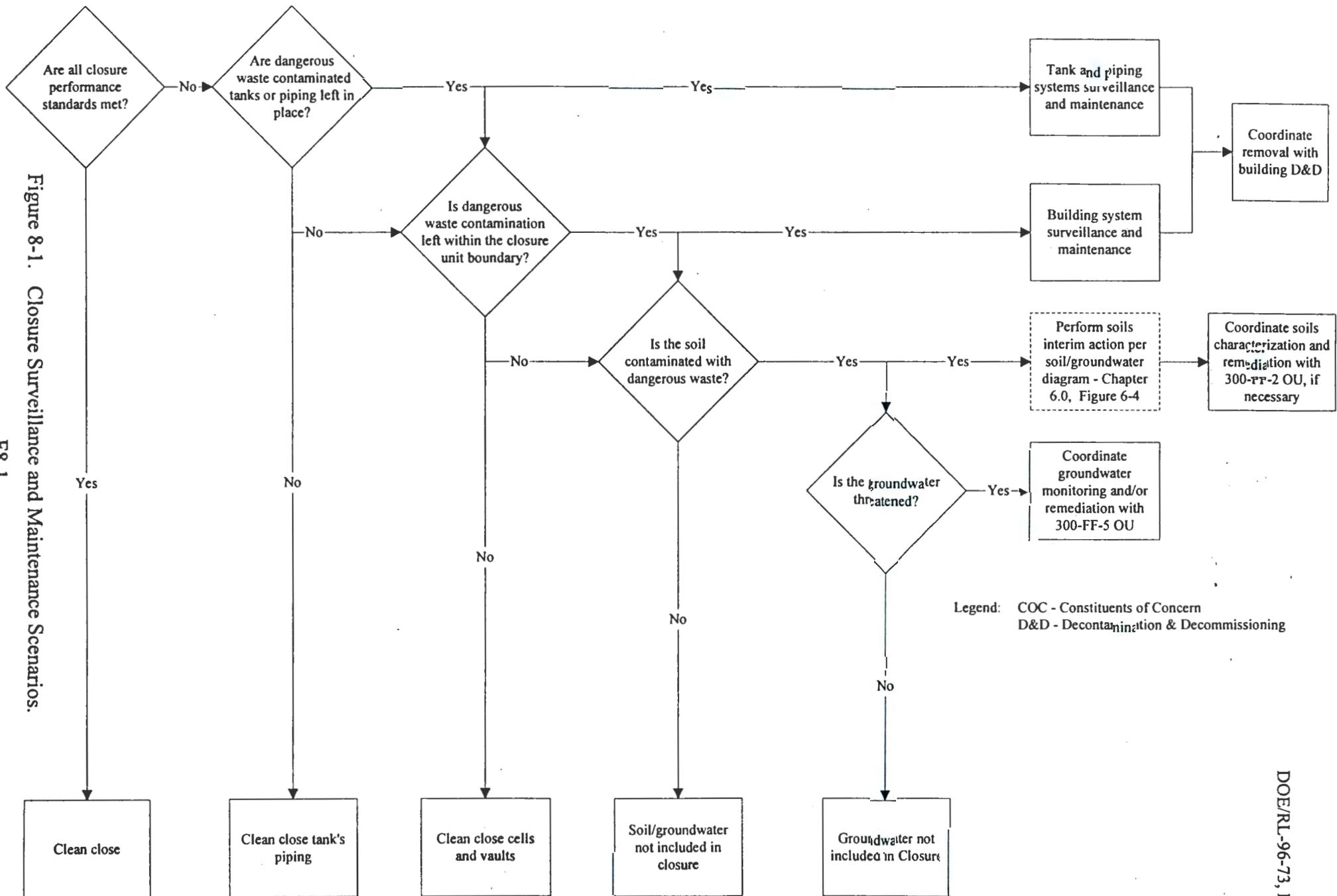
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- **Constituents of Concern** - A COC list will be developed for use in OU investigation and feasibility study activities. The major COC identified to date are lead, barium, cadmium, chromium, and the characteristic of corrosivity (refer to Chapters 4.0 and 5.0).
- **Cleanup Standards** - The cleanup standard for groundwater will be those specified in WAC 173-303-610(2)(b)(i) and RCRA will be specified as an ARAR for determining cleanup actions and goals.
- **Coordination of Remediation** - Remediation coordination for groundwater will be done through the appropriate CERCLA groundwater OU. This coordination will include an integration of schedules and development of a common approach for monitoring and/or remediation.

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Figure 8-1. Closure Surveillance and Maintenance Scenarios.
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Legend: COC - Constituents of Concern
D&D - Decontamination & Decommissioning

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CONTENTS

9.0 REFERENCES.....9-1

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9.0 REFERENCES

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PNL 1981, *TMI Zeolite Vitrification Demonstration Program Plan*, Pacific Northwest Laboratory, Richland, Washington.

PNL 1990, *Management of Radioactive Liquids Held in the 324 Building*, correspondence from J. L. McElroy, Pacific Northwest Laboratory, to J. J. Sutey, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

PNL 1994, *Designation of High Level Vault Tank Material*, dated April 20, 1994, correspondence from P. J. Weaver, Pacific Northwest Laboratory, to 'File', Richland, Washington.

PNNL-11470, *Hanford Site Groundwater Monitoring for Fiscal Year 1996*, Pacific Northwest National Laboratory, Richland, Washington, 1997.

SAIC, 1993, *Integrity Assessment Plan for PNL 300 Area Radioactive hazardous Waste Tank System*, Final Report, dated July 30, 1993, Science Applications International Corporation, Richland, Washington.

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APPENDICES

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3 1A Tri-Party Agreement Milestone M-89-94-01 1A-1
4 2A 324 Building Engineering Drawings 2A-1
5 7A Schedule for Closure Activities 7A-1

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Appendix 1A

Tri-Party Agreement Milestone M-89-94-01

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Description/Justification of Change (Continued)

The REC complex of the 324 Building is designed to handle high activity radioactive wastes and materials in a research setting, with remote handling capabilities, and with appropriate shielding and unique space considerations.

A 324 hot cell restoration project (the B-Cell Cleanout Project (BCCP)) has been initiated in an effort to clean out and stabilize high activity, dispersible MW that have accumulated in the REC B-cell. Work under The BCCP will also result in the removal of MW, inactive research equipment, and other materials housed in the B-cell. Containerized MW are currently being stored in the REC (primarily in B-cell). One container of oil and absorbent from a 1994 B-cell shielded viewing window leak is stored in the D-cell. Containerized storage of high activity MW in the B-cell will continue until a technically sound pathway for storage elsewhere, and/or treatment and disposal is developed. Containerized MW storage in the REC may include waste transferred from the HLV tanks as a result of implementation of the preferred option identified via milestone M-89-01A. The (M-89-01A) report will identify the preferred option, provide planning/execution details and allow implementation of actions necessary to ensure safe handling and removal of liquid MW in the HLV tanks. Treatment and storage of HLV tank wastes in the REC will require development of an acceptable technical process and compliance with regulatory requirements.

High activity liquid MW is being stored in the 324 Building HLV tanks (e.g., TK-104, -105, -107). These wastes were originally utilized as radioactive feed materials for research and development projects conducted in the REC.

Initial assessment by USDOE of the waste management options for these materials has determined that they present difficult management challenges in that (at present) no definitive workplan for transportation, treatment and disposal, and/or long term permitted storage exists. Because of the location of the 324 building with respect to the Columbia River and the Tri-cities, the high activity of the wastes, and the dispersibility of the waste in the B-cell, these wastes pose a significant environmental, worker safety, and public health risk. These milestones have been proposed to minimize these risks in the near term, to achieve compliant management of the wastes, and to ensure long term protection of human health and the environment.

The following Milestones set the Schedule for key actions necessary to achieve compliance and complete closure of non-permitted mixed waste units in the 324 Building Radiochemical Engineering Cell (B-cell and D-cell), and High Level Vault:

- | | | |
|----------|---|----------|
| M-89-00 | Complete Closure of Non-Permitted Mixed Waste Units in the 324 Building REC B-cell, REC D-cell, and High Level Vault. | TBE* |
| | *A date will be established for this Major Milestone immediately following Ecology approval of the REC/HLV closure plan (see M-20-55). | |
| M-89-01 | Complete removal of 324 Building HLV tank MW (e.g., TK-104, TK-105, TK-107) with the exception of residues which may remain following flushing and draining to the extent possible. | 10/31/96 |
| M-89-01A | USDOE will submit to Ecology a report identifying the preferred option for management of liquid MW in the HLV tanks. | 3/31/95 |

Description/Justification of Change (Continued)

M-89-02 Complete removal of 324 Building REC B-cell MW and equipment. 5/31/99

Actions under this milestone include containment and removal of all B cell dispersible materials, excess equipment and debris. Containerized MW will be managed in compliance with chapter 173.303 WAC, thereby reducing risks to human health and the environment. Any remaining residues following removal actions will be managed through the final closure process. USDOEs' 324 building REC B cell clean-out project (BCCP) will be used as a guide for containerizing dispersible MW and removing unnecessary equipment and materials from B-cell.

M-89-03 Achieve compliance with interim status facility standards at non-permitted 324 building MW units. 3/31/95

Because of high radiation fields associated with MW stored in the REC and HLV tanks, alternative compliance measures for some interim status requirements are expected. In these instances USDOE will propose alternative measures for Ecology approval no later than March 31, 1995.

M-89-04 Submit to Ecology a report identifying MW management alternatives and USDOE's proposal for achieving clean closure of the 324 Building REC B-cell, D-cell and HLV. This report will aid development of the 324 Closure Plan required by milestone M-20-55. 6/30/95

The proposal will outline a feasible and cost effective program to achieve clean closure of the non-permitted storage units and compliant management of the MW currently stored in them.

M-20-55 Submit closure plan for Non-Permitted Mixed Waste Units located in the 324 Building REC B-cell, REC D-cell and HLV. 12/31/95

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**Hanford Federal Facility
Agreement and Consent Order**

Fifth Amendment

July 1995

by

**Washington State
Department of Ecology**

**United States
Environmental Protection Agency**

**United States
Department of Energy**

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
AND THE
STATE OF WASHINGTON DEPARTMENT OF ECOLOGY

IN THE MATTER OF:

The U.S. Department of Energy,
Richland Operations Office,
Richland, Washington

)
) FIFTH AMENDMENT OF
) HANFORD FEDERAL FACILITY
) AGREEMENT AND CONSENT ORDER
)

Respondent) EPA Docket Number: 1089-03-04-120
) Ecology Docket Number: 89-54

In accordance with Article XXXIX of the Hanford Federal Facility Agreement and Consent Order ("Agreement") the Parties hereto agree to the attached amendments to the Agreement.

The approval of this Amendment further constitutes approval of the following Agreement change requests which are attached as part of this Amendment.

- M-80-94-01 Establish milestones and target dates for PUREX and UO3 Facility Transition, Milestone Series M-80.
- M-81-94-01 Establish milestones and target dates for the Fast Flux Test Facility (FFTF) transition, Milestone Series M-81.
- M-83-94-01 Establish milestones for the Stabilization of Process Areas in PFP, Milestone Series M-83.
- M-89-94-01 Complete closure of non-permitted Mixed Waste (MW) units in the 324 Building Radiochemical Engineering Cell (REC) and High Level Vault (HLV).
- M-20-94-01 Milestone M-20-00 Modifications (1994 Facility Transition Negotiations).
- A-94-01 Modify Appendix A To Include Facility Transition Decommissioning Process Terms, Update Environmental Restoration Terms, and Make Other Updates.

Modifications to the Agreement are indicated in the following manner:

~~Language removed from the text of the Agreement is displayed in strikeout mode.~~

Language added to the text of the Agreement is displayed in shaded mode.

IT IS SO AGREED:

Each undersigned representative of a Party certifies that he or she is fully authorized to enter into this Agreement and Action Plan and to legally bind such Party to this Agreement and Action Plan. These change requests and amendments shall be effective upon the date on which this fifth amendment agreement is signed by the Parties. Except as amended herein, the existing provisions of the Agreement shall remain in full force and effect.

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

for Charles Fuller
Chuck Clarke
Regional Administrator
Region 10
U.S. Environmental Protection Agency

7/26/95
Date

FOR THE UNITED STATES DEPARTMENT OF ENERGY:

RD. Galt *for*
John Wagener
Manager
U.S. Department of Energy
Richland Operations Office

7/25/95
Date

FOR THE WASHINGTON STATE DEPARTMENT OF ECOLOGY:

T. Husarman
Mary Riveland *for*
Director
State of Washington
Department of Ecology

7/28/95
Date

Appendix 2A

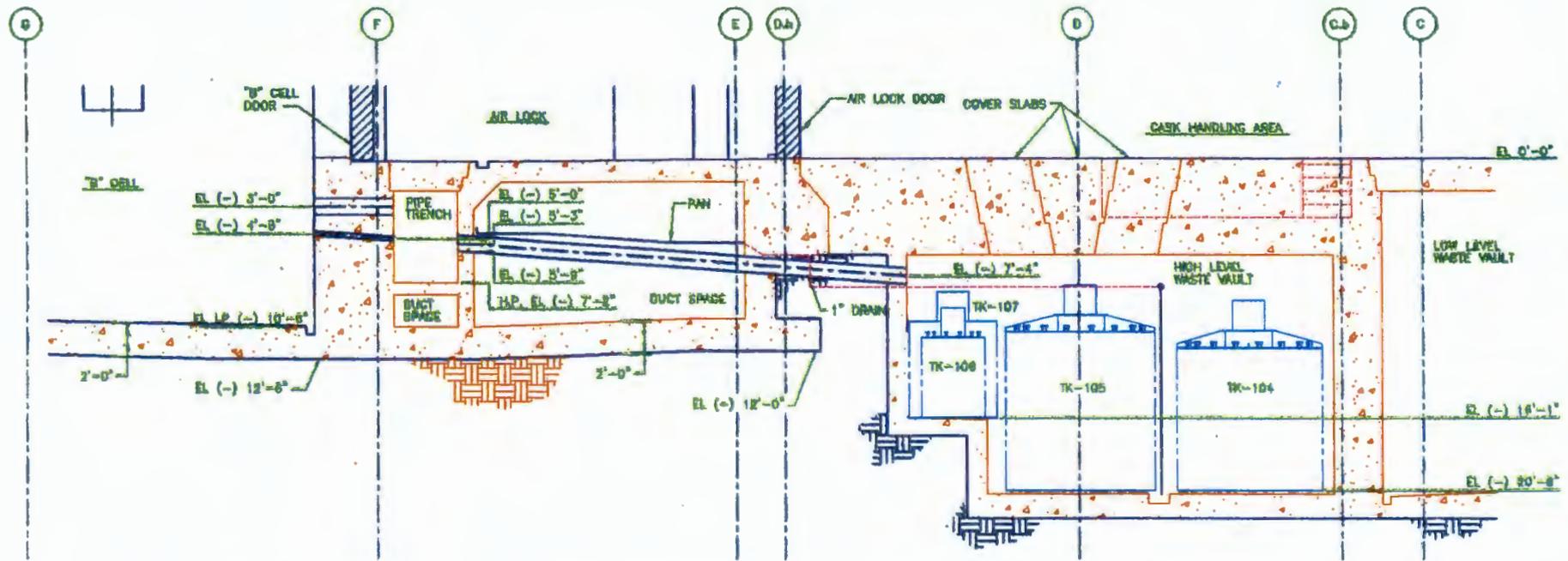
324 Building Engineering Drawings

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WS-HLV-0 High-Level Vault and Cell Area Building El At Section A-A, Rev. 0
WS-HLV-13 High-Level Vault and Cell Area Building El At Section A-A, Rev. 0
H-3-300262 Facility Drawings Cell Area Building El At Section C-C, Rev. 0

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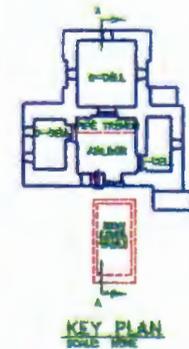
APP 2A-1



HIGH LEVEL WASTE SUMP			
INCHES	GALLONS	INCHES	GALLONS
.5	3.6	7.0	21.7
1.0	4.8	7.5	23.6
1.5	6.0	8.0	25.9
2.0	7.8	8.5	29.8
2.5	8.9	9.0	32.5
3.0	10.2	9.5	35.0
3.5	11.4	10.0	39.2
4.0	12.7	10.5	42.8
4.5	13.9	11.0	45.8
5.0	15.1	11.5	49.4
5.5	16.3**	12.0	54.2
6.0	18.1	12.5	57.8***
6.5	18.8		

LIQUID LEVEL	PIPE TRENCH SUMP* (GALLONS TO INCHES)									
	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
INCHES 0	0	2.4	3.6	6.0	7.8	9.6	12.0	13.9	15.7	16.8
1	18.3	20.5	23.8	24.1	28.0	28.0	31.3	33.7	35.8	36.7
2	40.8	43.4	48.2	50.0	54.2	57.2	60.2	62.7	65.3	68.7
3	72.3	75.3	78.9	83.1	86.7	89.8	93.9	97.0	101.2	104.8
4	107.9	115.7	122.9	130.7	138.8	145.8	154.2	160.8	168.3	172.3
5	177.1	183.1	189.2	194.0	200.0	204.8	213.3	219.3	226.6	232.5
6	238.8	246.4	253.9	262.7	270.6	277.1	286.5	292.7	301.2	309.8
7	318.0	326.5	335.5	344.8	353.0	362.8	371.1	379.9	389.5	392.8
8	408.0	409.8	418.9	429.3	433.7	442.2	450.0	458.0	467.9	478.9
9	483.7	493.9	503.9	509.8	518.1	526.5	534.9	543.4	551.8	560.2
10	567.5	578.5	589.5	593.9	602.4	609.9	619.3	628.5	634.9	643.4
11	651.8	660.2	667.5	675.9	684.3	692.8	700.6	708.4	716.9	726.3
12	733.1	740.9								

VOLUME DESCRIPTION	VOLUME (GAL.)
PIPE TRENCH / INCH	52.36
PIPE TRENCH TO 26.5 IN. HEIGHT	1462.4
HLV SUMP AND TRENCHES	57.7
HLV LINER MANHOLE TK104 & TK106	4036.4



- * SUMP ALARM TRIPPED
- ** SUMP OVERFLOW TO NORTH GUTTER
- *** NORTH GUTTER FULL

NOTE: SOLUTION OUT OVER FLOOR BEFORE WF REGISTERS
 SUMP ALARM TRIPS AT 1.3" FLOOR HALF-COVERED AT 3.0" FLOOR COVERED AT 7.5"

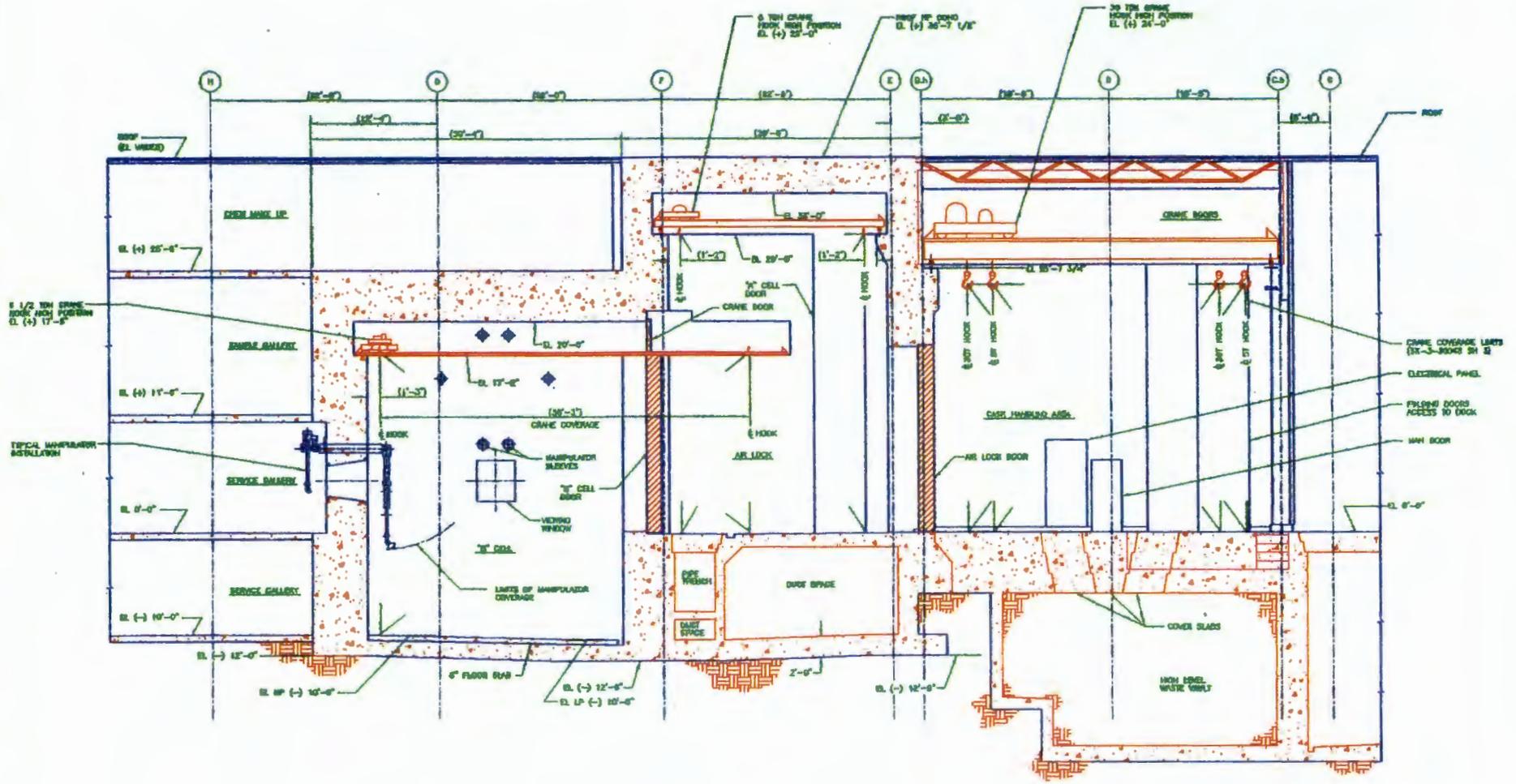
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CHECKED BY	DATE	SCALE	DATE
PROJECT NO.	DATE	SCALE	DATE
PROJECT TITLE	DATE	SCALE	DATE

U. S. DEPARTMENT OF ENERGY
 PACIFIC NORTHWEST LABORATORY
 HIGH LEVEL VAULT AND CELL AREA
 BLDG EL AT SECT A-A
 WS-HLV-010

DOE/RL-96-73, Rev. 1

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APP 2A-2



SECTION A-A
SCALE 1/4"=1'-0"

N-3-20440	POUND COVER AREA 3
N-3-20441	WALL, TYPE 17 SEAL
N-3-20442	276 DUCT AREA 3
N-3-20443	276 DUCT AREA 3
N-3-20444	CRANE ARMOR TEST CELLS

REVISED DRAWINGS
NEXT USED ON

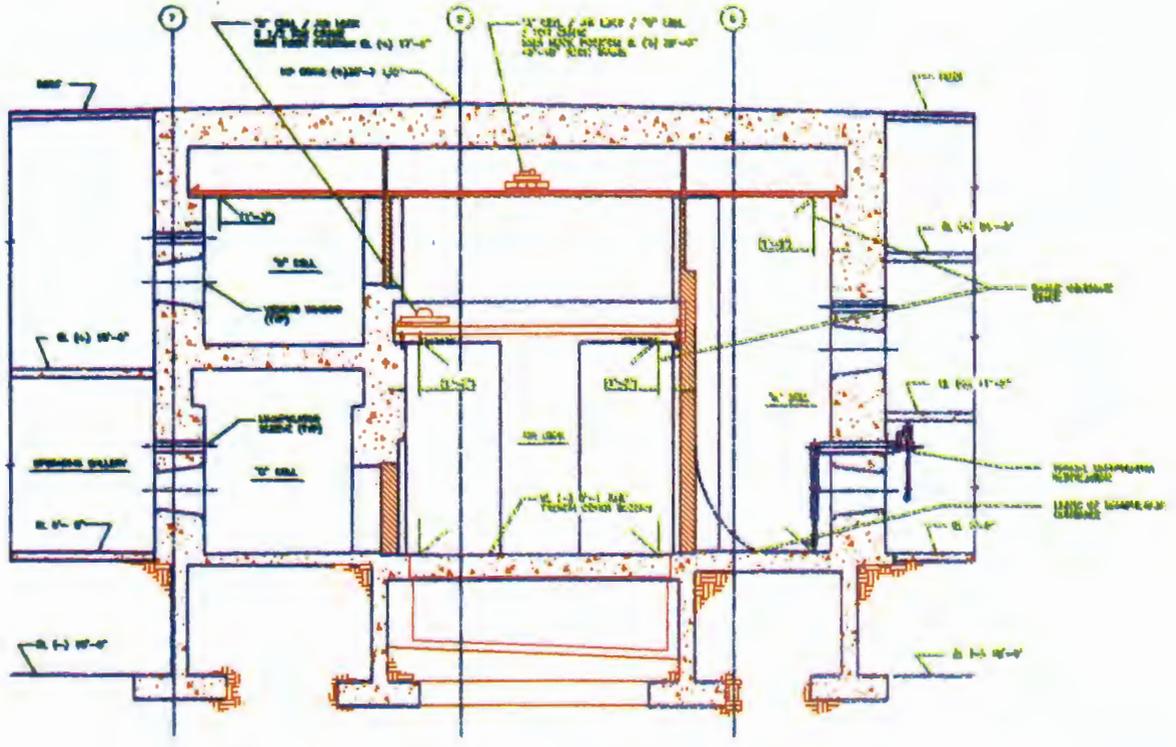
NO.	DATE	BY	CHKD.	DESCRIPTION

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST LABORATORY HIGH LEVEL VAULT AND CELL AREA BLDG E1 AT SECT A-A HIGH LEVEL VAULT ARMOR TEST CELLS	WS-HLV-13 0
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DOL/RL-96-73, Rev. 1

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App 2A-3



SECTION C-C
SCALE 1/4" = 1'-0"

 **COMMENT**
 NOT APPROVED FOR CONSTRUCTION

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST LABORATORY DIVISION OF ENERGY RESEARCH SERVICES	
FACILITY DRAWINGS CELL AREA EL AT SECT C-C	
PROJECT NO. H-3-300862.0 DRAWING NO. 0110 SHEET NO. 1 OF 9	DATE 08/85 BY ... CHECKED ...

DOE/RL-96-73, Rev. 1

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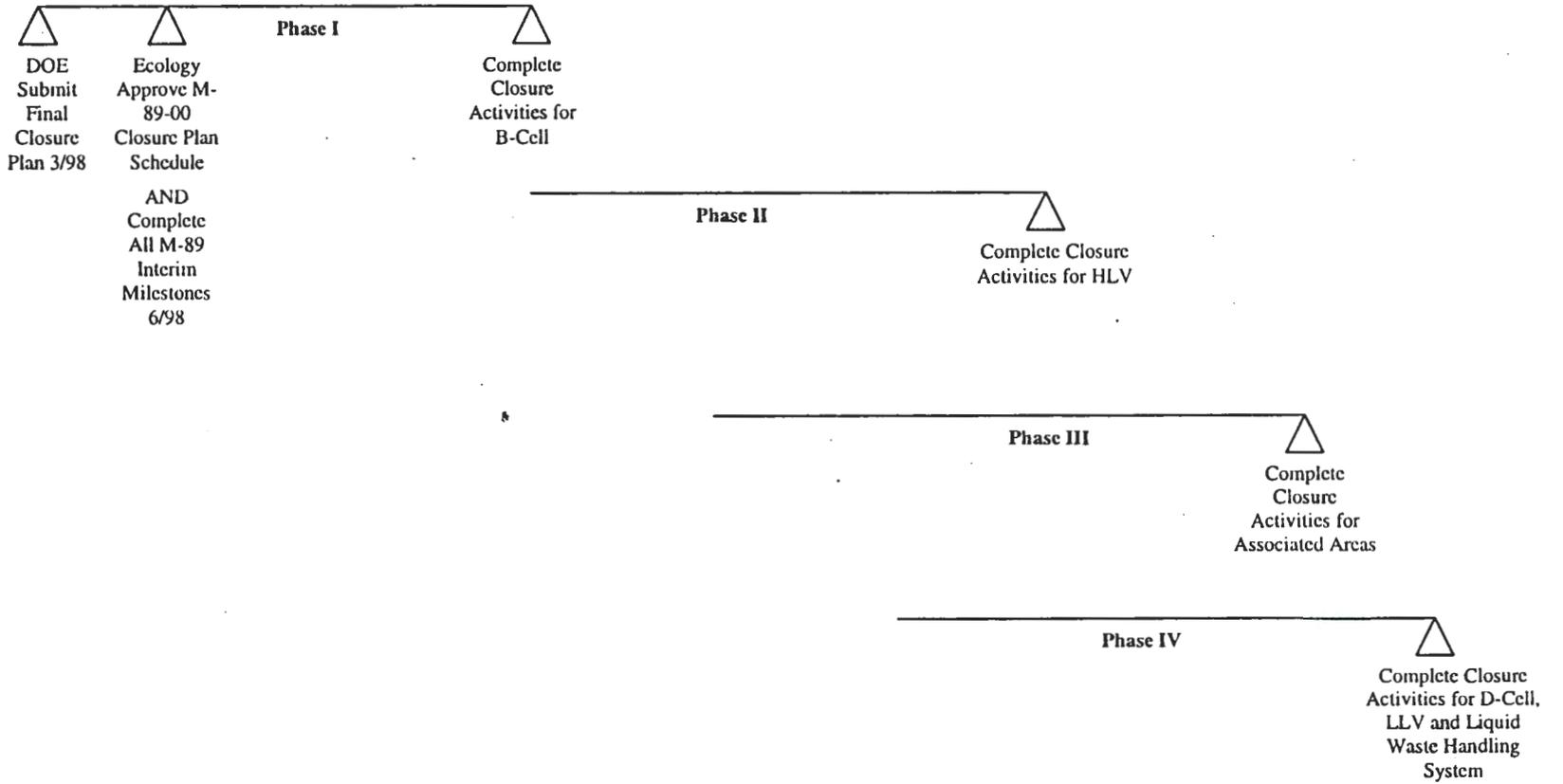
Appendix 7A

Schedule for Closure Activities

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Development of Final Integrated M-89 Closure Schedule

**Proposed Schedule
in Final Closure Plan**



Note: This schedule dates are under development. To be provided by May 15, 1998 per agreement with Ecology.

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